

**MECHANISMS FOR RAPID ORGANISATIONAL CULTURAL CHANGE TO
SUPPORT LEAN IMPLEMENTATION**

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PhD in Management

2021

Total Word Count: 115513

Contents

Thesis Summary

CHAPTER 1 – INTRODUCTION, METHODS AND SOCIO-TECHNICAL DESIGN..... 1

An introduction to research, and an overview and justification of the research methods used, plus an explanation as to the relevance of Socio-Technical Work Design to managing cultural change..... 1

Summary..... 1

A Short History to Lean 2

Definitions 4

Key Terms 8

Rationale for Research 8

Aim of the Research..... 10

Methodology 10

Fieldwork testing..... 12

Key Documents..... 14

Chapters..... 14

Justifying the Literature Review of Socio Technical Systems (Networks & Work Design)
..... 16

Justifying a Systematic Review into Obstacles to Lean..... 20

Justifying Field Reviews of Current Work Design..... 21

The Approach to Mechanism Development and Testing and Evaluation..... 22

A Brief History of Socio-Technical Work Design..... 24

Work Design Evolution..... 27

Socio -Technical Network Variants & Development - the Inclusion of Culture..... 29

A Typical Inherent Socio Technical Work Design..... 34

Conclusions and Recommendations for Further Research..... 37

CHAPTER 2 – OBSTACLES TO LEAN.....	40
Obstacles to lean implementation: A systematic review.....	40
Summary.....	40
Introduction.....	41
Effective Change Management.....	41
Research Questions for the Systematic Review.....	42
Systematic Review Design	43
Systematic Review Search Strategy	44
Inclusion Criteria.....	45
Sifting of Research Papers.....	49
Grading / Defining the Quality / Success (Outcome) of Each Case Study	51
Allocating Outcomes into Classes using the Outcomes of the Implementations	52
Barrier, Change Intervention and Promotor Identification & Coding	54
Results and Findings	56
Conclusions and Discussion	78
CHAPTER 3 – REVIEWING SOCIO-TECHNICAL WORKPLACES.....	82
Field tests for Socio Technical plant issues in order to identify common socio-technical gaps to support the consideration of wider science for intervention mechanisms.....	82
Summary.....	82
Introduction.....	83
Barriers and Interventions to Lean Implementation from Chapter 2	85
Methodology	87
Data Collection Tool Accuracy	118
Identification of Common Socio-Technical Issues	122
Data to Inform the Next Chapter – Selecting Theories and Practices for Synthesis	127
CHAPTER 4 – THEORIES FOR INCLUSION IN A LEAN-CULTURE DESIGN	131

Relevant theories for development and inclusion within a lean-culture socio-technical work design that could represent a schema / mechanism for rapid cultural change to support lean or continuous improvement	131
Summary.....	131
Background.....	131
Relevant Theories and Practices for Synthesis into the Lean-Culture Work Design	150
Synthesis of Selected Theories into a socio-technical work design.....	202
CHAPTER 5 – A LEAN CULTURE WORK DESIGN.....	210
The synthesis of practices and wider scientific theories into a lean-culture socio-technical work design to develop high-performance teams.....	210
Summary.....	210
Background.....	210
HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO PARTICIPATING PLANTS	218
HPT System Overview	218
HPT Roadmap and Implementation.....	224
HPT Team Assessments, Pilot Line Selection, HPT Boundaries & Standard Assessment	229
HPT Scorecard Development	235
Skill Certification.....	243
HPT Visual Standards	244
HPT Meetings	248
Team Support.....	251
Rewards and Recognition (R&R)	259
HPT Norming Stage Process	260
CHAPTER 6 – RESEARCH METHODOLOGY AND REVIEWS OF A LEAN-CULTURE DESIGN	262

Research methodology and case study evaluation of a lean-culture socio-technical work design within 6 manufacturing plants, developing high-performance teams as a mechanism of rapid organisational cultural change to support lean implementation	262
Summary.....	262
Background.....	263
Research Methodology	263
Case research approach and study question.....	264
Case study proposition – the HPT (High Performance Team) mechanism; the lean-culture work design.....	264
Researcher Entry Role.....	265
Case Study – Plant Selection	266
Assessment framework and data logic	266
Plant Coding and Descriptions.....	268
Plant Interaction	269
Data Collection Methods	273
Ethics	275
Data Creation and Collection Overview.....	275
Case Study Data	277
Case Study - CLEESE PLANT.....	277
Results Summary for Cleese Plant.....	287
Case Study - CHAPMAN PLANT	287
Results Summary for Chapman Plant	296
Case Study - GILLIAM PLANT	296
Results Summary for Gilliam Plant	306
Case Study - IDLE PLANT.....	306
Results Summary for Idle Plant	316
Case Study - JONES PLANT	317

Results Summary for Jones Plant.....	327
Case Study - PALIN PLANT	327
Results Summary for Palin Plant	339
Results Summary – All Plants Combined	340
CHAPTER 7 – CONCLUSIONS AND RECOMMENDATIONS	341
Research Conclusions and Recommendations	341
Summary.....	341
Analytical Approach	343
Cross Plant Review – Policy & Procedure - Barriers & Interventions	344
Cross Plant Review – Goals - Barriers & Interventions.....	346
Cross Plant Review – People - Barriers & Interventions	348
Cross Plant Review – Culture - Barriers & Interventions	349
Cross Plant Review – Infrastructure - Barriers & Interventions.....	351
Cross Plant Review – Technology - Barriers & Interventions	353
Performance and Implementation Quality.....	355
Discounting Wider Initiatives.....	359
Final Conclusions – Reducing Barriers, Implementation Weakness and Time Efficacy .	361
Final Conclusions – Has the Research Met the Aim?	363
Final Conclusions – STS in Manufacturing, Lean and Other Theoretical Perspectives ...	364
Recommendations for Lean-culture Work Design Development.....	370
Implications for Future Research	376
STS as an Organising Framework	378
References	380
ANNEXES.....	402
CHAPTER 3 - ANNEX 1 – BARRIER SURVEY DATA FROM PLANT A	403
CHAPTER 3 - ANNEX 2 – BARRIER SURVEY DATA FROM PLANT B	409

CHAPTER 3 - ANNEX 3 – BARRIER SURVEY DATA FROM PLANT C	418
CHAPTER 5 - ANNEX A – QUESTIONNAIRE FRAMEWORK FOR TEAM MATURITY ASSESSMENT.....	426
CHAPTER 5 - ANNEX B – QUESTIONNAIRE FRAMEWORK FOR TRANSFORMATIONAL LEADERSHIP ASSESSMENT	429
CHAPTER 5 - ANNEX C – HPT STANDARD ASSESSMENT QUESTIONNAIRE AND GRADING CRITERIA	432
CHAPTER 5 - ANNEX D – A SAMPLE HPT SCORECARD.....	445
CHAPTER 5 - ANNEX E – HPT MEETING MINUTE TEMPLATE	446
APPENDICES	447
APPENDIX 1 – COPY OF UCS ETHICS TEMPLATE USED FOR CHAPTER 3	448
APPENDIX 2 – COPY OF UEA ETHICS DOCUMENTS (TEMPLATE) USED FOR CHAPTER 6 INVOLVING ACCESS TO HPT STANDARD ASSESSMENT DATA..	454
APPENDIX 3 – COPY OF UEA ETHICS DOCUMENTS (TEMPLATE) USED FOR CHAPTER 6 INVOLVING QUALITATIVE INTERVIEWS	459

THESIS SUMMARY

This thesis advances the field of socio-technical work design by creating specific socio-technical instruments in order to rapidly develop an organisational culture that can better sustain lean implementation. It starts by introducing the origins of lean, its purpose to remove operational wastes through defining what value is in the eyes of the customer, and identifies its socio-technical and complex nature. The literature survey justifies the application of a socio-technical framework approach to reviewing the current-state of manufacturing organisations, and within such demonstrates the inclusion of organisational culture as a node within a 6-node socio-technical model that also includes: goals; people, processes and procedures; infrastructure; and technology. This is followed by a systematic review that demonstrates a high failure rate amongst lean implementations. The same review sought out the most prevalent barriers and interventions that were considered to either have contributed to lean success or were attributed as an obstacle. The interventions and obstacles were then classified by node in accord with the previously selected socio-technical framework. These unwanted outcomes were then cross-checked by reviewing three existing socio-technical work designs within the manufacturing sector; these were named inherent designs given that they have been established using largely traditional approaches to manufacturing work design, which only theoretically suit lean implementation, but in actuality may not. The drivers and resistors to lean from these inherent designs were merged with the information taken from the systematic review and literature survey in order to create a baseline for barriers and interventions that a revised/enhanced implementation needed to address. This design was to be named the lean-culture design given that it was constructed after obtaining further knowledge from a systematic review of empirical studies. Wider reading was undertaken in an array of theories that offered either benefit or relevance to the barriers and interventions that the lean-culture design needed

to address. A selection was made based on inclusion criteria, and the lean-culture design was created along with an instruction guide on how to implement it within a manufacturing organisation. An implementation assessment was also created using a Likert scale with detailed definitions so that the level/quality of implementation against the instructions could be accurately assessed. Six implementations were made across six different European plants within the same global tier-1¹ automotive component manufacturer. These implementations were assessed using: an implementation standard assessment; gathered artefacts; a qualitative semi-structured interview with the local implementers. The thesis identifies that provided the implementation standard assessment is circa eighty percent or above, then not only does the work design enable fiscal impact through lean implementation, but the design also seemingly becomes fully adopted as the new way of working, and a new culture is established. Furthermore, the organisations above this level of implementation demonstrate further innovation upon the lean-culture design. The weakness in the new work design is the observable investment in Gemba actor time through routine involvement in improvement meetings. Whilst this is easily recovered by the cost savings the lean implementations are producing, new leadership that is unfamiliar to the design may see such activity as a cost saving opportunity and inadvertently break the work design by removing the Gemba actor routine involvement.

¹ A tier 1 supplier is a manufacturer who provides products directly to the vehicle manufacturers (original equipment manufacturers – OEMs) without dealing with a middleman or other manufacturers.

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CHAPTER 1 – INTRODUCTION, METHODS AND SOCIO-TECHNICAL DESIGN

An introduction to research, and an overview and justification of the research methods used, plus an explanation as to the relevance of Socio-Technical Work Design to managing cultural change.

Summary

This chapter sets out to explain the key terms, definitions and key documents relating to the research. These are presented in order to help any reader that is unfamiliar with the concepts within lean manufacturing to gain a fundamental insight into the topic. The chapter also seeks to explain the rationale and aims of the research. In response to commercial pressures, lean improvement and its associated progenitors have been established as attractive methodologies, over the last few decades, as they offer business growth through improved customer focus, improved efficiency and reduced waste. However, the methodology has been established as a type that is problematic to implement and sustain with high change-project failure rates. Chief among the reasons for this failure rate are a variety of issues centring on inadequate socio-technical conditions and culture therein. This chapter also describes the methodology and resources used for this research. The research proposes to explore the barriers and interventions associated with the organisational change demanded for lean improvement and develop assessment and intervention protocols that would enable rapid identification and interventions to better prepare organisations for lean implementation. This knowledge can then be used to identify wider theories that can be combined into enhanced socio-technical conditions that attempt to change the organisational culture to better suit lean. Chapter 1 also provides a flowchart illustrating how each chapter links to the next, along with the outputs/inputs that direct the effort within each following chapter. The research uses a systematic review to specifically ask research questions pertaining to obstacles to Lean implementation; aimed at

identifying gaps or unwanted outcomes. A literature survey aims to justify the selection of socio-technical work design as the preferred model within which to frame the research, develop mechanisms and assess their impact. Other theories pertaining to cultural analysis were considered; however, the approach was selected given its applicability to kaizen activities upon the shop floor environment (the Gemba). The research intends to cross check the outcome from both the survey and the review by carrying out field reviews of existing arrangements that have not been designed from the start to accommodate Lean implementation. These extant arrangements are referred to as inherent socio-technical work designs. The collective outputs thus far should then be used to seek out and evaluate wider theories for merging into a revised lean-culture socio-technical work design aimed at addressing gaps and/or unwanted outcomes from the inherent socio-technical working arrangements. An implementation guide along with training will be developed for the new work design, and then implemented across 6 test plants. These implementations will then be reviewed individually and combined into an explanator case study wherein the impact of the lean-culture work design will be assessed using qualitative and quantitate data. This data will include` observable artefacts and an assessment of the implementation quality in order to support the outputs from qualitative and quantitate data. The impact of the lean-culture design, its key success criteria and future recommendations can then be developed.

A Short History to Lean

Lean is a business growth philosophy that was developed by Toyota in order to meet the demands of a world-wide vehicle market. Originally leading a successful textile manufacturer, Sakiichi Toyoda was encouraged by the Japanese government to diversify his company into vehicle production to meet domestic demands. This was to lead to the creation of the vehicle

manufacturer known as Toyota. Toyoda identified the global market for such products but was not fiscally positioned to duplicate the mass production techniques of the dominant American manufacturers of the time, Ford and General Motors, which were globally understood as having the recognized template and approach needed for breaking into the global vehicle market. Furthermore, the Japanese workforce held a strong union influence over indigenous industry and was not prepared to cooperate in any industry that viewed the workforce as a dispensable element, as was arguably the case with the American model. In response to this dichotomy, Toyoda and Taiichi Ohno identified that the mass production systems in America could be adapted to emerging ideas developed from their experience as a textile manufacturer; systems such as Autonomation, Jidoka, 5S were quickly developed along with new emerging principles that placed value-added analysis, waste identification/elimination and product flow at the heart of their approach to production. With the support of western quality gurus such as Deming and Shewart, the Toyota Company established a new approach to manufacturing that has since evolved into what is referred to as the Toyota Production System (TPS).

By the 1980's western automotive manufacturers were beginning to realise that Toyota was starting to out-perform them on price, vehicle specification and quality for mainstream consumer vehicles. In the 1990's an MIT research team published their findings from a comparative analysis of Toyota to the rest of the global car manufacturing sector. Their book "The Machine that Changes the World" provided a western name to the key elements and contexts that supported this competitive advantage, and thereafter the methodology was known as lean.

Having shown to develop competitive advantage, lean quickly became an essential system to be synthesised into western manufacturing (Womack, et al., 2007); with a plethora of consultancies offering advice and support of how to implement this new philosophy along with its progeny of tools and techniques. However, without the considerable experience of the

journey and its implied cultural changes, many transformation projects failed or produced short-term results with an emphasis on short-term work-force reduction and cost savings (Liker, 2014). With a mandate for comparatively rapid lean synthesis, compared to Toyota's long-term development, the western organisations were not experiencing the lasting improvement culture and the processes that provided Toyota with its enduring improvement focus; a focus developed from a philosophy that has been nurtured and established over decades. Many western organisations were hence viewing lean success as something attributable to (Japanese) culture (Japanisation) and something not suitable to the west, however, this position did not account for those Toyota plants established in the west that had successfully embraced the lean philosophy and were using a western workforce to do so (Womack & Jones, 2003). This prompted further reviews into lean implementation, and has resulted in pockets of expertise, of varying extents within differing industries, all experiencing varying degrees of success or failure regarding robust implementation and change (Lean Manufacturing Tools, 2015).

Definitions

Lean: lean manufacturing or lean production, often simply 'lean', is a systematic method for the elimination of waste, 'Muda', within a manufacturing system. Lean also takes into account waste created through overburden, 'Muri', and waste created through unevenness in workloads, 'Mura'. Working from the perspective of the client who consumes a product or service, 'value' is any action or process that a customer would be willing to pay for (Womack, et al., 2007). It is based upon the following 5 principles (Lean University, Cardiff, n.d.):

- Identify customers and specify value; recognise the small fraction of time and effort that adds value from a customer perspective.

- Identify and map the value stream; this represents the entire set of activities (end-to-end) that delivers value to the customer (what the customer wants).
- Create flow by eliminating waste; eliminating waste ensures the product or service flows to the customer without any delay.
- Respond to customer pull; understand your customer demand and develop your process to respond accordingly, only producing what the customer wants and when they want it.
- Pursue perfection; creating flow and pull requires radical reorganisation of the human-centric (socio-technical) systems – as this happens more layers of waste become visible, and the improvement cycle continues to constantly pursue perfection where every asset and action adds value to the end customer. This ‘kata’ becomes established thereafter as the norm and lean sustains. The process of continuously improving the process and removing waste is known as Kaizen.

Waste: more easily defined explanations that link to ‘Muda’, ‘Muri’ and Mura’ can be identified as follows (OEE Consulting, n.d.) .

- Manufacturing Industry (Lean Production):
 - Transport; the movement of materials from one significant location to another.
 - Inventory; the levels of raw material, in-process product or finished product.
 - Motion; unnecessary movement by human or machine within a significant location.
 - Waiting; the time taken for materials or information critical to the next process to arrive or be affected.
 - Over-processing; over-sized or over-specified equipment/processes and products produced beyond the quality needs of the customer specification.
 - Over-production; manufacturing/processing too much, too early.
 - Defects; products that do not meet customer specification.
- Service Industry (Lean Consumption):

- Delay; customers forced to wait for service.
- Duplication; customers forced to provide the same information more than once.
- Unnecessary movement; customer forced into unnecessary effort to receive service.
- Unclear communication; customer forced into clarification or misled into mistakes.
- Incorrect inventory; customer unable to obtain the precise product/service required.
- Lost opportunity; missing an opportunity to delight or serve a new/existing customer.
- Errors; the product or service not meeting the customers' demands.

Toyota Production System (TPS): Developed by Taiichi Ohno in the 1950s from work commenced by Sakichi Toyoda, Ohno brought Toyoda's improvement themes and established manufacturing methodologies from Ford as well as the Deming Plan-Do-Check-Act (PDCA) routines together to develop the TPS.

Six-Sigma: is a disciplined, data-driven, approach to eliminating defects from a manufacturing process. In recent years, practitioners have combined six-sigma ideas with lean manufacturing.

Total Quality Management (TQM): is a variant of lean manufacturing wherein the management approach uses the process review-and-improvement methodology to develop long-term success through achieving improved levels of customer satisfaction. In a TQM effort, all members of an organization are required to participate in improving processes, products and services (Anvari, et al., 2011).

Continuous Improvement (CI): is the name assigned to the ongoing effort within an organisation to improve products, processes and services; often using the Deming PDCA cycle as part of its routines.

Organisational Culture: the pattern of basic assumptions that a given group has invented, discovered or developed in learning to cope with its problems of external adaptation and internal integration. Furthermore, these assumptions would have been considered to have

worked well enough to be considered valid, and hence taught to new members as the correct way to perceive, think and feel in relation to those problems (Schein, 2010).

Socio-technical Work Systems: this relates to the inter-relatedness of social (people and society) and technical (machines and technology) and how factors within such create the conditions for successful (or unsuccessful) performance (Walker, et al., 2007). The application of lean, Six-Sigma, TQM, CI the TPS approaches can sometimes (not exhaustively) involve a combination of changes across the following organisational arrangements:

- Processes / Procedures. Whilst the implementation of each approach involves procedures and processes, the output from using the approaches can often result in the creation, adaptation or modification of existing business processes and procedures in order to remove wasteful activities.
- Technology. Lean invokes the separation of man from machine in that highly repetitive tasks should be automated where possible out of respect for the human, and with a view of improved efficiency by having one human monitor several automated processes. Within lean this process is referred to as Jidoka. Six Sigma processes can also focus highly on technology output, reviewing such for variance and capability. Each of these approaches can require modifications to existing technology, or the establishment of new technology.
- People. New or modified procedures are often required to be applied by people (actors) at various levels within the organisation. These actors need to understand the new practices required by new, modified or adapted procedures-or-processes so that they can be successfully expedited. Furthermore, the application of Jidoka or technical improvements invoked as a result of a Six-Sigma campaign could also affect the daily or weekly routines of the people within the business.

The above arrangements are common features of socio technical networks (Challenger, et al., 2014) and they contain artefacts, understanding and practice (Feldman, 2003). In view of their

correspondence to socio-technical work design, it is asserted that the implementation of the of lean, Six-Sigma, TQM, CI the TPS approaches is socio-technical in nature.

High Performance Teams (HPT): simply put, these are teams that achieve significantly large business results, in all key success dimensions (productivity, profitability, quality, safety, compliance), usually within less than a year (Hanlan, 2000). Often applied as a strategic project with a specific performance criterion targeted for achievement, HPTs have proven to be problematic to implement and sustain for the same reason lean has also proven challenging to successfully implement; it requires appropriate organisational cultural conditions (Hanlan, 2000).

Gemba: the location where value, from the perspective of the customer, is added i.e., the shopfloor, the manufacturing line or similar. Raw materials are processed into desired goods, or data is processed into desirable information.

Key Terms

Lean implementation, barriers to lean, change failure, socio-technical, culture, cultural change, organisational culture, socio-technical systems.

Rationale for Research

The current generation of organisations, particularly within the engineering sectors, have to continuously improve the efficiency, range and quality of their products and services in order to sustain growth and/or improve competitive advantage. In order to achieve such, recognised and structured approaches and established quality and business improvement doctrines are often selected for application and synthesis. Arguably the most common methodology applied

within the engineering sector, and gaining favour beyond (Anvari, et al., 2011), has been adaptation of lean, which is a systematic approach to identifying and eliminating waste, whilst redefining the customer perception of value as a guiding principle. Although it has its origins within the post-World War II automotive manufacturing sector, lean has become the most popular business performance improvement approach over the last few decades (Peters, 2010) (Jadhav, et al., 2014) and proliferated within many other sectors (Ballard & Tommelein, 2012) (Stone, 2012). Whilst the sectors newly adapting lean have become well versed in synthesising the procedural tools and mechanisms within the lean portfolio, it is considered that many fall short of developing an appropriate organisational culture in a timely manner (Atkinson, 2010); which has been established as a critical success factor to sustained lean improvement (Achanga, et al., 2006). To adapt and capitalise on the lean methodology often requires a shift in organisational thinking and philosophy, demanding critical reflection and adaptation from employees, and sometimes customers and suppliers, to review functions and processes in a completely different manner. However, the level of lean sustainability in these various sectors that significantly use such human-centric processes has been the subject of a continuing discourse (Peters, 2010). As a result of cultural (organisational) and human factors (Benton & Shin, 1998), successful lean implementation rates outside of Japan were reported toward the end of the last century to be as low as 10% (Bhasin, 2012). This rate has since increased with the improvement of awareness concerning cultural preparation (Calleam Consulting Ltd, 2011); however, success rates on large scale change projects still remains low by comparison to failure rates (McKinsey, 2013) with 70 per cent of lean implementations experience decaying and a returning to the pre-existing processes before lean transition (Schipper & Swets, 2010).

Aim of the Research

Discussions with many managers inside the field suggest that there is a need to develop a new system to deliver rapid cultural change (otherwise mutually exclusive terms) that will enable a faster and more reliable lean implementation process that, in turn, provides more assurance of lean success/survival. To this end, the need to address cultural conditions is essential (Atkinson, 2010) and requires consideration within any new system that is developed. Furthermore, the cultural conditions are to be considered essential in order to sustain the change. The aim of this research is:

to develop a lean-culture work design that enables organisations to develop an organisational culture that supports lean implementation within an 18-month period.

Methodology

The research starts with a justification of the research methods based upon an assumption that the application of socio-technical work design could form a viable basis for developing culture-change interventions, as well as fundamental surveys needed early in the research. This is then supported via a literature survey that reviewed socio-technical work design and its relevance to the research. This is then further reinforced further by a systematic review of case studies involving lean implementation. The literature survey aimed to confirm the relevance of using socio-technical network theories in the research for improving or influencing organisational culture change. Once this survey confirmed the relevance of the science, then a specific socio-technical model was selected as part of the final analytical approach within the systematic review. The output of the literature survey helped to frame the contextual analysis of the systematic review; however, both could be commenced in parallel to each other with the

literature survey needing to be completed first in order to support the analysis stage of the systematic review. The systematic review aimed to identify any trends regarding success, failure and missing elements in the approaches to lean implementation and reviewed such against their socio-technical contexts provided from the literature survey.

Using the knowledge gained from the literature survey and systematic review, the next step was the development of a socio-technical change-readiness assessment method that served to analyse an organisation's inherent socio-technical condition with respect to the readiness for approaching, or adapting to, a lean implementation. The purpose of this fieldwork was to identify unwanted outcomes and/or common gaps in a sample of inherent socio-technical arrangements. These gaps were then cross-checked against the outputs from the systematic review to either inform or reinforce the knowledge obtained from the review.

Using the analysis from the systematic review and the fieldwork, the next steps were to identify wider scientific themes that could be integrated into a lean-culture socio-technical work design that has the specific purpose of rapidly changing organisational culture to support lean. The lean-culture work design could then be tested by implementing it across six manufacturing plants. The lean-culture work design needed to have an implementation-assessment developed, and integrated into the design, so that the quality of each implementation could be measured and compared. These assessments were then also be used by the test plants to measure and track the implementation, and develop a sense of ownership and control. Hence the assessments performed two functions: they were part of the lean-culture work design by providing feedback to plant leadership on implementation progress; and they informed the research by way of providing a quantitative assessment for each implementation.

With the lean-culture work design completed, implementations were then expedited and measured using quantitative data from the assessments, and qualitative data from interviews with change leaders for each implementation. Business results were also observed in order to

identify the impact of the work design. The whole of this data was then used to propose whether or not a culture change has occurred that better suits lean. Furthermore, the quantitative assessment data was then used to identify an implementation level success-threshold for the lean-culture work design, below which the implementation may fail.

Fieldwork testing

Two fieldwork reviews were required. The first review needed to identify unwanted outcomes and/or common gaps in inherent socio-technical (work design) arrangements. The second review needed to test a lean-culture work design. Both reviews used manufacturing organisations otherwise referred to as manufacturing plants, selected from the automotive-component manufacturing sector. The test plants for each type of review were accessed and selected based upon the following criteria.

- For the identification of unwanted outcomes and/or common gaps in inherent socio-technical (work design) arrangements:
 - These test plants were obtained through the researcher's role as a lecturer whilst teaching on the Engineering degree for the University of Suffolk. Industrial Fellowship Scheme grants from the Institute of Innovation and Knowledge exchange were used to fund week-long surveys.
 - Organisations spanning different at least two sub-sectors of manufacturing were needed in order to ensure that organisational contexts (processes and ownership) were considered beyond a single type of manufacturing organisation.
 - The researcher used their LinkedIn network for generating manufacturing sector interest. The researcher has excellent links with the automotive manufacturing

industry, who provided opportunities as part of their interest in development their Manufacturing Excellence frameworks.

- Part time students on the Engineering degree course also represented an opportunity for linking up with wider and more diverse organisations.
- Test plants needed to be undertaking either a transition toward lean implementation, or actively attempting to sustain a lean implementation.
- For testing the lean-culture work design:
 - These test plants were specifically selected from the European, Middle-Eastern and African (EMEA) region of a global tier 1 automotive component manufacturer. The researcher was integrated within the regional management of the Manufacturing Excellence support team, employed by the global organisation headquarters to support the EMEA region in improving manufacturing performance across business criteria including productivity, quality, cost and safety.
 - The plants had stable operations i.e., they were established facilities with healthy profit-and-loss performance.
 - There were no plans for the test-plants to undergo any specific infrastructure transformation such as expansion or relocation.
 - The plants were expected to improve performance using lean as part of a corporate mandate.
 - The plants were to be dispersed across the EMEA region in order to discount any variations created by ethnic culture or diversity (at least as far as possible within the EMEA region).

The plants that tested the lean-culture work design were reviewed as case studies in order to identify the efficacy of the work design for lean implementation and sustainment. Results were analysed against organisational performance (artifacts) and espoused values were identified

through qualitative interviews. Thereafter, the case studies are cross-referenced with each other for conclusions and recommendations. In the final section, the success (or otherwise) of the developed work design is then evaluated.

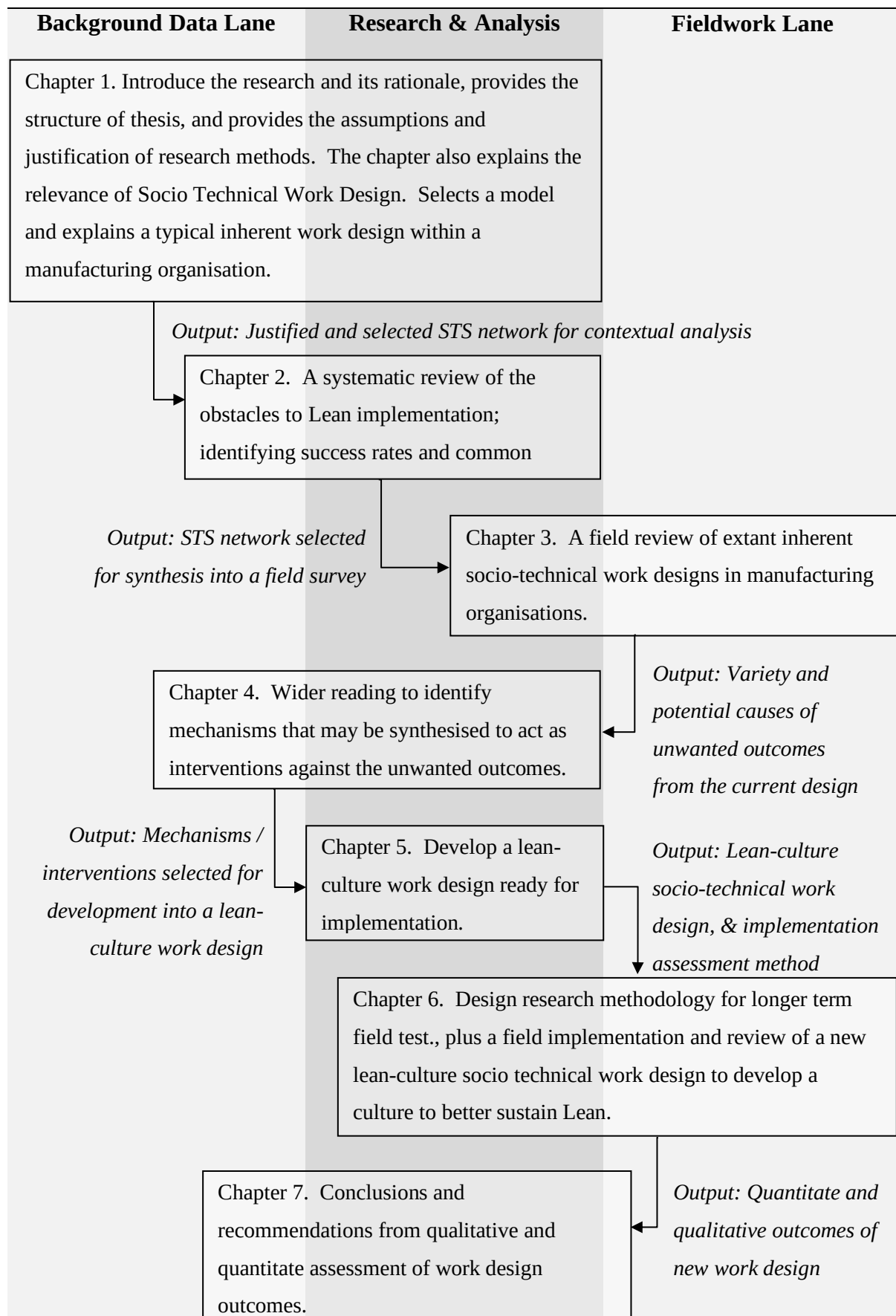
Key Documents

Since the term lean was first introduced by Womack et al (Womack, et al., 2007) (Womack & Jones, 2003) further research into the less obvious machinations of the Toyota approach to problem solving have indicated significant differences to those organisations outside of Japan (Rother, 2010). Japanisation and/or Toyotarism (Wood, 1991) has been identified as having significant cultural differences that arguably better support the adaptation of lean, which in turn has instigated a seam of research into the following: the impact of organisational culture; the reasons of change programme failure; and recommendations for improving organisational culture (Dewar, et al., 2011) (Beer, 2000) (Schein, 2010) (Schipper & Swets, 2010). This research is considerate of the human-centric nature of such changes and hence seeks to adapt the application of socio-technical work systems analysis (Cherns, 1987) (Davis, et al., 2014).

Chapters

The following flowchart in Figure 1 illustrates how the thesis is laid out chapter by chapter and how the mechanisms (tool(s)) are developed.

Figure 1. Thesis Flow Diagram



Justifying the Literature Review of Socio Technical Systems (Networks & Work Design)

The research aims to develop a set of mechanisms to improve an organisation's culture in order to better implement Lean. To this end a framework had to be sought that allowed a culture to be identified or considered in a comprehensive and pragmatic way, which in turn would more easily support the following:

- analysis of systematic review data.
- survey development for fieldwork.
- analysis of fieldwork data.
- intervention design.

A model is needed that can be easily synthesised or correlated against the familiar assets and features within any organisation, and particularly those that are most easily within the influence of leaders and employees to measure, assess and change. Henceforth, the selected model needs to use the tangible features of an organisation as part of its consideration as opposed to the less tangible aspect of organisational culture. Furthermore, the selected model must consider the organisational actors and hierarchical levels where lean is undertaken within the organisation (the actors involved in lean). In order help justify the selection of socio-technical network design, and an according literature survey, the wider theories pertaining to organisational culture must first be eliminated as candidates for further exploration. Such theories include the following, and will each be discussed in this section in order to explain why they will not be selected for further review:

- Johnson and Scholes (1992) cultural web analysis.
- Deal and Kennedy's (1982) 4-type cultural model.
- Holagh's model (2014) on creativity and organisational commitment.
- Iljins' (2015) model on the role of culture in organisational change conditions.

Cultural Web Analysis

The Cultural Web model comprises of six main elements of the corporate culture like power structure, organizational structure, rituals and routines, symbols, control systems, and myths and stories (More Business, n.d.) (Johnson, 1992) that centre around a paradigm that reflects the organisational culture and collective experiences. A benefit of this model is that it simply reflects a clear picture of cultural elements. An issue with the Cultural Web model is the robust identification of the components within the six elements, and that these components may be not enough to truly understand and measure organisational culture. This is because culture is intangible, making it impossible to measure its everyday operations and the way organisations manage certain departments (Cooper M, 2018). A similar issue resides with both the Deal-and-Kennedy (1982), Holagh (2014) and Iljins (2015) models.

Deal and Kennedy's 4-Types Cultural Model

Deal and Kennedy's cultural model indicates that companies utilise a combination of 4 types of culture: tough-guy/macho; bet-your-company; process; and work-hard/play-hard (Cacciattolo, 2014). These are based upon the level of feedback versus the level of risk the company owns in view of its culture (Deal T, 1982). Issues with this model include the point that there often exists an array of sub-cultures amongst the hierarchies (Cacciattolo, 2014) and that the interplay of the sub-cultures and hierarchies (i.e., between organisational management and shop-floor members) can be undefined (Maximini, 2015).

Holagh's model on creativity and organisational commitment

Holagh's model focuses on creativity and organisational commitment. The organisational structure is reviewed against three contexts: sophistication, formality and centralisation. The

apportionment of the organisation's structural behaviour across these nodes then rates the organisation's creativity and commitment from its members (Holagh, 2014). The model lends support to the cultural web model (Johnson, 1992) by proving that empowering members increases organisational creativity (arguably a cultural paradigm) through enhanced routines and rituals; however, it has proven problematic to attribute outcomes to cultural types as per the Deal and Kennedy model. This research is not seeking a cultural paradigm in terms of outcome, but assessing lean sustainment through observed artifacts, qualitative remarks and quantitative performance changes (Schein, 2010); hence this model is less favoured over the work design approach.

Iljins' model on the role of culture in organisational change conditions

Iljins' model focuses on the role of culture in organisational change conditions. The framework goes beyond that of the Cultural Web and 4-Types of Culture. It focuses on the role of the change agent (arguably a manager with influence within the organisation) and how that role contributes to the following facets of organisational culture: adaptability, consistency, employee satisfaction, employee involvement and the organisational mission (Iljins, 2015). Lean often requires a specific type of leadership; Liker calls this lean-leadership (Liker, 2014). Liker discusses how leading organisations such as Toyota places candidates for such roles on company-wide journeys, requiring the company to invest time and effort into the candidate's lean leadership development. These leaders are arguably the change agents within the Iljin model. This research does not seek to dispute the role that leadership plays within successfully sustaining a culture to suit lean; however, the research cannot be limiting its focus to this role. The Kaizen Institute proposes that lean implementations often fail due to the following 4 reasons (Durin, 2018):

1. Lack of direction and vision in running lean projects

2. Lack of time allocated for the lean
3. Lack of resources for lean implementation (tools, techniques and facilities)
4. Lack of adherence from employees affected by the projects

Point 1 arguably indicates a shortfall of leadership within the organisation; however, points 2, 3 and 4 arguably indicate wider social and technical issues that leadership alone may need new structures or routines to address. The above infers that in order to develop mechanisms, the framework needs to focus on the wider social and technical issues, and not predominantly the role of the change agent; hence the Iljin model is not considered.

The Selection of Socio-Technical Networks

The aforementioned models are more useful to change managers and business leadership, augmented with qualified research or consultancy expertise, to guide decision making at a strategic level. Lean directly concerns everyday operations and is best accommodated as part of such routines (Akers, 2011). Furthermore, lean sustainment is best sustained by small business-changes that continuously improve all functions; this is known as kaizen. Larger change projects that seek to transform significant processes are known as kaikaku (Miller, 2020). Miller suggests that both Kaizen and kaikaku are essential strategies within lean, and that kaikaku cannot succeed without a culture that encourages kaizen. As such it could be argued that the selected framework needs to consider the Gemba activities and routines (front line shop floor activities) where Kaizen is more observable than kaikaku. To this end, this research seeks a framework that is more focused on the daily routines that can be better associated with work design, wherein the culture is presented as a both an output and in input to other elements, as opposed to a paradigm presented from the elements. Accordingly, neither the Cultural Web, nor the Deal-and-Kennedy, Holagh and Iljins models present enough shopfloor (Gemba) context against which the research can more easily develop simple

interventions / mechanisms for improvement. This research is seeking to develop pragmatic interventions for all levels of organisational members, specifically at the kaizen-level of implementation. At this organisational level exists complex work design that aims to direct the interaction between people and technologies. Furthermore, the selected model must still consider the cultural outcomes from any intervention/mechanisms, but not restrain such by including fixed/limited definitions or pre-defined/aspired paradigms in advance of any organisational review. With this in view, the socio-technical work design model has been selected for further research and application and should be subject of a wider literature review within later within this chapter.

Justifying a Systematic Review into Obstacles to Lean

A systematic review has been selected to identify the barriers to lean sustainment and implementation. The following addresses why a systematic review should be selected for this research as opposed to a literature survey (presented later in this chapter). A literature survey introduces the context of a topic and the current thinking, but often without a specific research question covering an aspect of a topic. In contrast, a systematic review uses a precise question to produce evidence that aims to underpin specific pieces of research in advance of progressing further research (Wiley Online Library, 2015). Systematic reviews identify specific gaps within a body of knowledge. They search databases using precise search terms, whereas a literature survey is more random in nature identifying take home messages (Elsevier, 2019). The precise search terms and systematic review design will allow the replication of the review so that the findings and conclusions can be considered to be repeatable and hence authentic. Given that this research needs to robustly identify and agree the barriers to Lean, a specific question needs to be addressed, and gaps within the literature need to be identified; hence a

systematic review is selected for the function of identifying specific barriers to lean implementation.

Justifying Field Reviews of Current Work Design

The literature survey should inform the research by providing a socio-technical work design (framework) with different socio-technical contexts that can then be used within the analysis for the systematic review. This analysis can then categorise gaps, barriers, outcomes and interventions within their socio-technical context. The analysis from the systematic review should indicate likely barriers, gaps, interventions and outcomes from previous lean implementations, and then categorise these features by their socio-technical context. Becky Morgan from the Association for Manufacturing Excellence suggests that the majority of lean implementations fail because the tools and methodology are not integrated into the business processes and routines, and are instead attached to the extant arrangements without a specific purpose that matters-to and guides employee decision making and actions at all levels (Morgan, 2016). This thesis refers to these processes and routines within the extant arrangements as the inherent work design; wherein goals, people, processes, technology and infrastructure are previously arranged to suit the core operational needs of the business when it was previously established, potentially without integrating specific arrangements for either lean implementation or sustainment. Lean tools are often copied and grafted onto these extant arrangements; however, the efficacy of the implementation is potentially flawed in view of the possibility that organisations do not fully understand the tools that are being copied, and what is needed to firmly imprint them into their extant processes (Morgan, 2016). The inherent design is built upon theory and works on the principle that if everything goes as planned, and unless something changes, then the design will be successful (ThoughtCo., 2019). The lean-

culture design is an enhancement of the inherent design that is a derivation from observations (Merriam Webster, n.d.). The unwanted/unpreferable outcomes of established inherent designs are identified. Wider research can then be applied in order to work backwards from the unwanted outcomes so that their cause is established. The inherent design is then enhanced with features that are targeted to address the cause of the unwanted outcomes; the inherent design with the additional features is hence referred to as the lean-culture design. This research aims to develop the lean-culture design, specifically enhancing socio-technical arrangements with interventions/mechanisms that could be integrated into new ways of working. Before the lean-culture design is developed, a review of extant inherent designs could be valuable to:

- confirm the relevance of socio-technical work design as an analytical method.
- confirm the gaps and/or unwanted outcomes from the systematic review.
- potentially identify further common gaps/unwanted outcomes.
- potentially indicate wider scientific theories that may direct further research toward the development of interventions/mechanisms.

The Approach to Mechanism Development and Testing and Evaluation

The combined findings from the systematic review and inherent work design field review should be used to identify wider scientific theories that may be relevant to countering the gaps in the inherent socio-technical work design. These theories can then be combined/merged (Subiyakto, 2016) into a lean-culture socio-technical work design for implementation and testing in candidate organisations. Candidate organisations were selected from the researcher's host/employer, a multinational tier-one supplier within the automotive sector. The business case for change (Hall, 2000) was provided by linking the change as a requirement of the company's manufacturing excellence system, and hence targeting cost savings from lean

implementation. Six manufacturing plants were selected for test implementations and focused support from the researcher to aid the implementation. Implementation required an instruction guide or 'playbook' for organisations to use as part of a structured implementation and be delivered with training and coaching by the researcher in order to support successful business change (Hall, 2000). As part of the instructions within the playbook (otherwise referred to as implementation instructions) will be the formation of a plant-based steering committee for the implementation. The committee members will be formed by the plant management team plus the local change-agents appointed to manage the implementation on a day-to-day basis (if not already part of the management team). Six to 12-months after implementation the organisation can then be reviewed in order to assess if the mechanisms have been successful in developing improved outcomes. Participating organisations can be visited for at least half a day in order to walk through the changes, observe and record artefacts, collect quantitative data regarding operational improvement; and then qualitative data will be obtained through discussion with the plant-based change-agents about the implementation and its effects. In order for the review to have meaning, the quality of implementation will need to be assessed so that false negatives are not generated. In response to this need an assessment survey will be developed to match the playbook, asking the plant-based steering committee for the percentage of implementation against key features within the playbook. Definitions will be provided against 0%, 25%, 50%, 75% and 100% implementation question akin to a Likert scale against each key feature (Trochim, 2006). This survey could easily be provided in advance of the review and sense checked through dialogue between the researcher and the plant-based change-agent. The outputs could then be combined to form part of each plant's review. The reviews from each plant could then be combined to form an explanatory case study (Yin, 2018) in order to explain variability of implementation quality between each plant. It is aimed to evaluate if the

mechanisms used have been successful in developing a socio-technical arrangement that can better sustain lean.

A Brief History of Socio-Technical Work Design

The Tavistock Institute of Human Relations was founded 1947 with the purpose finding ways to apply psychoanalytic and open systems concepts to group and organizational life. Eric Trist was a founding member, and a leading scientist in the field of organisational development. Fred Emery held a UNESCO Fellowship in social sciences and was attached to the Institute.

By 1948 the British economy was in difficulties following World War 2; the pound had been devalued, and both productivity and capital investment in new technology were low. The government formed an Industrial Productivity Committee, which included a Panel for Human Factors. This Panel provided various research grants, one of which had a focus on developing organizational innovations that could raise productivity. Through this grant mechanism the Tavistock Institute developed sociotechnical systems design for joint optimization of both technical and social resources; it was based on their work using workers and technology within the English coal mines. Ken Bamforth was a miner, as well as an industrial fellow of the Tavistock Institute. Eric Trist, Fed Emery and Ken Bamforth discovered the potential of achieving improved productivity through self-regulating work groups within a coal mine. This was the first hint that a new paradigm of work might be emerging along the lines indicated by the Institute's work with open systems concepts to group and organizational life.

These studies revealed that the innovative use of self-managed work teams improved both the performance and the psychological well-being of the workers. These teams not only managed their own local working arrangements but were also empowered to solve their problems. This was a contradiction to previous forms of work design in traditional high volume manufacturing

sectors operating within a Fordism economy, employing an approach where efficiency was increased through breaking down production into specialist (narrow-skill) repetitive tasks (Taylor, 1911) requiring high levels of repetitive narrow-skill worker activity. This approach to work design demanded that explicit instructions were provided for the repetitive tasks, and adoption was assumed without question. In further contradiction to this, and given the interdependence of systems and the environment, the socio-technical approach was to structure the system of work so that the self-managed work teams could respond to changing external demands in a rapid and flexible manner. The self-managed teams were enabled to develop their own adaptation to new technology. The design for this enablement was developed from empirical studies that proposed work design principles such as

- harmonise the compatibility between a process and objectives.
- develop only a minimal specification of tasks, roles, and objectives.
- take control of issues as close to their point of origin.

Throughout the 1960's and 1970's, STS was used in change-approaches within Europe, particularly in Scandinavia (Trist, 1981); meanwhile, in the US a different change-approach that relied on evolving the organisation's psychology, through behavioural science, was being developed and practiced. This approach was designated Organisational Development (OD) (Beer & Nohria, 2000) and differed from STS in that it did not explicitly consider the technical aspects of the organisation's development (it was humanistic as opposed to socio-technical); however, both STS and OD had a common theme of participatory development across the organisation's members. In the 1980's the dominance of both STS and OD approaches to organisational change were successfully challenged by the emergence of a new approach, Strategic Management Theory (SMT). Given that changes could involve down-sizing and divestment, participatory change management could be seen as ineffective due to worker self-interest acting as a barrier to fiscal decision making. Transferring entire control to senior

management, as with SMT (Beer & Nohria, 2000), potentially offered greater efficacy for changes involving divestment and down-sizing. When using SMT it is suggested that leaders need only to engage in the rhetoric of empowerment to subordinate staff (Burnes, 1996), (Dunphy & Griffiths, 1998); such empowerment is essential for STS and OD. Despite the upsurge in SMT, conditions of low unemployment and high absenteeism in the 1970's and 1980's forced the Swedish manufacturing industry to respond by the continued use of STS work design in order to develop improved working conditions (Burnes, 2009). It is now believed that this preparatory work created an excellent foundation for lean implementation (Dabhilkar & Ahlstrom, 2013) and supports an argument that both STS and lean paradigms can be converged (Wallace, 2004) as the technical principles of lean implementation are best supported by the socio-technical behaviours that an STS approach to change provides. However, SMT arguably prevailed as a dominant theory for organisational change within the Western civilisations until the proliferation of lean in the 1980's (Hines, et al., 2004) started questioning its validity. Whilst no predominant approach prevailed during this period, research continued in the context of socio-technical systems theory and its wider applications. Since its introduction into operations management in 1988, the transition to lean, and the competitive advantages it may offer, has been pursued across many industrial sectors; this has been particularly prevalent within manufacturing (Womack, et al., 1990). This pursuit often demands significant organisational changes (Womack & Jones, 2003) that are socio-technical in nature. Accordingly, STS theory is arguably an optimum model to help explain the lean change management process (successful or otherwise) in a modern organisation (Mumford, 2006). In later research regarding applications for STS, the network was further refined for the purposes of research into crowd behaviours (Challenger, et al., 2010) wherein a systems approach to crowd management was developed using a six-node socio-technical network comprising: goals, people, policy/processes/procedures, technology, infrastructure and culture.

Whilst proving successful in analysing crowd events and preventing further crowd disaster (Challenger & Clegg, 2011), the six-node model covers all aspects (social and technical) of a modern industrial organisations (Alves, et al., 2012), (Feldman, 2003), (Gurumurthy, et al., 2013), (Langstrand & Elg, 2012), (Raja, 2011), (Sadeghi, 2011). Subsequently, researchers have proposed that consideration be given to the wider application of socio-technical systems theory in a “*call for bravery*” (Challenger & Clegg, 2011).

Work Design Evolution

Socio-Technical Systems theory is the third of three variants of job (work) design (Burnes, 2009) that follows on from the work of Maslow (1943). As working conditions and society have evolved (lower unemployment rates, globalization and technological advancement), then the higher-order needs of workers have risen in profile. Whilst this creates a demand for more flexibility and skill from the worker, organisations must now also realize that to get the best performance from staff, jobs must be designed to not only meet their financial needs, but also their psychological demands such as self-actualization. The first two variants of job design are:

- job enlargement, where the variety of tasks is increased through a combination or rotation of fragmented tasks.
- and job enrichment where control is handed over to the worker, passing over some responsibilities previously held by the manager.

Socio-Technical Systems theory differs from job enlargement and enrichment in that it shifts the design focus from the fundamental (value-adding) activities of the worker to the organisation, which is composed of a network of interdependent social and technical components (nodes). The suggestion is that there is little point in changing any one component / element of the system without considering the other interdependent parts of the network for

change, or adaptation to the change. Businesses are constantly required to change and adapt to new commercial conditions and environments in order to maintain market position and growth (Applebaum, 2012); this often requires everyday-innovation in the form of either new products, and/or new business processes at all levels of the organization (F.Patterson, 2009). Such innovations require change in a range of measures and levels of management; and hence it can be reasoned that embedded within the processes of everyday innovation at all organisational levels is change management (Euchner, 2013). Although the organisation's engineers, accountants and administrators may not view themselves as such, they often have a second role: that of "the change manager", a role that also requires a specific set of competences. Both Crawford (2010) and Zink (2008) propose that organizational change within manufacturing (an endeavour that would typically encompass the range of systems within the socio-technical umbrella) requires a specific set of competencies and tools (Crawford, 2010) and that most endeavours and their leaders have limited success (Zink, 2008). These change programs have to consider the more social and behavioural elements of change as well as the systematic and technical; hence aspects of leadership and culture have to be considered. Accordingly, authors such as Schein (2010), Pardey (2007), Burnes (2009) and Atkinson (2005) have improved awareness of such social challenges and solutions to organizational change management features. Despite a plethora of information and techniques for change management; McKinsey and Gartner (2011), amongst others, have reported high (Western) change program failure rates from the year 2000 to 2014. This was reinforced by the work of Sterman and Repenning (2001), who claimed that a management paradox was growing, whereupon the growth in choice of tools and techniques to develop improvement has little to do with the organization's likelihood or capability to benefit from whatever tool is selected (e.g., TQM or Lean) (Repenning, 2001). This has spawned a seam of research within the field of failure-analysis and failure-review by authors such as Beer, Eaton and Keller. Beer (2000), Eaton (2010) and

Keller (2014) argue that change success is attributable to how the introduction of change interacts with the physical, emotional, technical and psychological structures within which the implementation occurs; arguably a mix of culture and technology that is accommodated by the socio-technical framework in this thesis. It is also noteworthy that amongst the range of published change management tools, techniques and philosophies, significant emphasis is being placed on the impact and importance of cultural-change to change-sustainability and performance (Atkinson, 2010).

Socio -Technical Network Variants & Development - the Inclusion of Culture

In 2003, Langstant and Elg synthesized the research from Feldman (Feldman, 2003), to employ a socio-technical network model consisting of only 3 nodes: artifacts, understanding and practice. The significant feature in the research is that it demonstrated a reciprocal relationship between organisational routines and the people's (staff/employees) understanding of how the organisation operates. Thereafter, the people's understandings then guided their practice, which in turn created and reinforced their understandings. If understanding equated to culture, then this culture was both informed by, and mediated, the practices (Zeffane & McLoughlin, 2006). Langstrand and Elg combined the organisational change perspectives of human behavioural-patterns and environmental-interactions into a socio-technical system that consisted of non-human and human actors (Langstrand & Elg, 2012). The aim was to identify how non-human resistance to change is developed, and how the misalignment of these non-human actors to the change initiatives could inhibit change. The non-human actors included the following:

- routines or principles that opposed new change initiatives.
- potential side-affects (changes) that could have a negative impact.

- overly complex procedures that took time away from change activities.
- and procedures and artifacts that did not support the main change activities.

In terms of the socio-technical system network introduced by Challenger and Clegg (Challenger, et al., 2010), the Feldman (2003) network covers four of the six nodes: people goals; policies and procedures; and culture. Alves et al (2012) drew the evolution of manufacturing from that of a techno-centric mass-production (Fordism) environment (where the worker needed only minimal thought input to carry out basic, standard and repetitive work), to a more sophisticated working environment that encourages the worker to contribute to problem identification and resolution (such as the lean environment that is socio-technical in nature) (Alves, et al., 2012). Accordingly, Alves identifies that the modern socio-technical working environment is one that promotes the workers qualifications, teamwork, and mobility; as such it is ideally an organisation that empowers team members (a culture of empowerment). Typical to modern manufacturing organisations, socio-technical systems (and hence the cultural context) are also linked to strategies that adopt: multi-skilling, job rotation, job enlargement, and job enrichment (a function of policy and procedure) to avoid the worker's boredom (Azizi, et al., 2010), whilst relying on self-management (van Amelsvoort & Benders, 1996). Through this Alves (Alves, et al., 2012) defines the socio-technical system as one that is based on the utilisation of flexible equipment (technology) and skilled human resources (people) adapted to the needs of its organisation (Kovacs & Moniz, 1994), and through the coordinated establishment of local decision making (goal alignment) by teams that have the autonomy to prioritize and manage their tasks (Molleman, 2000). To this end, all of the socio-technical nodes identified by Challenger et al are identified with the exception of infrastructure (Challenger, et al., 2010). Raja compares the principles of lean production with socio-technical systems through a cross-sectional organisational survey that indicates social practices have a direct effect on technical practices, and that these impact the employees' quality of life (Raja,

2011). It links the principles of lean through to socio-technical work design and supports Shah and Ward's definition that "*Lean production is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability*" (Shah & Ward, 2007). Furthermore, Shah and Ward's research supports Raja by indicating that the behaviours of middle management are crucial for the implementation and sustainability of lean as it provides the support necessary for the usage of appropriate social and technical practices that are implicit in its robust implementation. Of note, when defining the three levels of organisational culture (Schein, 2010), Schein identifies the observed middle management beliefs as espoused values in the second level. These values are built upon underlying assumptions (the first level) and create artefacts (behaviours at the 3rd level); all of which combine to define the organisation's culture. This links with Raja's research to the STS domain of organisational culture as the social values become technical practices (artefacts). Whilst Raja does not offer an explicit network as part of the research, a review of the evolution of socio-technical systems is considered, and amongst that is the more recent model from Clegg et al. Amongst the limitations to the study was the restriction of the survey to middle management and supervision respondents within the participating organisations, wherein Raja proposes the respondents were subject to cognitive bias with regard to questions concerning their employee's work practices, quality of life, and dissonance.

Gurumurthy et al synthesized a socio-technical arrangement to use a graph theoretic approach in order to analyse the change readiness of an organisation for adaptation to lean thinking (Gurumurthy, et al., 2013). Their research attempted to develop an approach for analysing change readiness that predominantly considered the humans ('main-actors') within and beyond the organisation through the following roles: management, employees, suppliers, customers (with separate networks for each actor) and the organisation. Amongst the networks developed for each main actor was the organisation network, the purpose of which was to review the

systems, procedures, culture (inertia or resistance to change) as well as resources needed for the change(s). The research used six network diagrams covering twenty-six sub-factors across the five main-actors; it was hence statistically complex and required skilled researchers to draw out data. Given its analytical resource requirements it was excluded from this research as an approach to rapid cultural assessment and change. However, of particular interest is that the graph theoretic approach developed a six-node network for the organisational interdependencies with the following contexts: existing culture of the organisation; availability of resources to carry out change; roadmap for change and contingencies; current status of the organisation; consultants to guide the change; and degree of inertia or consensus. From this it can be seen that between the actor and organisational networks from Gurumurthy there is correlation to the Challenger, Clegg and Robinson network (Challenger, et al., 2010) as follows:

- culture, policies and procedures (plans for change);
- resources in terms of technology and infrastructure (the organisation's systems);
- goals (current organisational status);
- people (consultants to guide the change - these could be internal and external consultants).

To this end, the network reinforces the Challenger model in terms of structure, although such is not explicitly linked within Gurumurthy's paper. Of note, Gurumurthy et al hypothesized that a lack of assessment for change readiness was a reason for lean implementation failure (Gurumurthy, et al., 2013). Sadeghi reviewed the alignment of organisational change strategies and their relationship to organisational performance (Sadeghi, 2011). Sadeghi used the socio-technical contexts of goals, humans (people), culture, technology and infrastructure; five contexts of the six associated with the network used by Challenger et al (Challenger, et al., 2010), wherein the context of policy/procedure are used in addition to the Sadeghi contexts. Despite the apparent absence of the sixth context, Sadeghi demonstrated that the more aligned

the socio-technical nodes with regard to the typologies for organisational change, the higher the performance was in terms of group and individual behaviours. This is reinforced outside of the manufacturing sector through a case study in teleworking (Bentley , et al., 2016), where it is argued that socio-technical systems theory can be synthesized to theorise and analyse how multiple social and organisational factors jointly contribute to telework outcomes'. Whilst the factors used in the study were less technical than most other such studies (focusing more on a network entailing humanist elements such as social isolation, psychological strain and job satisfaction), it clearly states that 'the better the fit between these sub-system elements (a central theme to the application of socio-technical analysis), the more effective telework will be in terms of desired outcomes for the individual and hence the organisation. This is reinforced by research from Edwards and Cooper (1990) into the person-environment fit approach to stress, claiming that a lack of congruence among individuals and their environment has been found to be a cause of stress (Edwards & Cooper, 1990). Zeffane and McLoughlin (2006) go on to add that the organisation's culture could then either: help individuals resolve this stress where culture is positively aligned to provide a remedy for the lack of congruence between individuals; or it could compound the stress in such instances where the culture is unsuited to address such incongruences (Zeffane & McLoughlin, 2006).

Advantages of the 6-Node Network

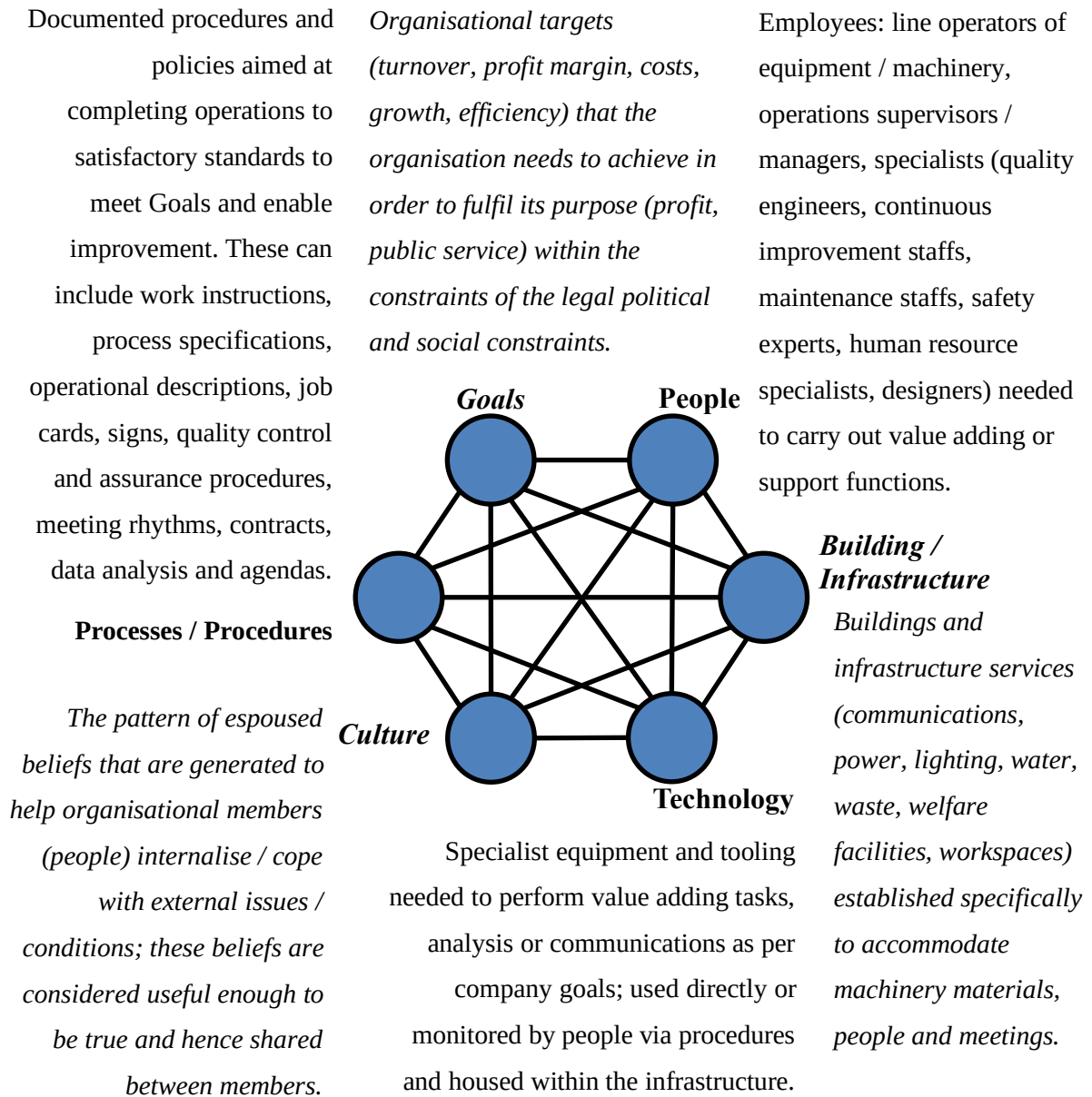
The main advantage to the six-node socio-technical network (Challenger & Clegg, 2011), is that it proposes the two-way influence between the cultural node and the five other nodes (goal, people, processes, technology and infrastructure); inferring that not only does culture direct and inform decisions and performances within the other nodes, but also that the organisation's culture and workers' ability to embrace change (or feel threatened by such) is developed and reinforced by conditions and information from the remaining nodes (Dent & Powley, 2003).

Culture is hence both an output and an input. This is akin to the high-level socio-technical approach (Langstrand & Elg, 2012) where the circular interactions between artifacts, understanding and practice (Feldman, 2003) inform and reinforce each other. Whilst the network is proven to perform well, wider reading within the realm of socio-technical systems and OD suggests that other areas of change management and organisational psychology could be considered for inclusion into a new socio-technical change aptitude survey or lean-culture work design.

A Typical Inherent Socio Technical Work Design

The following diagram (Figure 2) uses the 6-node socio-technical system network (Cherns, 1987) with expanded boxes that explain examples of features/artefacts that could be explained as part of the socio-technical work design arrangements for a manufacturing plant. The nodes and the indicative content in Figure 2 could be used as part of the analysis within Chapter 2 to categorise barriers and interventions identified from the systematic review into obstacles to lean. The 6 node arrangements, and the indicative content, can also be used as part of the field review in Chapter 3 to identify any unwanted outcomes from extant manufacturing plants using an inherent work design.

Figure 2. Typical Contents of an Inherent Socio-Technical Work Design



Change Management Sophistication needed for Lean

Given that Miller suggests that organisations do not integrate lean as part of routine (Miller, 2020), any lean changes resulting from Kaizen or Kaikaku could arguably be implemented using a Lewinian 3-stage model of unfreeze, change, re-freeze (Mind Tools Content Team, n.d.). This may better suit Kaikaku where large scale projects are undertaken, but is contrary to the nature of Kaizen where small improvements need to ideally be constant and part of daily

/ weekly routines (Miller, 2020). In terms of the Lewinian 3-stage model, Kaikaku can often take the form a rapid improvement event wherein a new process (e.g., replacing an outdated material replenishment system with a new Kanban system, or reducing inventory levels) may be physically introduced onto the Gemba in a rapid manner akin to unfreeze, change, re-freeze. This would require a lot of attention from change-agents and likely considerable preparation from all stakeholders in advance of the change implementation. That same should be said for Kaizen, wherein smaller changes can be made in an equally fluid 3-stage motion championed by Gemba stakeholders (e.g., installing spare consumable tooling closer to the Gemba to reduce downtime); however, Miller suggests that these routines and such empowerment are not integrated as part of the Gemba actor's routine or job role; hence lean is not integrated, change is restricted and the 3-stage change model is not expedited. For a lean change or transformation to occur there needs to be the following (Liker, 2014):

- accountability (somebody responsible for the change or change-impact); communication
- stakeholder engagement
- transparent progress reporting.

Accountability, communications, stakeholder management and transparency could be arguably all facets of change management theories that have evolved from the Lewin model. In contrast to the needs of lean transformation (and hence Lewinian change), the Gemba actor's routine and limited empowerment may restrict lean change as follows:

- lack of accountability (the actor may not be considered as the owner of their process with sufficient influence to own and change it).
- resistance in communicating ideas or initiatives through no formal mechanism/opportunity, or a lack of communications skill.
- given the relatively low hierarchical status of a Gemba worker, they may not have the social or structural influence to engage the required stakeholders for the change.

- a shortfall in transparent reporting if a local Gemba initiative is taken as no such reporting mechanism may be established or encouraged.

In short, most inherent socio-technical work designs are not necessarily constructed to accommodate the sophisticated (by comparison) change mechanisms that lean kaizen truly requires. They arguably have more in common with simplistic and transactional leadership structures used within more historic manufacturing work designs such as with Fordism.

Conclusions and Recommendations for Further Research

Socio-Technical System Performance and Application

STS analysis is suggested to benefit the assessment of barriers to work optimisation. It can identify the humanist (cultural) aspects that techno-rational implementation or growth philosophies may otherwise omit; it is important that social and technical aspects are equally valued across the nodes of the network. Misalignments between the STS nodes can result in the failure of change programs. The value of using STS and change formulae to categorise and assess drivers and resistors is that the each are comprehensive. The analysis of the inherent-state socio-technical work design should be reasonably uncomplicated and allow socio-technical misalignments to be identified.

Network Congruence

From a review of varying STS network models in this chapter, it can be proposed that there is general agreement between the networks. Whilst node quantity may vary, there remains broadly a similarity in that technological, procedural and people nodes exist. The phenomenon of culture appears later within the evolution of models, as does infrastructure and goals; these provide more suitable contexts within which to allocate differing observations or artefacts

found within an organisation. To this end, the Challenger & Clegg model offers the most suitable arrangement to cover modern manufacturing facilities within the scope of this research.

Wider Theorems Pertaining to Change Readiness

In order to fully un-pack the contributory elements pertaining to culture, wider consideration could be given to elements beyond a traditional socio-technical network. In order to rapidly and yet consistently assess an artefact, espoused belief or an observation as either a positive or negative asset to an organisation's socio-technical arrangements the researcher may require some sort of assessment framework in order to assess observations in a consistent manner. There may be a need to undertake some form of qualitative analysis of an organisation's change readiness, wherein change formulae could be best employed to review qualitative data and help leaders quantify and benchmark change readiness for improved decision making in advance of full lean implementation programs. It could be argued that change readiness and organisational culture may be related (Senge, 2006), and that in order for a learning organisation to be developed (i.e., an organisation capable of developing its own improved sociotechnical work designs) then significant effort must first have been undertaken to develop a culture to support this orientation (Garvin, et al., 2008).

Obstacles to Lean

In order to specifically identify the barriers and interventions commonly associated with lean success and failure, a systematic review was undertaken and reported in the next chapter, wherein wider literature can now be interrogated with specific research questions. The data from this review was then classified against the 6-node socio-technical of Challenger et al. (2011).

CHAPTER 2 – OBSTACLES TO LEAN

Obstacles to lean implementation: A systematic review

Summary

This chapter provides a systematic review of 1088 case studies involving lean and similar improvement change projects from 2010 to 2015 within multiple employment sectors across the world. These projects involve large-scale organisational and behavioural change, and are aimed at reducing waste and improving competitive advantage. Organisations were separated into two types: those with high project outcomes (successful); and those with mid to null outcomes (unsuccessful). The review aimed to identify the differences between the groups in terms of: the barriers identified to the change; the interventions used to bring about change; and the promoters who supported the change. The review also grouped the barriers and interventions into their socio-technical contexts in order to identify any trends. It was concluded that organisations with successful change-projects were more culturally aware, with a majority of such organisations proposing that cultural unsuitability and organisational philosophy represented barriers to change. Organisations with unsuccessful change projects tended to cite lack of lean knowledge and poor leadership skill as their largest barriers. Both types of organisations demonstrated an equal amount of investment on resources for lean process implementation and training, whilst the more successful organisations invested more effort on goal alignment and philosophical adjustment. The cases do not explicitly report on initial assessment activities that test their change readiness in advance of any change project.

Introduction

This review aims to identify the common contexts of success and failure in terms of the barriers, interventions and actors involved with Lean implementation, so that further research could be directed toward developing practices that may support successful lean transformation. This review examines the activities that contribute to successful lean projects and identify any data trends and gaps that infer the need for further analysis. Finally, the outcomes will be grouped by their socio-technical context in order to ascertain the relative importance of the contexts within the change process. Socio-technical systems in organizational development is a framework that recognizes the interactions between working environments, technology, policy and people (Trist & Murray, 1993) through the establishment and cross-linkage of 6 inter-dependent nodes: Goals, People, Infrastructure, Processes, Technology and Culture. A key principle of the framework is that any change to one node will affect the other(s) (Cherns, 1987).

Effective Change Management

Established and published organisational theories often imply or explicitly state their standpoints of effective change management mechanisms within the explanations of their concepts and schemes. However, philosophical perspectives between the more extreme theories are diverse, and this makes the definition of effective change management difficult to define. The Human Relations movement (Rose, 1988) views change as a complex socio-technical system (Cherns, 1987); an irrational process that relies on excellent leadership and persuasion to bring about successful change-outcomes from emotional beings. Developments along this line include the Japanese model of change management (Wood, 1991) and the Organisational Learning model (Argyris, 1999), both of which involve a focus on developing

people and involving them in the planning process. This is in stark contrast to old, yet unperceptively enduring Classical approach to change management (Taylor, 1911a) (Taylor, 1911b) where a set of rational responses are demanded from workers (complete acceptance of the change and its mechanisms) in order to develop an organisation into what it should be. These differing approaches to change management are critically analysed by Burnes who observes the following: *“The one clear message that emerges is to beware of any theory which claims that it is the one best way (sic) yet all three of the approaches appear to advocate just that”* (Burnes, 2009). From this, we can ascertain that there will be differing perspectives on what constitutes truly effective change management. According to Hayes, change scale can take two main forms (Hayes, 2002): there is incremental change wherein the focus is on high-frequency small-scale changes to improve performance by continuous adaptation whilst maintaining or slightly adapting the stability of the organisation; and there is discontinuous change wherein a large-scale transformation is required/expected from a single project/change-piece that is ultimately occurring-in/producing instability. Each change process requires different combination organisational (socio-technical) conditions for success; each requiring differing behaviours, processes and goal alignment.

Research Questions for the Systematic Review

The following research questions were developed in order to identify the reasons for change failure and success through the analysis of barriers to the change, plus interventions and stakeholders applied and involved in the change process. The questions begin with the identification and occurrence-rate of the barriers to change. Research Question 1 is developed to identify the barriers and classify such to an STS context to identify barriers within a cultural context. The classification also makes it possible to identify whether non-cultural barriers sponsor the cultural disposition. Likewise, the same type of data is required to interventions

(the responses applied to the barriers for change); to this end the same process was applied and structured within Research Question 2. Qualitative observations can then be made regarding the consistence of interventions and barriers within cases of high-level outcomes or otherwise. Given the nature of culture pervading all levels of an organisation, as well as the influence that customers and suppliers have upon an organisation, the second question also aimed to identify stakeholders-participants in the change process. Finally, the third question's aim is to compare the quantitative data from research questions 1 and 2 and identify trends in terms of barriers and interventions against cases that have high to null level outcomes. The rationale is to identify common or absent themes.

The research questions are as follow:

- RQ1: What represents the largest barriers with respect to improvement (change) failure?
- RQ2: What interventions/promoters support improvement success?
- RQ3: What are the differences between cases that have positive improvement (outcomes) against those that have nil/negative improvement in terms of preparation, and addressing issues?

Systematic Review Design

The main purpose of the review was to obtain data on a significantly high number of recent and relevant failed and successful change interventions (case studies), centring on lean, and analyse each for differences between explicitly identified barriers, change interventions and promoters (actors) to identify trends that may help conclude common reasons for failure and success. As well as lean, other improvement processes that require significant project management and resources to realise were also included: Continuous Improvement (CI); Total Quality Management (TQM); Six Sigma; and progenitors of lean such as Kaizen, Just-In-Time

(JIT) etc. The rationale behind this was that these all share the same ultimate purpose (to provide competitive advantage), deploy in similar organisations/environments, share similarities in terms of origin (Deming et al) and have common barriers in implementation and hence common change interventions. The review also aimed to capture studies from differing parts of the world and industrial sectors in order to remove any cultural bias from region or employment sector. The information will be presented in tabular form. Barriers, interventions and promoters will be cross referenced against the following: a percentage as the total number of records; and a percentage of cases with positive outcomes; and a percentage of the cases with null-to-moderate outcomes.

Systematic Review Search Strategy

For the review to draw in papers including either case studies or similar examples, the strategy needed to focus on the reason(s) for either ‘change program’ success or failure within the lean context of improvement. This simple and short search terminology prevented misinterpretation of ‘lean’ (i.e., inclination) by providing equal justification to only 2 other terms: ‘reason’ and ‘change-success’. From this, it was apparent that lean progenitors such as Six Sigma, TQM etc. were already being collected under the single key-word search term of lean; however, the search term ‘change-success’ and variants thereof were predominantly yielding mostly theoretical works (literature surveys and periodical articles) and not a sufficiently encouraging seam of case studies. Furthermore, it has been previously established that circa 70% of change projects fail (Keller, 2014), (McKinsey, 2013), and it was noted from a sample that under the search term of ‘change-success’ the failure ratio was a lot lower; potentially indicating a non-representative sample. In response to this, the search term was modified to ‘change-failure’; immediately more case study samples were brought forward, and a sample yielded a failure

ratio akin to the McKinsey findings. The final search terms were hence as follow: ‘Lean, TQM, 6-Sigma, change programme, change success, change failure’.

Inclusion Criteria

Lean gained significant profile after the publication of MITs International Motor Vehicle Programme (IMVP) research and subsequent publication in 1990, *The Machine That Changed the World* (referred to by the authors as “Machine”) by JP Womack, T Jones and D Roos. It was the IMVP (now named the PVMI – Program on Vehicle Mobility and Innovation) that provided the name “lean” during Phase 1 of their research between 1985 and 1990. For the purposes of this review and follow-on research, lean processes remain the main focus, hence the significance of the IMVP date, however, its progenitors (Total Quality Management, Continuous Improvement) and elements/counterparts (TPM, Six Sigma etc.) are also being grouped under the banner of ‘lean’ implementation due to their origins and similarities in ethos. Phase 2 of the IMVP lasted until 1998, and its main purpose was to track the diffusion of lean production. Phase 2 also saw follow-up publications such as *lean Thinking*, first published in 1996 and again in 2003 that explained how different industries could synthesise some of the principles described within “Machine”. The consultancy sector reacted to the market need for lean consultancy services as industries beyond the automotive and manufacturing sector started developing their lean journeys (some successful, some otherwise). Through the search parameters, it was observed that the publication rate has reflected this journey of lean discovery and proliferation; since 1990 the rise of journal publications commenting on such has demonstrated a reasonably exponential increase from a near-zero (static) baseline to a steady increase in annual publication rate, peaking at 54 per annum within the previous 5 years (2010-2015) up to the point of the review. At the chronological point of the review, the data also indicated that 47% of potentially relevant

articles from the search were produced between 2010 to 2015 (the last 5 years leading up to the review). As the aim was to review lean implementation (and its progenitors) in wider commercial contexts, not just manufacturing, a timeline between 2010-2015 would provide data with a sufficiently rich seam of implementations that benefited from institutional experience (consultants and sectors), whilst also allowing time for greater cross-sector proliferation. Furthermore, selecting a later timeline would reflect technological developments in social networking etc. that should prove relevant. The data set provided sufficient quantity for a Systematic Review from the near-50% of potentially relevant and recent articles; hence it was considered to be representative of contemporary trends and experiences.

Standards of Evidence

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) report was designed as a guideline to help researchers undertaking systematic reviews to report the purpose of their reviews, what they did and what they discovered. The advances in systematic reviews have required the methodology and terminology have necessitated an update to the guideline. An expanded 27-item expanded checklist is established to define reporting recommendations for review identification, selection and appraisal. Along with the checklist is also a recommendation for developing and including flow diagrams that visually depict the inclusion/exclusion process (BMJ, 2021). Given the multimethod nature of the literature and outcomes that are not as strictly defined as in medical research, the full PRISMA checklist was suggested as being too prescriptive. The PRISMA checklist was not mandated for the review, so a synthesis of the checklist by Majumder at Project Gurus has been used (Majumder, 2012), and the Nesta standards considered. The systematic review checklist is in the following table.

Table 1 - Systematic Review Checklist

Topic	No.	Checklist Item	Level of Importance	Response	Yes	No	N/A
Title	1	Identify the report as a systematic review, meta-analysis, or both, or the type of paper and the title scope.	High	Report is identified as part of the Chapter introduction.	●		
Abstract	2	Clarity of the study with; background, aim, methods used, findings, conclusion and other relevant information.	High	Abstract included within the chapter, which is dedicated to the Systematic Review.	●		
Introduction	3	Must have a rationale.	High	Research aim is included within the chapter.	●		
	4	Must mention the objectives of the study	High	See sections on Effective Change Management, and Systematic Review Research Questions.	●		
Methods	5	Protocol registration.	Low	Not applicable.			●
	6	Eligibility criteria mentioned.	Moderate	Inclusion criteria stated.	●		
	7	Information sources or the data collection sources.	High	A section on sourcing and sifting of research papers is included. PRISMA flow diagram included with paper references numbers. The sections also includes how the papers where cross checked by volunteers in order to address selection and inclusion bias before the quality checks with research supervision.	●		
	8	Search strategies or the research paradigm/philosophy.	Moderate		●		
	9	Study selection or the research approach.	Moderate		●		
	10	Data collection process or the sample size.	High		●		
	11	Data items.	Moderate		●		
	12	Risk of bias in individual studies.			●		
	13	Summary measures or the tools of analysis	High	Coding selected and stated.	●		
	14	Synthesis of results or the methods of analysis	High	Results presented across 3 tables, 2 of which use radar button tables for ease of reference.	●		
	15	Risk of bias across studies	Low	Not applicable.			●

	16	Additional analyses	Low	No additional analyses beyond identifying a gap in the literature.	●
Results	17	Study selection of the key findings	High	Key findings presented in tabularised form and statistics on proportionate frequency of the occurrence of coded items.	●
	18	Study characteristics or statistical presentations	High		●
	19	Risk of bias within studies	Low	Papers reviewed with qualitative remarks, and samples taken by research supervisors for audit. Audit rules explained.	●
	20	Results of individual studies or graphs and tabular presentations	High	Results are broken up and presented by context (barrier, intervention, actor).	●
	21	Synthesis of results	Low	No results obtained for risk bias – not applicable – not results missed.	●
	22	Risk of bias across studies	Low	Not applicable.	●
	23	Additional analysis	Low	No additional analyses beyond identifying a gap in the literature.	●
Discussion	24	Summary of evidence	Moderate	Summary of evidence is given within qualitative remarks, results tables / section.	●
	25	Limitations	High	Search terms and time-limit for papers selected indicated within the research design, otherwise the limitations based upon findings beyond gaps in the literature are not identified.	●
	26	Conclusions	High		●
Funding	27	Information about funding or author conflict	Low	Not applicable.	●

Standards of Evidence ... continued

Formerly known as the National Endowment for Science, Technology and the Arts (NESTA), Nesta is an innovation foundation based within the United Kingdom. The organisation provides funding and resources for a range of research programmes and helps to develop policy and promote social innovation across a variety of sectors. A part of its work within social innovation is the establishment of a five-level standards framework for grading evidence. The Nesta Standards of Evidence were developed to help by Nesta to guide their grant funding. The levels are given in the following table.

Table 2 – Nesta Levels

Nesta Level	Standards Descriptor
5	You have manuals, systems and procedures to ensure consistent replication and positive impact.
4	You have one + independent replication evaluations that confirms these conclusions.
3	You can demonstrate causality using a control group or comparison group.
2	You capture data that shows positive change, but you cannot confirm you caused this.
1	You can describe what you do and why it matters, logically, coherently, and convincingly.

(Whitmore, et al., 2018)

The above Nesta framework aims to specifically provide a stepped hierarchy to better assess the level of evidence within social research, which is more suitable to this systematic review given that lean implementation is both a social innovation, and not subjected to any professional standards framework to robustly measure and compare the quality of outcome from each implementation (as would arguably be the case within other sectors such as medicine). The research papers within the review are able to infer either positive or nil change, which is inferred to be caused by the Lean implementation. Hence the papers and this systematic review would meet Level 2 on the Nesta framework.

Sourcing and Sifting of Research Papers

The papers were sifted using the settings as per the following table, with any discipline being considered, but filtered thereafter on the journal article's subject terms. Consistency of the sift based upon subject heading and abstract was achieved by peer review with volunteering undergraduate students studying a lean transformation module. At each stage of evaluation, studies were excluded from the sifting process if certain inclusion criterion were not satisfied; to elaborate, studies had to relate to a specific lean implementation or set of implementations and include qualitative remarks as part of a narrative on the outcome of the implementation. Consistency was maintained through the application of volunteer undergraduate students proof reading selections of papers that were selected or de-selected based on the criteria. This was also subject to consultation through PhD supervision, with de-selected papers being provided.

Table 3 – Summary of Search Settings

Search terms input:	(reason OR reasons) AND “change-failure” AND lean	
Search Refined to:	Full Text Online + Scholarly Peer Review + Peer Review	
Content Type:	- Journal Article	
Discipline:	- Any	
Publication Date:	- 1/1/10 to current	
Subject Terms:	- Behaviour - Business - Case studies - Engineering, industrial - Engineering, manufacturing - Health care, industry - Implementation - Innovations - Leadership - Lean - Lean Manufacturing - Lean Production - Management - Operations research - Organisation change - Organisations - Production management - Productivity - Public Sector - Quality Management - Six Sigma - Strategy - Studies - Systems - Total Quality	
Beyond library collection:	- Yes	
Database:	UCS Summon online discovery tool linking to all databases accessible to the University of Suffolk in 2015	

The search settings and inclusion criteria were checked with PhD supervisors before progressing into the review. Consistent interpretation was then quality assured by providing PhD supervisors with a represented sample of papers and qualitative analysis to ensure that the analysis matched between researcher and PhD supervisor. Any discrepancies were resolved through discussion until a consensus was reached. If consensus could not be reached, or if agreement fell below an 80% level across the samples, then further papers and their case studies and analysis would be drawn upon to increase the sample size for review. This was to identify if there was either an intolerable amount of unresolvable mismatch between interpretations, or assure that further interpretations, beyond the initial sample, met with sufficient academic rigour. The following flow diagram indicates the number of relevant papers from the initial survey and the filtering processes up to the point of full review, together with the case study quantities associated with the papers at full review. The flow diagram is developed in accord with the recommended layout by PRISMA (PRISMA, 2021).

Grading / Defining the Quality / Success (Outcome) of Each Case Study

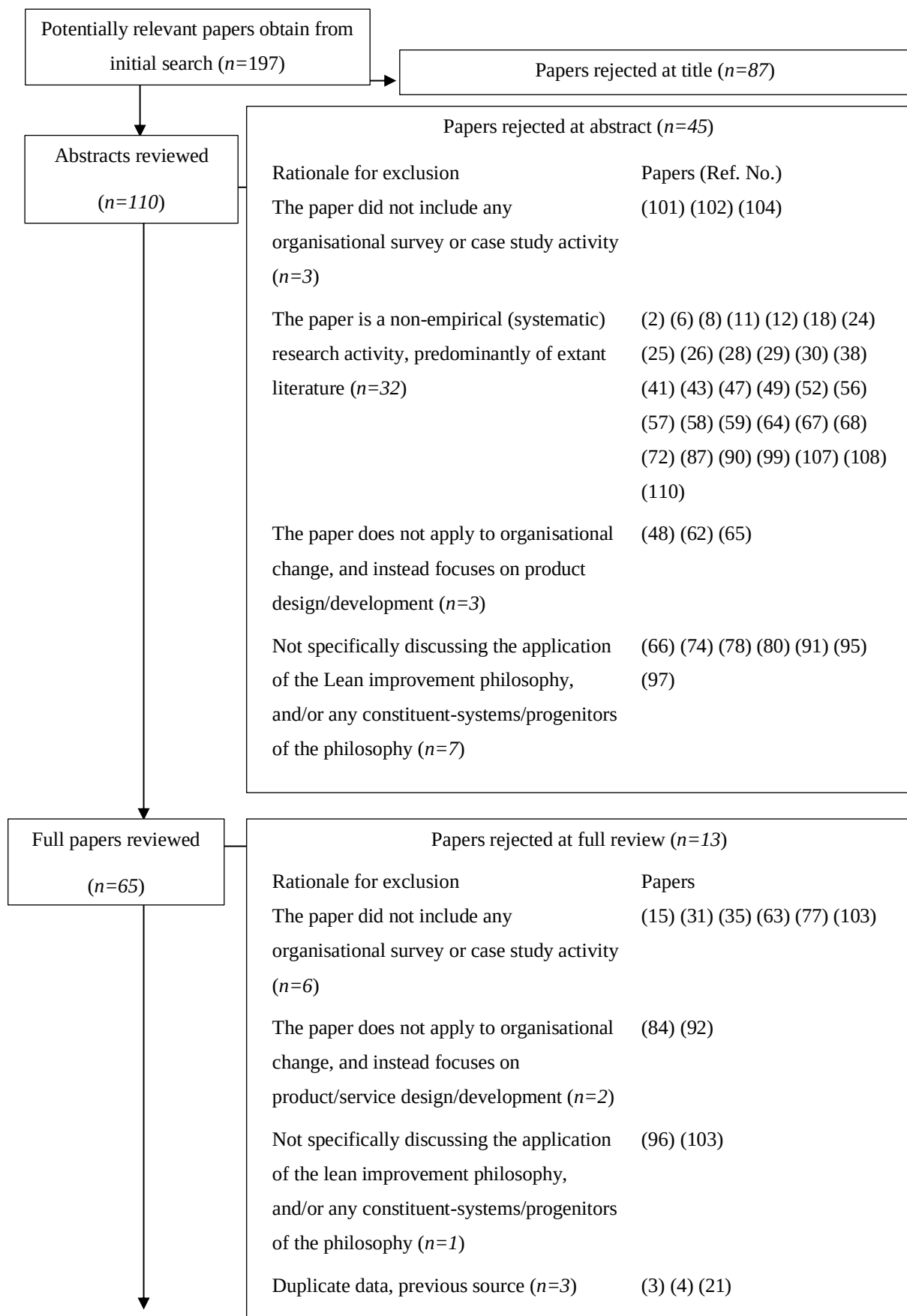
It is proposed that a simple approach be taken for the purposes of the study; hence, this review identified change effectiveness purely in terms evidence that the completed undertaking brought about targeted/intended improvement. For the purpose of this review cases that were explicitly stated as being successful in their implementation were considered to have ‘High’ outcomes. Cases that were explicitly stated as moderate outcome (i.e., little change/improvement was sustained) were classified as ‘Mid’ outcome level; these also including cases that at the time of were undergoing implementation with insufficient data to confirm robust success. Failure was defined by those change initiatives that are either abandoned or missed the target to such a degree that they were considered a failure. Cases that

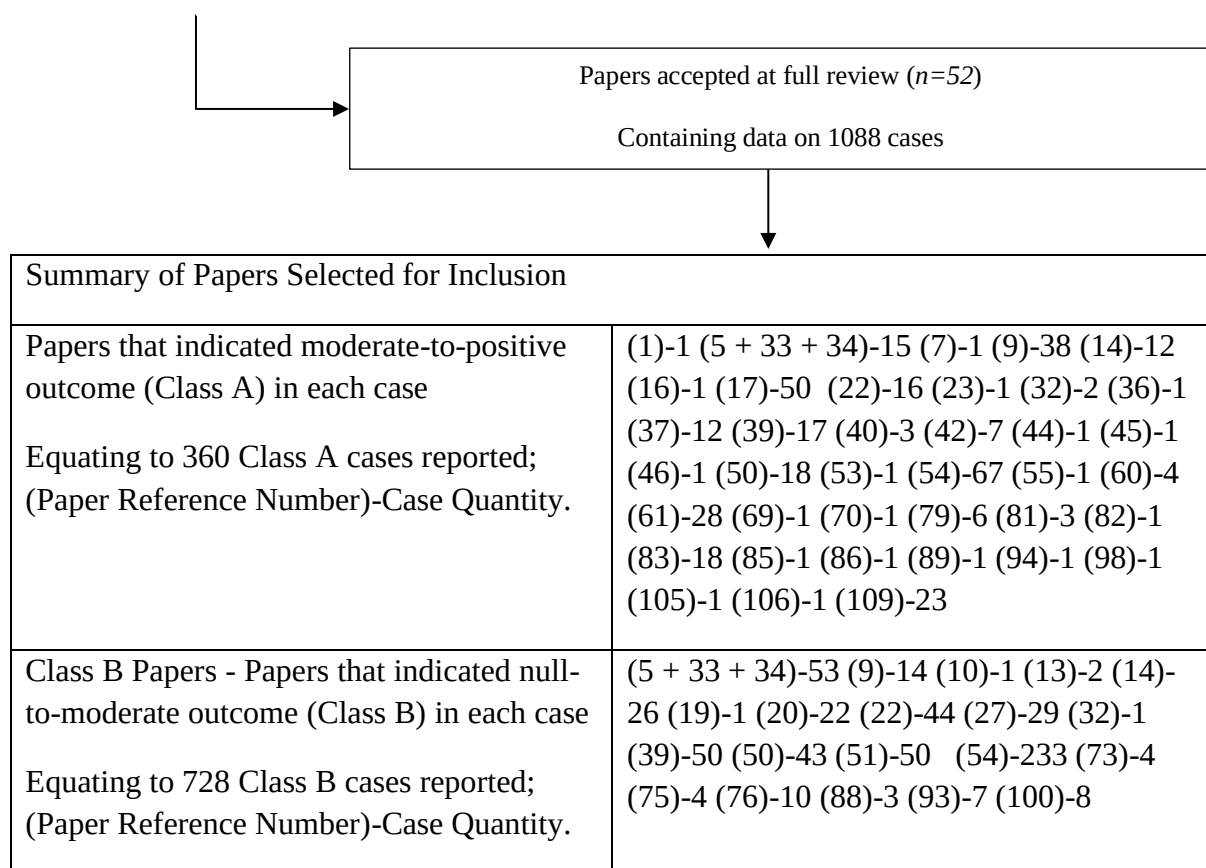
were identified as failure were thereafter classified as having ‘Null’ outcome level. This approach provided two clear groups for case studies to be allocated; ‘High’ impact (denoted as Class A), where success is robust and ‘Mid + Null’ impact where success is either inconclusive or illusive (denoted as Class B).

With respect to the NESTA levels, Class A cases comply with Level 2, where positive change is indicated, and it is not through influence of the researcher; however, there are also no controls groups to enable a NESTA grade of Level 3 or above. Where no positive change is indicated beyond the situation before Lean implementation, NESTA grade Level 1 applies in that the Lean implementation could not show positive change.

Allocating Outcomes into Classes using the Outcomes of the Implementations

As discussed, the cases within each paper were assessed as having either ‘High’, ‘Mid’ (Moderate) or ‘Null’ outcomes. Successfully (‘High’) outcome implementations were grouped into ‘Class A’. The remaining implementations (with ‘Mid’ and ‘Null’ outcomes) were hence considered unsuccessful and grouped into ‘Class B’. The nomenclature of ‘Class A’ and ‘Class B’ are arbitrary alphabetised titles, the purpose of which is to develop a shortened group-title for successful and unsuccessful implementations.





Barrier, Change Intervention and Promotor Identification & Coding

In order to avoid pre-judging barriers, interventions and promotors (actors), established definitions for such were not created in advance of any full paper review. Instead, the papers containing the largest sample size of case studies were selected first for full review (6 papers: 5, 33, 34, 17, 51, 54), which totalled 468 separate case studies, 43% of the review total. The barriers, interventions and promotors were identified from within these studies; hereafter, referred to as core features and then allocated a code. Codes were allocated only upon the explicit detail of any such feature. Full paper reviews were then conducted on the remaining articles, and their barriers, interventions and promotors classified where appropriate against the established codes. If new features were identified that did not fit into the established coding, a new code was added. Within each paper, studies with differing outcomes, (positive, null and negative) were identified and grouped as sub-sets within the paper. Their codes were then

listed separately against each outcome sub-set and later form differing entries within the evidence table for the review. The result was that each sub-group for each paper was allocated with number of cases, grouped by outcome, and codes allocated to each group that identified barriers, interventions and promoters. All of these were then combined with the high-level data (sector and improvement context) along with a qualitative remark upon the quality of the paper; all of which would combine to form an entry for the paper within an evidence table. In the event that the paper contained multiple cases with differing outcomes, more than one entry was developed for the evidence table given that the intention of the review was to identify core differences between successful and unsuccessful projects. In order to avoid cognitive bias, the studies were divided across 8 undergraduate volunteers studying lean transition to check-review and assign codes without prior over-sight of the initial assessment.

Finally, each barrier or intervention was assigned a relevant socio-technical context using the 6-node framework, with each context defined as follows:

- People, i.e., Instances where sufficiently suitable qualified people were either unavailable or acted as an enabler
- Goals, i.e., instances where priorities and direction were either inconsistent/ conflicting or aligned and integrated.
- Technology, i.e., tools, technique, equipment and/or technology were either inadequate or well provisioned.
- Infrastructure, i.e., the fabric and associated services (communication, energy, space/locale) of the building were either inadequate or well-provisioned.
- Policies, Processes and Procedures, i.e., the policies, processes and procedures were aligned/flexible to adaptation or inflexible and obstructive.
- Culture, i.e., the beliefs and assumptions by organisational members either supported or obstructed endeavours.

Results and Findings

Industrial Sector Detail

The following data in the table shows the cases broken down by sector and success/failure. At the highest level, the table also demonstrates the success-to-failure ratio of cases (360:728), which is akin to the expected 30:70 ratio (McKinsey, 2013). Manufacturing represents the most frequently studied sector, and the Knowledge and Information Business Services sector is the second most frequently studied sector. Of interest, the ratios for each sectors success/failure are reasonably consistent, with a the most notable exception being the medical sector, which is showing a 50:50 (11:11) ratio. Otherwise, the results demonstrate a cross-sector failure ratio consistency, and it can be assumed that the cases are indicative of contemporary experience.

Table 4 - Industrial Sector Detail

Class	Sector	Paper Qty (n=)	Case Qty	% of Class A Cases	% of Class B Cases
Class A – moderate to positive outcomes = 360 cases	Manufacturing	(n=21)	267	74.2%	
	Medical (Health Care)	(n=9)	11	3.1%	
	Government and Public Sector	(n=2)	7	1.3%	
	Energy, Utilities and Energy Retail	(n=2)	2	0.6%	
	Construction	(n=1)	3	0.8%	
	Knowledge Intensive Business Services (KIBS) and Finance	(n=3)	69	19.2%	
	Undefined	(n=1)	1	0.3%	
Class B – null to moderate outcomes = 728 cases	Manufacturing	(n=13)	443		60.9%
	Medical (Health Care)	(n=2)	11		1.5%
	Government and Public Sector	(n=2)	41		5.6%
	Energy, Utilities and Energy Retail	(n=0)	0		0%
	Construction	(n=0)	0		0%
	Knowledge Intensive Business Services (KIBS) and Finance	(n=1)	233		32%
	Undefined	(n=0)	0		0%

Evidence Tables

The following data in the table provides the summary data and qualitative remarks for each sub-group (where relevant) of each paper at full review. Codes have been translated into plain English remarks within the Barriers, Interventions and Stakeholder Involvement columns. The evidence tables have been particularly important in sense-checking the researcher's findings with PhD supervisors via a sample being randomly selected for independent analysis. A sample consisting of 10% of the total number of papers was taken at random. With a total of 57 papers being reviewed, the 10% sample was rounded up to 6 papers. If agreement was complete for all the papers, then no further samples would be taken. Disagreement would incur a wider follow-on sample being selected and passed over to the PhD supervisors for sense-checking. In this review, agreement was reached for all 6 papers from the initial sample; no further samples were required. The following tables present the high-level evidence/findings from the selected papers, and the qualitative review thus:

- Table 5.1 presents the qualitative remarks for the supervisor to review each paper against using their reference number. This data was presented in advance so that the supervisor could select a sample for peer review and sense check the researcher's findings also using Tables 5.2, 5.3 and 5.4.
- Table 5.2 (immediately following Table 3.1) presents the high-level content of each research paper selected for inclusion within the systematic review. The content includes: the outcome of the change presented within the case study; the type of change; the industrial sector; and whether the change was stated as socio-technical (STS) in nature.
- Table 5.3 presents the barriers identified within the papers against the outcome of the implementations.
- Table 5.4 presents the interventions and actors identified as part of the implementations, as well as the outcome of the implementations.

Table 5.1 Qualitative Remarks	
Ref.	Qualitative Remark
1	A robust analysis with relevant data. The only explicitly intervention doesn't seem sufficient to address the barriers with respect to goals and culture.
5/34	Read in conjunction with Paper 34, an extension of the study. Analysis of high quality; providing good data in every category. Interventions are well-placed to address the barriers, & prevalent when the outcome-level cases & interventions are compared.
7	Small sample size and near-minor analysis. Not a high-quality study.
9	With an excellent sample size, this documented presented good analysis with relevant data. Interventions seem well placed to address the barriers, though only through STS linkage.
10	Small sample size and minor analysis. Not a high-quality study
13	A robust analysis with relevant data, with interventions well-placed to address technical and skill barriers, but not cultural types.
14	A generous sample size, but short on comparative analysis between outcome-levels. Relevant data concerning barriers and high outcome cases only suggests that high and low outcome cases experience the same barriers (organisation-al starting-point for Lean).
16	A robust analysis, small sample size, with relevant data; interventions seem well placed to address the barriers.
17	Small sample size and minor analysis. Not a high-quality study
19	Small sample size and near-minor analysis. Not a high-quality study
20	A generous sample size, with relevant barrier data, though short on intervention detail. Interventions seem insufficient to address the barriers, as the outcome also suggests.
22	A robust analysis with relevant data for barriers but short on analysis for interventions and stakeholders. A lack of intervention detail hinders analysis; however, the barrier identification at different outcome levels is of interest.
23	Small sample size and minor analysis. Not a high-quality study
27	Small sample size and near-minor analysis. Not a high-quality study
32	A robust analysis, small sample size, with relevant data. Interventions seem well placed to address the barriers, with a clear difference in intervention approach and outcome.
36	A robust analysis, small sample size, with relevant data, though short on intervention detail. Interventions seem insufficient to address barriers.
37	A robust analysis, small sample size, with relevant data. Interventions seem well placed to address the barriers.

Table 5.1 Qualitative Remarks ... continued

Ref.	Qualitative Remark
39	This study presented a generous sample size and detailed interventions for cases with successful implementations; otherwise, the data was light for other cases. The intervention difference between case outcomes is useful.
40	A small sample size of cases, with low detail for barriers, but reasonable detail for interventions and stakeholders. Interventions seem well placed to address the barrier.
42	Small sample size and minor analysis. Not a high-quality study
44	A robust analysis, small sample size, with relevant data. Interventions seem well placed to address the barrier; with People potentially addressing cultural barriers.
45	A robust analysis, small sample size, with relevant analysis regarding interventions and stakeholders but less so for barriers.
46	A robust analysis, small sample size, with relevant data. Interventions seem well placed to address the barriers.
50	A robust analysis, with a generous sample size, with relevant data for barriers, but less so for interventions and stakeholders. A poor differential analysis between case-outcome levels reduces the quality of this report.
51	A generous sample size, with relevant data for barriers, but less so for interventions and stakeholders. Interventions do not seem sufficient to address the barriers, which would tally with the outcome level.
53	Small sample, near minor analysis. Low quality study
54	A robust analysis, small sample size, with relevant data. A poor differential analysis between case-outcome levels reduces the quality of this report.
55	A robust analysis, small sample size, with relevant data.
60	A robust analysis, small sample size, with relevant data. A low amount of intervention does seem well placed to address some of the key Cultural and People barriers.
61	Small sample size, with relevant data for interventions, but short on analysis for barriers. Interventions do not explicitly address culture, but link to it.
69	A robust analysis, small sample size, with relevant data. Interventions address People barriers and link to Cultural barriers.
70	A robust analysis, small sample size, with relevant data. Interventions address People barriers and link to Cultural barriers.
71	Small sample size, with relevant data for interventions, but short on analysis for barriers. Interventions do not explicitly address culture, but link to it.

Table 5.1 Qualitative Remarks ... continued

Ref.	Qualitative Remark
73	A robust analysis, small sample size, with relevant data. Interventions seem well placed to address the barriers.
75	A robust analysis, small sample size, with relevant data. Intervention does not explicitly address the barriers.
76	A robust analysis, small sample size, with relevant data. Interventions do not explicitly address culture, but link to it.
79	A robust analysis, small sample size, with relevant data. Interventions seem well placed to address the barriers.
81	A robust analysis, small sample size, with relevant data. Interventions seem well placed to address the barriers.
82	Small sample size and near-minor analysis regarding barriers; however, reasonable data for interventions and stakeholders was presented. Not a high-quality study.
83	A robust analysis, small sample size, with relevant data. Interventions do not explicitly address the barriers but link to them.
85	Small sample size and near-minor analysis regarding barriers; however, reasonable data for interventions and stakeholders was presented. Not a high-quality study
86	A robust analysis, small sample size, with relevant data. Intervention does not seem well placed to address all the barriers.
88	A robust analysis, small sample size, with relevant data. Interventions seem well placed to address the barriers.
89	A robust analysis, small sample size, with relevant data. Interventions seem well placed to address the barriers.
93	A robust analysis, small sample size, with relevant data. Though small on scope, the intervention does address the goal and cultural barriers.
94	A robust analysis, small sample size, & relevant data. Interventions do not directly address the Goal & Cultural barriers but link to them.
98	Small sample size and near-minor analysis. Not a high-quality study.
100	A robust analysis with relevant data regarding barriers, but less so for interventions. There is also a possibility that the research activity may have influenced the data.
105	Small sample size and near-minor analysis regarding barriers; however, reasonable data for interventions was presented. Not a high-quality study.
106	Small sample size and near-minor analysis regarding barriers; however, reasonable data for interventions was presented. Not a high-quality study
109	A robust analysis, small sample size, & relevant data. Interventions do not directly address the Goal & Cultural barriers but link to them.

Table 5.2 High Level Content of Each Research Paper																
Ref. No.	No of Cases	Outcome			Sector						Implementation Type					Noted as an STS work design
		High	Mid	Null	Manufacturing Processing	Healthcare	Government Public Sector	Construction	Energy Utilities	KIBS	Lean	6-Sigma	TQM	TPM	TPS	
1	1	●			●						●	●	●	●	●	●
5/34	15	●			●						●	●	●	●	●	
	53		●		●						●	●	●	●	●	
7	1	●			●						●	●	●	●	●	
9	38	●			●											●
	124		●		●											●
10	1		●		●						●	●	●	●	●	●
13	2			●			●				●	●	●			
14	12	●			●						●	●	●	●	●	
	26			●	●						●	●	●	●	●	
16	1	●				●					●	●	●			
17	50	●			●						●	●	●	●	●	
19	1		●		●						●	●	●	●	●	
20	35		●		●						●	●	●	●	●	
22	16	●			●						●	●	●	●	●	
	30		●		●						●	●	●	●	●	
	14			●	●						●	●	●	●	●	
23	1	●						undefined			●	●	●	●	●	
27	29		●				●				●	●	●			

Table 5.2 High Level Content of Each Research Paper ... continued

Ref. No.	No of Cases	Outcome			Sector						Implementation Type						Noted as an STS work design
		High	Mid	Null	Manufacturing Processing	Healthcare	Government Public Sector	Construction	Energy Utilities	KIBS	Lean	6-Sigma	TQM	TPM	TPS	Bespoke Operational Excellence or CI System	
32	2	●			●						●	●	●	●	●		
	1		●		●						●	●	●	●	●		
36	1	●			●						●	●	●	●	●		
37	12	●			●						●	●	●	●	●		
39	17	●			●											●	
	50		●		●											●	
40	3	●						●			●	●	●	●	●		
42	7	●			●						●	●	●	●	●	●	
44	1	●					●				●	●	●				
45	1	●					●				●	●	●				
46	1	●							●		●	●	●	●	●		
50	18	●			●						●	●	●	●	●		
	43			●	●						●	●	●	●	●		
51	50			●	●						●	●	●	●	●		
53	1	●			●						●	●	●	●	●		
54	67	●							●							●	
	233		●						●							●	
55	1	●			●						●	●	●	●	●		
60	4	●			●						●	●	●	●	●		
61	28	●			●						●	●	●	●	●		

Table 5.2 High Level Content of Each Research Paper ... continued

Ref. No.	No of Cases	Outcome			Sector						Implementation Type						Noted as an STS work design
		High	Mid	Null	Manufacturing Processing	Healthcare	Government Public Sector	Construction	Energy Utilities	KIBS	Lean	6-Sigma	TQM	TPM	TPS	Bespoke Operational Excellence or CI System	
69	1	•				•					•	•	•				
70	1	•				•					•	•	•				
71	1	•								•	•	•	•				
73	3		•			•					•	•	•				
75	4		•			•					•	•	•				
76	10		•				•				•	•	•				
79	6	•					•				•	•	•				
81	3	•				•					•	•	•				
82	1	•			•						•	•	•	•	•		
83	18	•			•						•	•	•	•	•		
85	1	•			•						•	•	•	•	•		
86	1	•				•					•	•	•				
88	3		•			•					•	•	•				
89	1	•					•				•	•	•				
93	7		•		•						•	•	•	•	•		
94	1	•				•					•	•	•				
98	1	•								•						•	
100	8			•	•						•	•	•	•	•		
105	1	•				•					•	•	•				
106	1	•							•		•	•	•	•	•		

Table 5.2 High Level Content of Each Research Paper ... continued																	
Ref. No.	No of Cases	Outcome			Sector						Implementation Type						Noted as an STS work design
		High	Mid	Null	Manufacturing Processing	Healthcare	Government Public Sector	Construction	Energy Utilities	KIBS	Lean	6-Sigma	TQM	TPM	TPS	Bespoke Operational Excellence or CI System	
109	23	•			•						•	•	•	•	•		

Table 5.3 now follows, which presents the barriers identified within each case study documented within the selected research papers.

Table 5.3 Barriers Identified within each Research Paper

Ref. No.	Out-come: High / Mid / Null	Barriers																	
		Culture unsuited to Lean	Wrong approach selected	Resistance to change	Organisation and service perceived unsuited Lean	Organisational Structure not suited	Lack of teamwork, problem solving	Lack of Leadership Skills / Direction	Lack of Shared Vision	Union does not share leadership vision	Lack of Non-Human Resources inc. Finance	Lack of Lean/CI Knowledge	Lack of Human Resources and time	Lack of Specific Technical Skills	Lack of internal Coop and Communications	Lack customer/supplier co-operation	Government Policies & Legislation	Lack of Policies and Procedures	No Barrier Identified
1	High	●	●					●				●							
5/34	High	●		●			●	●	●			●							
	Mid	●		●			●	●	●			●							
7	High			●								●							
9	High		●					●				●							
	Mid		●					●				●							
10	Mid																		●
13	Null		●	●				●											
14	High	●								●		●	●						
	Null	●								●		●	●						
16	High						●							●					
17	High																		●
19	Mid		●																
20	Mid			●	●					●	●	●	●						

Table 5.3 Barriers Identified within each Research Paper ... continued

Ref. No.	Out-come: High / Mid / Null	Barriers																	
		Culture unsuited to Lean	Wrong approach selected	Resistance to change	Organisation and service perceived unsuited Lean	Organisational Structure not suited	Lack of teamwork, problem solving	Lack of Leadership Skills / Direction	Lack of Shared Vision	Union does not share leadership vision	Lack of Non-Human Resources inc. Finance	Lack of Lean/CI Knowledge	Lack of Human Resources and time	Lack of Specific Technical Skills	Lack of internal Coop and Communications	Lack customer/supplier co-operation	Government Policies & Legislation	Lack of Policies and Procedures	No Barrier Identified
22	High										●								
	Mid			●							●								
	Null			●			●				●								
23	High																		●
27	Mid																		●
32	High			●			●		●		●								
	Mid		●	●			●	●	●		●								
36	High	●								●		●							
37	High	●		●									●						
39	High																		●
	Mid																		●
40	High				●														
42	High																		●
44	High					●	●	●								●			
45	High					●													
46	High						●									●			

Table 5.3 Barriers Identified within each Research Paper ... continued

Ref. No.	Out-come: High / Mid / Null	Barriers																	
		Culture unsuited to Lean	Wrong approach selected	Resistance to change	Organisation and service perceived unsuited Lean	Organisational Structure not suited	Lack of teamwork, problem solving	Lack of Leadership Skills / Direction	Lack of Shared Vision	Union does not share leadership vision	Lack of Non-Human Resources inc. Finance	Lack of Lean/CI Knowledge	Lack of Human Resources and time	Lack of Specific Technical Skills	Lack of internal Coop and Communications	Lack customer/supplier co-operation	Government Policies & Legislation	Lack of Policies and Procedures	No Barrier Identified
50	High				•	•					•		•			•			
	Null				•	•					•		•			•			
51	Null	•			•			•			•	•	•				•	•	
53	High			•								•							
54	High	•		•							•			•					
	Mid	•		•							•			•					
55	High						•												
60	High	•									•	•	•	•					
61	High	•																	
69	High					•	•								•				
70	High	•	•			•													
71	High		•																
73	Mid	•		•		•													
75	Mid							•								•			
76	Mid	•	•					•	•			•							
79	High	•			•														
81	High			•				•										•	

Table 5.3 Barriers Identified within each Research Paper ... continued																		
Ref. No.	Out-come: High / Mid / Null	Barriers																
		Culture unsuited to Lean	Wrong approach selected	Resistance to change	Organisation and service perceived unsuited Lean	Organisational Structure not suited	Lack of teamwork, problem solving	Lack of Leadership Skills / Direction	Lack of Shared Vision	Union does not share leadership vision	Lack of Non-Human Resources inc. Finance	Lack of Lean/CI Knowledge	Lack of Human Resources and time	Lack of Specific Technical Skills	Lack of internal Coop and Communications	Lack customer/supplier co-operation	Government Policies & Legislation	Lack of Policies and Procedures
82	High																	•
83	High		•								•	•	•					
85	High	•																
86	High				•	•								•				
88	Mid		•	•							•		•					
89	High	•						•						•				
93	Mid		•				•							•				
94	High						•	•				•						
98	High			•														
100	Null		•					•			•		•					
105	High																	•
106	High																	•
109	High	•				•												

Table 5.4 now follows, which presents the interventions and actors identified within each case study documented within the selected research papers.

Table 5.4 Interventions and Actors Identified within each Research Paper

Table 5.4 Interventions and Actors Identified within each Research Paper																		
Ref. No.	Out-come: High / Mid / Null	Interventions						Actors										
		Training Provided with linkage to purpose	Introduced Lean Tools and Processes	Resource Provided (Human, Finance & Time)	Reward Schemes	Change Approach to Philosophy	Change from Project to Daily Improvement	No Intervention Identified	Frontline Workers (Gemba)	Management (Non-Executive)	Researchers	Customers	External Consultants	Internal Coaches	Investors & Government Leaders	Directors (Executive)	Suppliers	No Actors Identified
1	High		●							●								
5/34	High		●			●			●									
	Mid		●						●									
7	High							●										●
9	High	●	●	●						●								
	Mid		●	●						●								
10	Mid							●										●
13	Null	●		●								●						
14	High							●										●
	Null							●										●
16	High					●			●			●				●		
17	High							●										●
19	Mid		●							●								
20	Mid		●							●								

Table 5.4 Interventions and Actors Identified within each Research Paper ... continued

Ref. No.	Out-come: High / Mid / Null	Interventions							Actors									
		Training Provided with linkage to purpose	Introduced Lean Tools and Processes	Resource Provided (Human, Finance & Time)	Reward Schemes	Change Approach to Philosophy	Change from Project to Daily Improvement	No Intervention Identified	Frontline Workers (Gemba)	Management (Non-Executive)	Researchers	Customers	External Consultants	Internal Coaches	Investors & Government Leaders	Directors (Executive)	Suppliers	No Actors Identified
22	High							●										●
	Mid							●										●
	Null							●										●
23	High							●										●
27	Mid							●										●
32	High		●			●			●	●	●							
	Mid		●							●	●							
36	High		●															●
37	High	●			●	●				●								
39	High		●	●														●
	Mid							●										●
40	High	●		●		●			●		●						●	
42	High							●										●
44	High	●	●	●					●	●					●		●	
45	High	●	●	●					●				●					
46	High	●				●			●	●								

Table 5.4 Interventions and Actors Identified within each Research Paper ... continued

Ref. No.	Out-come: High / Mid / Null	Interventions						Actors										
		Training Provided with linkage to purpose	Introduced Lean Tools and Processes	Resource Provided (Human, Finance & Time)	Reward Schemes	Change Approach to Philosophy	Change from Project to Daily Improvement	No Intervention Identified	Frontline Workers (Gemba)	Management (Non-Executive)	Researchers	Customers	External Consultants	Internal Coaches	Investors & Government Leaders	Directors (Executive)	Suppliers	No Actors Identified
50	High							●									●	
	Null							●									●	
51	Null		●											●				
53	High							●										●
54	High	●	●	●	●				●									
	Mid	●	●	●	●				●									
55	High				●	●			●					●				
60	High	●									●		●					
61	High	●		●														●
69	High	●	●	●					●									
70	High		●	●					●	●			●					
71	High	●		●						●								
73	Mid		●			●	●		●	●						●		
75	Mid		●															●
76	Mid		●	●								●						
79	High	●				●	●					●		●				
81	High	●				●			●				●					

Table 5.4 Interventions and Actors Identified within each Research Paper ... continued																		
Ref. No.	Out-come: High / Mid / Null	Interventions							Actors									
		Training Provided with linkage to purpose	Introduced Lean Tools and Processes	Resource Provided (Human, Finance & Time)	Reward Schemes	Change Approach to Philosophy	Change from Project to Daily Improvement	No Intervention Identified	Frontline Workers (Gemba)	Management (Non-Executive)	Researchers	Customers	External Consultants	Internal Coaches	Investors & Government Leaders	Directors (Executive)	Suppliers	No Actors Identified
82	High		●	●						●		●				●	●	
83	High	●	●	●					●	●		●						
85	High	●		●					●									
86	High		●						●		●							
88	Mid		●			●							●	●				
89	High		●	●		●				●								
93	Mid					●			●	●						●		
94	High		●	●					●	●			●					
98	High		●						●		●							
100	Null							●			●							
105	High		●	●						●		●						
106	High	●	●	●									●	●				
109	High	●		●	●					●								

The data was then reviewed in order to develop a response for each research question (RQ). RQ1 is addressed first using Table 6.

Reponses to Research Questions

RQ1: What represents the largest barriers with respect to improvement (change) failure?

Table 6 - Barriers to Successful Change Grouped by STS Context

Barrier	As a Percentage of the 1088 Cases from the entire review	As a Percentage of the 2915 Barrier records within the entire review	As a Percentage of the 728 Class B Cases (null-mod outcome)	By STS Context
Culture unsuited to Lean	54.9%	20.5%	43.7%	Culture
Wrong approach selected	19.8%	7.4%	21.4%	
Resistance to Change	19.6%	7.3%	22.0%	
Organisation and service perceived unsuited Lean	14.1%	5.2%	17.6%	
Organisational Structure not suited	8.8%	3.3%	6.5%	
Lack of teamwork, problem solving	7.4%	2.7%	8.2%	
Lack of Leadership Skills / Direction	30.2%	11.3%	36.5%	Goals
Lack of Shared Vision	7.3%	2.7%	8.8%	
Union does not share leadership vision	0.3%	0.1%	0.1%	
Lack of Non-Human Resources inc. Finance	23.7%	8.9%	25.4%	Infrastructure
Lack of Lean/CI Knowledge	38.0%	14.2%	43.5%	People
Lack of Human Resources and time	20.1%	7.5%	22.7%	
Lack of Specific Technical Skills	12.7%	4.7%	12.1%	
Lack of internal Coop and Communications	0.2%	0.1%	0%	
Lack customer/supplier co-operation	6.2%	2.3%	6.5%	Processes
Government Policies & Legislation	4.6%	1.7%	6.9%	
Lack of Policies and Procedures	0.3%	0.1%	0.0%	

The data in Table 6 indicates the following in response to RQ1. Cultural unsuitability represents the most frequent barrier; however, this is identified more frequently with Class A

cases, inferring that this barrier is more readily identified (and largely overcome). A lack of lean/CI knowledge is the next most frequent overall barrier; however, this identified more frequently by Class B cases. A lack of leadership skills and leadership direction is the next most frequent barrier, with nearly doubles the frequency of records for Class B cases compared to Class A. The overall, the barriers within the cultural socio-technical context represent the more prevalent occurrence level.

RQ2: What interventions/promoters support improvement success?

The data in Table 7 indicates the following in response to RQ2, and specifically what interventions are used to support success. The most frequent intervention is the introduction of lean tools and processes (training new processes), followed by providing resources (human and financial). The third most frequent intervention is the development of reward schemes, and the fourth is linking training to purpose. Interventions with the socio-technical context of People represents the majority of interventions, followed by Process and then Goals; Cultural interventions represent the lowest intervention category.

Table 7 - Intervention Analysis

Interventions (total 2459 records from 1088 cases)	Percentage of the total records from 1088 Cases	Percentage of the Cases Identified from Class A Cases (positive outcome)	Percentage of the Cases Identified from Class B Cases (null-mod outcome)	STS Context
Training Provided with linkage to purpose	14.8%	70.0%	15.4%	Goal
Introduced Lean Tools and Processes	29.2%	67.5%	65.1%	Process
Resource Provided (Human, Finance & Time)	25.4%	56.9%	57.6%	People
Reward Schemes	15.7%	49.2%	19.4%	People
Change Approach to Philosophy	1.5%	12.5%	1.8%	Culture
Change from Project to Daily Improvement	0.2%	1.7%	0.4%	Culture

The data in Table 8 indicates the following in response to RQ2, and specifically what actors are involved to support success. Front line (Gemba) workers and non-executive management are the most influential promoters of sustained improvement. There is a significant disparity of non-executive management involvement between Class A and B cases with positive cases representing a higher frequency of management involvement.

Table 8 – Stakeholder (Actor) Analysis

Actors (Promoters) (total 1620 records from 1088 cases)	Percentage of the total records from 1088 Cases	Percentage of the Cases Identified from Class A Cases (positive outcome)	Percentage of the Cases Identified from Class B Cases (null- mod outcome)
Frontline Workers (Gemba)	22.8%	32.8%	47.2%
Management (Non- Executive)	5.1%	20.8%	3.3%
Researchers	13.0%	11.7%	23.1%
Customers	5.5%	10.0%	7.3%
External Consultants	1.7%	4.4%	1.7%
Internal Coaches	0.9%	3.1%	0.4%
Investors & Government Leaders	4.4%	2.2%	8.7%
Directors (Executive)	0.9%	0.8%	1.4%
Suppliers	4.1%	0.0%	6.3%

RQ3: What are the differences between cases that have positive improvement (outcomes) against those that have nil/negative improvement in terms of preparation, and addressing issues?

The data within Table 9 indicates the following in response to RQ3, and specifically regarding the barriers that were identified. Class A cases more readily identify culture as a barrier, whilst Class B cases more readily identify leadership skill shortfall and product/service unsuitability to be barriers. Class B cases also more readily identify a lack of Lean/CI knowledge as a barrier. Class A cases more readily identify organisation structure as a barrier. The largest swing differential between case types is within the socio-technical context of Culture; Class A cases appear more culturally aware.

Table 9 - Differential Analysis of Barriers

Barrier	Percentage of Class A (Positive Outcomes)	Percentage of Class B (Mod-Null Outcomes)	Comparative % Difference		STS Context
			Barrier identified more by Class A Cases (Positive Outcomes)	Barrier identified more by Class B Cases (Mod-Null Outcomes)	
Culture unsuited to Lean	77.5%	43.7%	33.8%		Culture
Lack of Leadership Skills/Direction	17.5%	36.5%		19.0%	Goals
Organisation and service perceived unsuited Lean	0.0%	17.6%		17.6%	Culture
Lack of Lean/CI Knowledge	26.7%	43.5%		16.9%	People
Lack of Human resource & time	15.0%	22.7%		7.7%	
Resistance to Change	14.7%	22.0%		7.3%	Culture
Org. structure unsuited	13.6%	6.5%	7.2%		Culture
Government Policies & Legislation	0.0%	6.9%		6.9%	Processes
Low resource inc. finance	20.3%	25.4%		5.1%	Infrastructure
Wrong approach	16.4%	21.4%		5.0%	Culture
No shared vision	4.2%	8.8%		4.6%	Goals
Poor teamwork, problem solving	5.6%	8.2%		2.7%	Culture
Lack of Specific Technical Skills	13.9%	12.1%	1.8%		People
Lack customer/supplier co-op'n	5.6%	6.5%		0.9%	Processes
Lack of Policies and Procedures	0.8%	0.0%	0.8%		Processes
Lack of internal Co-operation & Communication	0.6%	0.0%	0.6%		People
Union does not share the vision	0.6%	0.1%	0.4%		Goals

The following data in Table 10 indicates the following in response to RQ3, and specifically regarding the interventions and actors that were identified. Both Class A and Class B cases have near-equal (6% differential) and high intervention rates in terms of lean Tool Training and Implementation, and Resource Provision. This suggests that the intervention does not present itself as the differing factor between success and failure. There exists a disparity in

intervention response; Training Provided with Linkage to Purpose, wherein Class A cases have a record-rate nearly 400% larger than Class B cases. Upon deeper review, it is noted that the remaining Class B cases that provide records of this intervention (yet remain in Class B) are 99% within the moderate outcome sub-set and represent nearly all Class B cases that invested in training front-line workforce members. Class A cases record a 5-fold increase middle-management involvement with lean/CI implementation, which may indicate a shift in leadership culture through implementing and synthesizing improvement processes and interventions.

Table 10 - Differential Analysis of Interventions & Actors

Intervention & Actors	Percentage of Class A (Positive Outcomes)	Percentage of Class B (Mod-Null Outcomes)	Comparative % Difference		STS Context
			Barrier identified more by Class A Cases (Positive Outcomes)	Barrier identified more by Class B Cases (Mod-Null Outcomes)	
Training Provided with linkage to purpose	70.0%	15.4%	54.6%		Goal
Reward Schemes	53.3%	26.6%	26.7%		People
Change Approach to Philosophy	7.5%	1.4%	6.1%		Culture
Introduced Lean Tools and Processes	67.5%	65.1%	2.4%		Process
Change from Project to Daily Improvement	1.7%	0.0%	1.7%		Culture
Resource Provided (People, Money & Time)	56.9%	57.6%		0.6%	People
<i>Frontline Workers</i>	22.8%	39.4%		16.6%	<i>People</i>
<i>Management (Non-Executive)</i>	15.8%	3.4%	12.4%		<i>People</i>
<i>Researchers</i>	11.7%	23.1%		11.4%	<i>People</i>
<i>Investors & Government Leaders</i>	2.2%	8.7%		6.4%	<i>People</i>
<i>Suppliers</i>	0.0%	6.3%		6.3%	<i>People</i>
<i>No Actors Specified</i>	65.8%	60.4%	5.4%		<i>People</i>
<i>External Consultants</i>	4.4%	1.6%	2.8%		<i>People</i>
<i>Customers</i>	10.0%	7.3%	2.7%		<i>People</i>
<i>Internal Coaches</i>	3.1%	0.4%	2.6%		<i>People</i>
<i>Directors (Executive)</i>	0.8%	1.5%		0.7%	<i>People</i>

#This data possibly provides a warning to anyone planning to implement a CI system that does not place emphasis on leadership development as an inherently socio-technical context. We may infer that companies can suffer and survive inadequate business systems (lean systems/techniques or otherwise), but not inadequate leadership and goal development-and-alignment. Such a top-to-bottom approach would be familiar within a Rapid Realignment or Hoshin Kanri leadership methodology. Hoshin Kanri is otherwise known as Policy Deployment or Strategy Deployment, and is the process of communication across all levels of an organisation to discuss the actions pertaining to strategic goals at all levels. Its aim is to ensure that the strategic goals of a company drive progress and action at every level within that company, plus eliminate the waste that comes from poor communication or direction (Lean Production by Vorne, n.d.).

Conclusions and Discussion

Main Findings

The review identified the following as the most frequent barriers to lean implementation: culture unsuited to lean; a lack of lean/CI Knowledge; a lack of leadership skills or leadership direction; a lack of non-human resources that include finance, infrastructure (space for working on issues), equipment and technology; and finally, a lack of financial resources directed toward rewards and recognition of employee effort. The most frequent interventions from the review were as follows: changes in the organisations approach to philosophy (i.e. undertaking a sea-change in thinking regarding the vision of what is to be achieved – for example undertaking a shift from using lean as a cost saving system to moving the organisation to become the best in class); training provided with linkage to purpose (or new vision); installation of fiscal reward

schemes; and, finally, ensuring the involvement of management (non-executive) in supporting lean implementation and sustainment.

Gaps in the Literature

The concepts of aligning goals and matching behaviours (Labovitz & Rosansky, 2012), delegating decision-making to the lowest level (Womack & Jones, 2003) and forming second nature behavioural routines for problem analysis and resolution (Rother, 2010) (Liker, 2014) are well established within the literature; each suggesting success after their implementation. Despite such readily available guidance, some of which dates back over two decades (Bate, 1994), high failure rates for lean projects are still apparent. The literature tends to prescribe improvement techniques and processes, rather than assisting the readers in initially assessing and hence identifying the appropriate strengths and weaknesses of their organisation in advance of process implementation. From the systematic review, only 2% of cases (21 cases across 2 journal papers) referred a socio-technical work system connection to lean implementation, nearly all of the 21 cases pertaining to such were in Class A in terms of outcome (positive outcome). Considering the high percentages of total records that indicated various cultural barriers, and apparent need for goal alignment, a rapid analytical system is needed that recognises at least both socio-technical contexts and their interconnectivity between each other as well as the remaining socio-technical progenitors. None of the papers discuss how the subject organisations were assessed or prepared in advance of lean implementation.

Conclusions

Cases with positive outcomes appear to be more aware of cultural issues and weakness than their less successful counterparts. Furthermore, they are more ready to change approaches to improvement (their improvement philosophy). Whilst this appears to be counter-intuitive, it is

interesting to note that those organisations obtaining moderate-to-null outcomes would appear to be investing as much resource in business system training and implementation as those organisations obtaining positive outcomes. From this, it is argued that the education of lean processes alone does not necessarily address the issues or prepare the environment needed to be attended to if new processes are to sustain and new values created. A preparatory mechanism is either being under-utilised or missed-out. Initial Assessment is a fundamental process of lifelong learning (Gravells, 2010), demanding the assessment of prior knowledge and ability/suitability to undertake learning. Whilst this approach is a standard feature in education, it is not a pervasive feature of staff/organisational learning akin to lean process implementation, which demands a considerable ability to learn and adapt on behalf of the organisation and its staff. In this regard, it is arguably reasonable to assess an organization's change-readiness before embarking on change programmes and their preparatory training. Such an assessment would need to be considerate of each of the interrelated socio-technical contexts within the organization, at all hierarchically levels, and be able to identify perceived shortfalls in change capability.

Further Research

The main findings have provided a direction to further review specific issues via fieldwork review and follow-on analysis. However, the main barrier identified from this review presents the research with an issue. Whilst it emphasises the relevance of this research, the main barrier of 'culture unsuitable to lean' is not explicit enough to be able to develop a logical and opposite intervention or line of enquiry without further consideration. Socio-technical systems analysis recognises the interaction between people, technology, goals, processes, infrastructure and (most significantly) culture. If we use Schein's proposition that culture is a pattern of beliefs and assumptions (Schein, 2010) and suggest that these beliefs and assumptions are influenced

by socio-technical arrangements, then perhaps socio-technical work design can be expanded to help develop an intervention to improve organisational culture. It is, therefore, important to next review extant socio-technical work designs and its relevance to managing or influence organisational culture before any further work design can be taken forward. It may be that the term cannot be easily unpacked further, and the interventions within the remaining 5 nodes of the chosen socio-technical network could be sufficient to support a change within the culture node.

CHAPTER 3 – REVIEWING SOCIO-TECHNICAL WORKPLACES

Field tests for Socio Technical plant issues in order to identify common socio-technical gaps to support the consideration of wider science for intervention mechanisms

Summary

The main purpose of this chapter was to build upon the knowledge in Chapter 2 through collecting data on socio-technical conditions within three manufacturing plants. The aim was to identify relevant socio-technical gaps for lean and continuous improvement (CI) implementation by rapidly assessing an organisation's current-state socio-technical conditions against its readiness for substantial change (akin to lean) through the six Socio-Technical Systems contexts: Goals, People, Process/Procedures, Buildings/Infrastructure, Technology and Culture. The data would be combined with the knowledge in Chapter 2 to review the viability and value of wider scientific theories and workplace practices for synthesis in Chapter 4 for synthesis into new work design within Chapter 5. Three European automotive component manufacturing plants were selected that were either: on the cusp of receiving coaching to start implementing a lean continuous improvement philosophy; or that were about to use further exploit an ongoing lean philosophy as part of an extant growth strategy. Employees comprising a range of roles from plant-manager (senior site manager) to production operators contributed with written perceptions of the organisations' readiness for change against the socio-technical contexts. The perceptions were analysed within a 7-day timeframe using researchers that were previously unfamiliar to both the sector and the plants. Change-readiness scores and common themes were developed for each socio-technical context and then reviewed by senior executives who considered such to be an accurate assessment of the plants' strengths and

weaknesses. Socio-technical gaps were then identified in order to inform further research into an improved socio-technical work design.

Introduction

This research synthesizes the socio technical systems network (Cherns, 1987) (Clegg, 2014) into a tool that rapidly develops a snapshot of issues within an organization’s socio-technical arrangements. The assessment aims to identify gaps in socio-technical arrangements that may otherwise be needed to support lean implementation (or CI – Continuous Improvement machinations). Identified gaps may ether reinforce the data obtained from the systematic review or build upon such with new data. As well as support this research, the assessment may also assist local change managers identify specific areas for improvement. A diagram showing the 6 socio-technical nodes is given below in Figure 3:

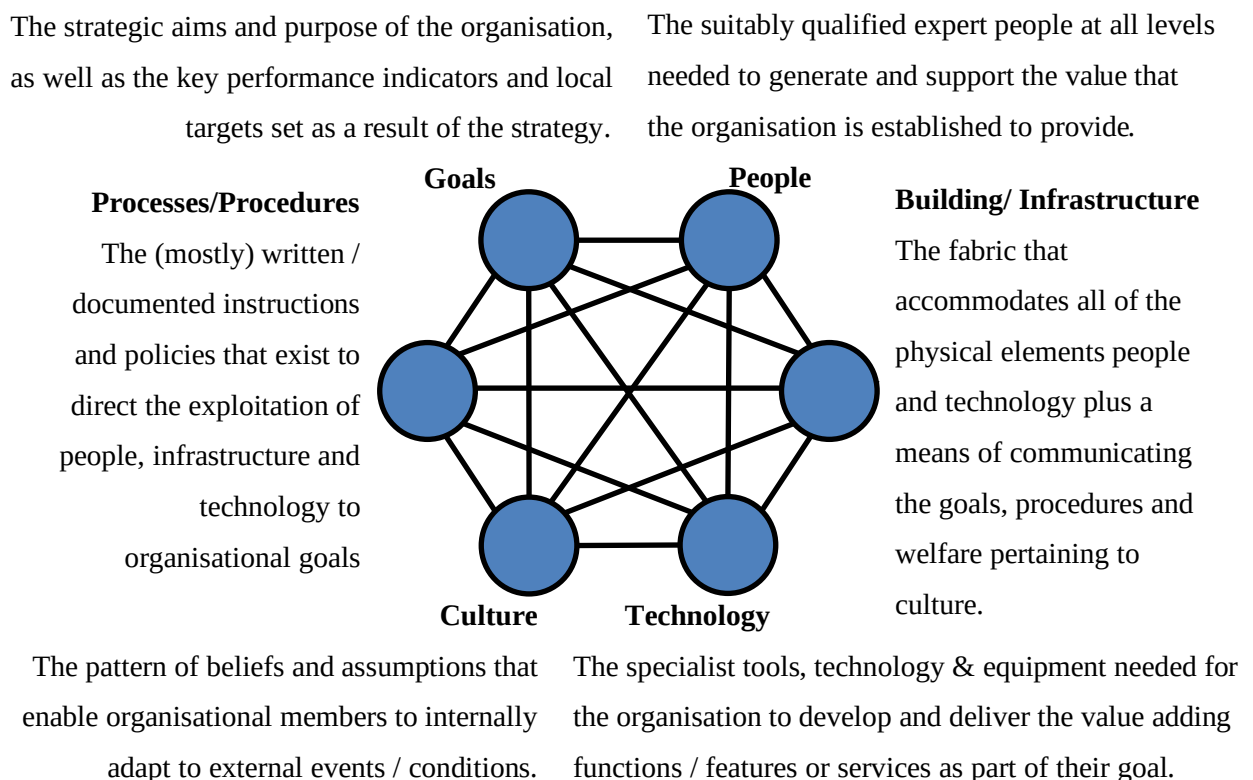


Figure 3. Socio-technical network and indicative content

By utilising a line of enquiry pertaining to change-readiness, the research was able to not only frame questions pertaining to socio-technical arrangements within the context of lean, but also provide a benefit to the host organisations used for the survey; all participating plant leaders were interested in their employee's organisational perceptions in advance of proceeding with their lean journey. Due to a myriad of globalised factors, substantial and sustained change has become important for manufacturing organizations to remain both competitive and relevant (Applebaum, 2012). Different organizations have different levels of change readiness, which ultimately impacts on the likelihood for change to be implemented and sustained. With between 50% and 70% of change programs failing (Calleam Consulting Ltd, 2011) (McKinsey, 2013), a significant amount of resource is wasted due to a lack of preparation (change readiness assessment). Whilst not a direct aim of the thesis, mechanisms for assessing an organization's ability to undertake lean transition part of a wider remit could be useful to business leadership in preparing their organisations for such changes. In order to develop a system to qualitatively assess an organization's socio-technical strengths and weaknesses from employee perceptions, established change-measures and theory were sought and synthesised.

Three plants were selected for initial testing and development; Plants A, B and C. Plants A and B belong to the same world-wide conglomerate, and produce a similar range of products for the automotive component sector; Plant A is based in Poland and Plant B is based in the UK. Also based in the UK is Plant C, a small-to-medium enterprise OEM, owned by a multinational company, that designs and produces products for the condition monitoring and hydraulic control sector. The factories each comprise secondary manufacturing processes, packing and dispatch operations, as well as other associated support functions such as maintenance, logistics and administration. All are well-established plants: Plant A was about to embark on a program that involved transition-to-lean; Plant B has undergone a similar transition 2 years previously as part of business recovery, and was about to move to a new level

of lean implementation post stabilisation from a loss-making position; and Plant C was procured several years previously by a larger concern who thereafter installed their unique continuous improvement/manufacturing excellence system akin to lean. All three plants represent organisations that are either transitioning to new, or continuously adapting-to extant philosophical and behavioural change process that ultimately develops and empowers organisational members to identify waste and improve value (lean).

In terms of fiscal performance, Plant A is considered at the time to be amongst the best in its group, whilst Plant B was considered at one point 2 years previously to be the one of the worst in group (but has had shown some improvement since and is now within the bottom third of the group). Plant C was financially secure at the time of the survey.

The socio-technical system approach was selected as it offered an opportunity to capture data that included aspects of culture whilst also considering the blending of technology and people. The surveys provided further opportunities to identify any obstacles to lean implementation, beyond the systematic review, that could constitute target areas of opportunity as part of the development of a lean-culture work design. The future intent beyond this fieldwork was that a lean-culture design could then be developed and tested as a mechanism for rapid organisational culture change for supporting Lean.

Barriers and Interventions to Lean Implementation from Chapter 2

The systematic review in Chapter 2 identified the following barriers and interventions for lean implementation across Tables 7, 8, 9 and 10 thus:

- Barriers:
 1. Culture unsuited to Lean
 2. Lack of Lean/CI Knowledge

3. Lack of Leadership Skills / Direction
 4. Lack of Non-Human Resources including Finance – i.e., space, equipment and technology
 5. Lack of Non-Human Resources including Finance – i.e., rewards and recognition
- Interventions:
 6. Change Approach to Philosophy
 7. Training Provided with linkage to purpose
 8. Reward Schemes
 9. Management (Non-Executive) involved and in support

Items 2, 3, 4 5, 7, 8 and 9 are easily accommodated by changes to work design using a socio-technical network to influence culture and shall be accommodated later in the research; the culture becomes an input. However, item 1. represents culture as an input:

- Barriers:
 1. Culture unsuited to Lean

Fieldwork Validation

It was proposed that preliminary field testing of a basic socio-technical survey be conducted in order to further identify the barriers for lean implementation, especially in response to the aforementioned barrier item 1. Culture Unsuitable to Lean, where more specific issues within the remaining network would contribute to an unsuitable organisational culture. A survey could also help in identifying the common themes and conflict between nodes. Integrating change formulae into a rudimentary survey to test the issues as a threat or opportunity helped to differentiate between threats and opportunities. The threats represent an aspect for improvement (barriers), which in turn could become opportunities to improve the organisation's cultural conditions. This would help address the aforementioned intervention

item 6 (Change Approach to Philosophy (Culture)) by identifying a driver for changing the current state (current ways of working). Thereafter wider theories would need to be investigated for combining into a new lean-culture socio-technical work design to support improved organisation lean performance and cultural development.

Methodology

The purpose of this fieldwork was to rapidly capture the socio-technical current state from the perspective of the Gemba actors within each plant. The Gemba actors represent the level of the organisation wherein lean tools will have impact and need to be sustained. Carrying out a review of organisations on the cusp of a lean project / implementation could reveal useful insight into the socio-technical current state, and the philosophical conditions that Chapter 2 had indicated as a barrier (philosophy unsuitable to lean). The inherent socio-technical current state could either: reflect and reinforce the findings from Chapter 2; further expand upon any undesirable outcomes identified in Chapter 2 that may act as a barrier to lean; or, identify any new outcomes or gaps that were not part of the findings from the previous chapters. Gemba actors are incredibly busy employees, and their activities on the shop-floor are exclusively where value is added (Womack & Jones, 2003). Their tasks are often repetitive, in line with original design by Taylor (Taylor, 1911b) wherein they are highly trained to perform a specific task repetitively, and required to meet a certain level of output rate to a specific level of quality. In order to keep costs competitively low enough, aspired production rates set by senior leadership seldom include contingency for excessive rest. With this in mind, any data collection method would have to be very quick to conduct as the Gemba time would not be given over easily by either management or the Gemba actors. Given the short introduction of the data collection request to the actors, and that the transmission of any data would be very

quick, a small team of sense-checkers was established for each organisation. Details of the plants and sense checking teams are provided on the following table.

Table 11. Plants and Sense Checking Teams

Plant A	A Polish-based injection moulding plant for the motor vehicle seating industry. The plant is considered one of the best in class for Europe by its multinational owners. It is about to initiate an array of projects as part of new manufacturing excellence system implementation. The organisation employees +200 people operating a 3-shift system 7 days per week.	Sense checking team: - Researcher - Manufacturing Excellent Business Partner for the UK - A recently qualified and recruited HR assistant - Volunteer undergraduate
Plant B	A UK-based injection moulding plant for the motor vehicle seating industry. The plant is considered one of the worst in class in Europe by its multinational owners, and being subject to enterprise value stream analysis using external consultants. The organisation employees +400 people operating a 3-shift system 7 days per week.	Sense checking team: - Researcher - A recently recruited CI Manager - Volunteer undergraduate
Plant C	A UK-based electronic component manufacturer that has recently been purchased by a larger company, and about to undertake a lean value stream event using the new owner's business system. The organisation employees +200 people operating a 2-shift system 5 days per week.	Sense checking team: - Researcher - CI Manager - A part time Engineering undergraduate employee - Volunteer undergraduate

Rationale for the Approach

The whole data collection process would have to occur as part / in parallel to a plant-wide operations and events. Once the data collection period had been completed over four days, a fifth day was allocated to analyse the perceptions. Once the data had been collected it would need to be sense-checked and then reviewed in order to ascertain if it represented a driver or

resistor to the business-change. To this end, a change formula model was selected in order to assist in categorising the data. The formulae within the model would enable the data to be classified against any one of four drivers or four resistors to change. The application of change formulae would ultimately enable the qualitative responses to be converted into quantitative data, which would be more accessible for the plant's stakeholders (the hosts) and change agents to understand, whilst also providing a visual measurement for the researcher against the broad socio-technical aspects of change-readiness and socio-technical current-state.

The Socio-Technical Data Wall

The intent was to have a drop-in area where plant employees could quickly contribute data on a voluntary and ad-hoc basis. The notion of a data-wall was a location free from management and researcher oversight that was near a main thoroughfare (i.e., between cafeteria and production lines) wherein employees could visit without significant diversion from their core activities. The wall would be left open over a week so that users could visit as little or as much as they prefer, and then provide hand-written self-adhesive notes the wall. During the data collection period, the researcher was in near proximity to help answer any questions, and ensure that the wall and the data was not compromised. Furthermore, the researcher had to rapidly review each data item as it was submitted in order to ensure that the data did not mention persons by name, or include any unethical commentary. Impartial interpreters from outside the plant were used where the wall had to be converted into a non-English language. Once the wall was established, employees were introduced to the facility as a single shift at the end of the first lunch period of the working week, across each shift. Participation was never mandated; the aims was to voluntarily obtain current-state data on each socio-technical aspect. The moderation of each data item was undertaken upon each contribution, whilst deeper sense checking and categorisation of the data against the change model formulae occurred after

access to the wall was removed at the end of the week. For each plant, the ‘Wall’ comprised of using a blank length of a spare corridor whereupon brown paper was temporarily fixed and an interactive chart could be developed using masking tape and POST-IT notes. At the centre of the chart was a representation of the core socio- technical contexts within a hexagon form, as indicated in Figure 4 (Cherns, 1987).

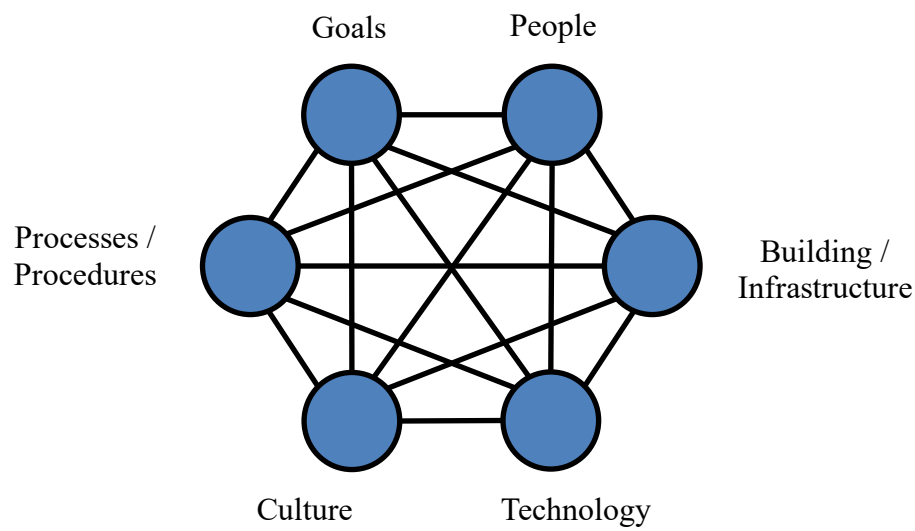


Figure 4. The Core Socio-Technical Hexagon

From the hexagon were branches that separated the wall into six large sections (one section per socio-technical context). Within each section were the following prompts for each context, provided only to assist with ideas and provide a measure of unobtrusive guidance:

- Goals:
What are the priorities in your view? Are the priorities in the right order? How should priorities change?
- People:
Are the right people available with right skills and attitudes? How involved are the people in the change process? Are people empowered? Is leadership sufficient? Is training sufficient? How responsive are people/departments/ management?

- Building/Infrastructure:

Is space sufficient or lacking? Is the condition poor or good? Is the layout optimised or needing change?

- Technology:

What technology or equipment is used/ needed? Is the technology reliable and easy to use? Are any systems/equipment failing or inadequate? How familiar are the systems? Is control and adaptability sufficient? Is training sufficient? Is the organization over-reliant on technology? Is the condition/maintenance suitable?

- Culture:

How does the organization help individuals learn? What is important to the organization? What is important to the people? What stories and rituals exist? How flexible and open is the organization to change and new ideas? Are suggestions encouraged? Does the organization assign blame? Does it balance the needs of the task, the team and the individual?

- Processes/Procedures:

Planning & Preparation (good/bad/how/why)? Existing procedures are adequate /inadequate? Open reporting (data is shared whether good or bad)? How flexible are procedures? Are procedures too complex? Cooperation between departments and organizations good or bad?

At the top of the chart was placed the core question (de-facto title). In this case the question was: 'How Ready is the Plant for Change'. Figure 5 indicates the completed wall ready for introduction to the organization.

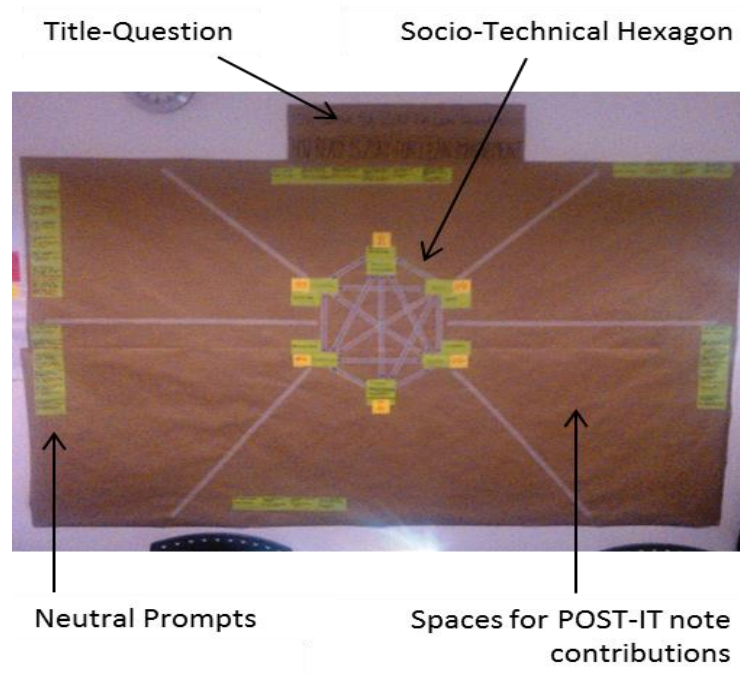


Figure 5. The Socio Technical Wall

Researcher Entry and Ethics

The researcher entry was via an industrial fellowship link, giving the researcher visitation access to each plant. Ethical approval was sought from the University of Suffolk (lead university at the time of the fieldwork – Spring 2016) – a copy of the completed ethic approval template is given at APPENDIX 1, and signed by the relevant regional manager for each plant.

Data Collection

The Data Collection was achieved by encouraging staff to contribute through adding POST-IT notes anonymously to any or all sections. The wall was located within an area either specifically made communal (spare corridor or room that was out of direct view by any workstation or office). The staff were briefed on the nature and purpose of the activity and invited to contribute as much or as little as they wished. The areas were not used for any other function during this period with an open-door policy enacted throughout and well-stocked with pens and POST-IT notes. The approach was informal, as this was considered to have the most

likelihood of obtaining feedback from all classes of employee; particularly employees with lower social status (Luria, et al., 2015). The data collection tool specifically avoided using inherent set of questions for cultural evaluation so that the groups would reveal what they felt intensely about (Schein, 2010). It was considered that with intensity would probably come more negative comments than positive, as these were more likely to be as a result of recent change attempts and hence generate high levels of anxiety or resistance (Schein, 2010). Furthermore, it is considered that the data collection tool process itself will be seen as a force that is imposing productive dialogue, and will develop defensive routines from the staff (Argyris, 1985). Given that the data collection tool's aim was not part of a research line to generate a robust socio-technical survey, the tendency to generate negative comments was not seen as an issue. The benefit would be that the data collection tool was more likely to identify barriers, provided the employees felt comfortable and not coerced to contribute; these barriers could then be cross-referenced against the findings from the systematic review for their originality or reinforcement of established findings. Change readiness was used as the context within which to draw out thinking.

For Plant A, a total of 59 contributions (from 25 staff members undergoing Lean training) were made with the majority being contributed within the first 24 hours of release, as indicated by Figure 6. It was important for contributors to return and read other contributions in the event that any member considered that counterpoints should be added. This need was also reinforced to the organization through further briefings. Anonymity was assured by restricting access to one employee at a time and writing remarks on their behalf (whilst also ensuring that remarks were not personally directed).



After 24 hours

Figure 6. The Socio Technical Wall +24 hours – Plant A

Plant B received 180 comments with availability to 267 staff members (the entire plant); whilst Plant C received 91 comments from 60 staff members (the entire plant).

Sense Checking and Data Analysis

For each plant a team was constructed to sense check and analyse all remarks obtained from the data collection. The teams always consisted of the researcher, the indigenous change manager (various job titles but usually the Continuous Improvement Manager for the plant) and a volunteer undergraduate from the University of Suffolk. Gathered data was sense checked in order to ensure that the language and context of each remark was clearly understood. Sense checking was carried out at the end of each day away from the employees, ensuring that contributions could be understood and that disagreements in interpreting the remarks could be resolved before contacts was lost with the plant's impartial employees on the sense-checking team. Through a voting process, the team then ensured that each remark was then allocated to the correct socio-technical context in the event the employees had either misunderstood a

context or made an error placing the POST-IT note. The team then reviewed each remark for relevance against the four drivers and four resistors as per Tables 13 and 14.

Data Grouping

The POST-IT notes were fastened more permanently to the brown backing, and the 'Wall' removed for off-site review. Although the POST-IT notes were already grouped by socio-technical context in accord with the employee perceptions of such, the notes were reviewed by the team at the end of the week to ensure that the remarks within the notes were most considerate of the socio-technical context where they were placed, and to which they would ultimately contribute a change-readiness score. This process was carried out after the data collection period so that employees did not have visibility of any interference; giving them the feeling that they had ultimate control over the input of the process.

Change Formulae for Socio-Technical Assessment

Applebaum identifies the key differences between socio-technical systems and OD, and proposes integrating them in a coordinated approach to change management (Applebaum, 1997) wherein it is proposed that overall productivity is directly related to the STS's accurate analysis of social and technical needs and requirements. The research states that any node should not operate at the expense of the other, and that there must exist three prerequisites in order for change to be possible: a. there is dissatisfaction with the present state as a basis for change; b. positive mindset is a force to initiate a proactive attitude; c. ideas that are based on reality to complete achievable and planned changes. These prerequisites link to the components of previously established change formula by Gleicher (Dannemiller, 1992), $D \times V \times F > R$ wherein the following is inferred: D. dissatisfaction with the current state; V. vision of what is trying to be achieved; F. first steps to be taken toward the vision; R. resistance to the

change effort. The use of this formula in approaching whole system interventions (Hayes, 2002) such as STS is further endorsed in order to allow the organisation's members to quantify the discrepancy between the current state and the desired future state (Fritz, 1984). Whichever formula is evolved/used, there is an apparent emphasis for these prerequisites as part of a socio-technical system diagnostic survey that has the ability to not only assess change readiness against the formula, but also identify specific details (barriers) that can impact on other areas of the network. In an evaluation of change programmes within the aviation sector, McDonald states that an improved knowledge of cause-and-effect in socio-technical system change could be important in more effective planning and management of change, and conversely, a relative lack of knowledge will adversely impact on achieving change objectives (McDonald, 2015). This demonstrates the importance of having in depth knowledge of the issues relating to each STS node when designing and planning a new systems or changes.

Data Tabulation

The contributions within each section were then analysed by the researcher so that the comments could be given scores against change formulae. The scoring system was developed by synthesising Gleicher's formula for change as a basis from three elements into four. The three elements from Gleicher are $D \times V \times F > R$:

D - Dissatisfaction with the current state among the team

V - Clarity of the Vision of what the organization is trying to achieve and what it means to individuals

F - Clarity of the what the first steps will be

R - Resistance to change

It was felt that the equation did not take into account skills for change; a core theme for intervention success (Eaton, 2010). Similar alternative formulae were obtained as follow:

Keller's Conditions (2014) A to B:

- A - A Compelling Story: Participants must see the point of the change and agree with it, at least enough to give it a try.
- B – Role-modelling: Participants must also see colleagues they admire modelling the desired behaviour.
- C - Reinforcement Systems: Surrounding structures, systems, processes and incentives must be in tune with the new behaviour.
- D - The Skills Required for Change: Participants need to have the skills to do what is required of them.

Eatons Elements (2010):

- 1. A Pressure for Change that is felt throughout the organization.
- 2. A clear and shared vision for where the organization must improve.
- 3. Internal capability (time and skills mostly, but also including financial investment) to implement the changes.
- 4. An agreed program of activity.

Where Gleicher calls for three provisions (D, V and F), both Keller and Eaton suggest four conditions (Keller, 2014) or elements (Eaton, 2010). As Table 1 indicates, it can be argued that Keller's Conditions A to D and Eaton's elements 1-4 have similarities to each other (provided Eaton's 3rd and 4th elements are swapped around as with Table 12).

Table 12. Keller's Conditions and Eaton's Elements

Keller's Conditions	Eaton's Elements	Comparison / Commonality
<i>A. A Compelling Story: Participants must see the point of the change and agree with it, at least enough to give it a try.</i>	<i>1. A Pressure for Change that is felt throughout the organization.</i>	Stories of dissatisfaction, opportunity or success quickly become pressures for change, whilst negative stories symbols become barriers to change. (Oana, 2014)
<i>B. Role Modelling: Participants must also see colleagues they admire modelling the desired behaviour.</i>	<i>2. A clear and shared vision for where the organization must improve.</i>	Role model behaviour and ideas/visions quickly become emulated by supported within the organization. Role models and vision require clear goals.
<i>C. Reinforcement Systems: Surrounding structures, systems, processes and incentives must be in tune with the new behaviour.</i>	<i>4. An agreed program of activity.</i>	Plans that are essential to start change, and policies that promote change completion and development, yet flexible enough to adapt.
<i>D. The Skills Required for Change: Participants need to have the skills to do what is required of them.</i>	<i>3. Internal capability (time and skills mostly, but also including financial investment) to implement the changes.</i>	Both cases here are clearly support the need for human skills and wider non-human organizational capabilities as inherently.

With Table 1 in view, the next step was to synthesise the 4 areas matched in Table 11 into Gleicher's core provisions of D, V and F. The first and second provisions, D and V, transfer in a straight-forward manner, whilst the 3rd provision, F, has to be separated into two sub-categories as indicated in Table 2. This was then mapped against the STS network in order to categorise the relevant features of change formula against each STS node.

Table 13. A Synthesis of Gleicher's & Eaton's formulae – Drivers (D1, V1, F1a & F1b)

Drivers for Change		STS Category and Guidance
(Gleicher)	(Keller and Eaton)	(Challenger & Clegg)
D1 - Dissatisfaction with the current state among the team	D1 - Compelling Stories / Pressure for Change	Stories that contribute to a positive culture that encourages learning and positive behaviours
V1 - Clarity of the Vision of what the organization is trying to achieve and what it means to individuals	V1 - Role Modelling / Clear Shared Vision	Examples of clear and suitable goals and direction
F1 - Clarity of the what the first steps will be	F1(a) Reinforcement Systems / Agreed Program	Change plans demonstrated with supporting policies
	F1(b) Skills for Change / Internal Capability	Evidence of suitable and accessible capabilities (skills/resources) in: people, infrastructure & technology

Finally, it was determined that the model did not provide sufficient detail for change resistors, 'R', and that participant statements often had connotations that alluded to both positive elements (drivers) of the model as well as negative elements (resistors/preventers) to change; often in unequal measure. In order to correct for this, the equation was modified with opposing sections of resistors as shown in Table 12 where the R value for the model has effectively been replaced with opposing variables D2, V2, F2a and F2b and greater details included for simple STS analysis. This meant that statements could be more easily analysed according the STS node and guidance evolved from the change formula as per the example in Figure 7. The sum of the negative remarks under each negative category depending on the STS context (either D2, V2, F2a or F2b) were subtracted from the corresponding positive category (D1, V1, F1a or F1b) and divided by the total remarks to identify the balance between contributions from the organization's members.

Table 14. A Synthesis of Gleicher's & Eaton's formulae – Resistors (D2, V2 F2a & F2b)

Drivers for Change		STS Category and Guidance
(Gleicher)	(Keller and Eaton)	(Challenger & Clegg)
D2 – Dissonant dissatisfaction with the current state among the team	D2 - Compelling stories, rituals that demonstrate an inability for change	Stories that contribute to a negative culture that discourages learning and positive behaviours
V2–Poor clarity of the Vision of what the organization is trying to achieve and what it means to individuals	V2–Lack of Role Modelling (or negative role models) / Clear Shared Vision	Examples of goals being confused, diluted, inappropriate and/or absent
F2–Poor clarity of the what the first steps will be	F2(a) Lack of Reinforcement Systems / Agreed Program	Change plans are absent or unsuitable, and/or there is a lack of supporting policies
	F2(b) Lack of skills for Change / Internal Capability	Evidence of suitable and accessible capabilities (skills/resources) in: People, infrastructure & technology

Using the revised formula for drivers and resistors, each remark was then reviewed and tabulated as indicated in the Figure below.

Employee Remark	Drivers				Resistors				Comments / Observations
	D1	V1	F1 a	F1 b	D2	V2	F2 a	F2 b	
<i>Departments only concentrate on their own goals; (they have) no time for the plant (goals). Sometimes you need to sacrifice something to be able to achieve more.</i>						y			<i>No shared vision</i>
Sub Total						1			Common Themes:
V1-V2	-1								

Figure 7. Example of Agreed Analysis of an Employee Remark

STS Indices

The totals of each change/resistor column within each STS context (D1-D2, V1-V etc.) were then divided by the total number of remarks obtained during the survey. This ratio was hence named the STS Index and used for graphical analysis within the results. In order to provide a method of comparing the analyses, a common ratio was developed using the ratio of 1/6 of total contributions divided by the total contributions. This demonstrates the cumulative point at which all remarks would reach provided the contributions from the employees were:

- All negative perceptions (Resistors to change)
- Evenly distributed across all 6 socio-technical contexts. This assumes that all drivers and barriers for change have proportionately equal and opposite effects. Arguably this evenness does not accurately reflect the reality for effect of each driver or barrier. This approach, however, is justified in this case through the following arguments:
 - The aim of the research is not to create a detailed or robust socio-technical change readiness assessment, which would otherwise require further specialised research. Effort was hence constrained in order to rapidly develop a tool with the main purpose of identifying socio-technical gaps that were not apparent from the systematic review.
 - The inaccuracy of the tool could arguably be consistent across all three subject plants, appearing as the same anomaly, and potentially discountable as a shortfall of the tool.
 - The results were never going to be used as part of any strategic decision support system by the subject plants, and so errors created by not accounting for unevenness would have no impact on employees.

It provides a common measurement with which to compare all analyses with each other, as the organizations each had differing amounts of employees and hence contributions to the survey. It is referred to as the Maximum STS Balance-Index. Contributions were sense checked at the

survey point, and the results shared with a cross section of plant personnel in order to validate the general tone of the findings.

Linking back to Lewin

Kurt Lewin developed a change model involving three steps: unfreezing, changing and refreezing. The unfreezing stage is used to create awareness for the change within all stakeholders (people affected by the change). The aspects to be changes are also examined so that the more is known about the change, and communicated, the more likely the change will be adopted and risks to the change effort can be identified and addressed. The next stage is the change activity where the organisation and its members can transition to the new condition. New socio-technical arrangements are implemented through careful planning and execution, combined with communication to all stakeholders to support the process and obtain feedback during the change activities. The final step of (re)freezing the change involves reinforcing, stabilising and solidifying the new state / condition after the change is initially completed. Effort has to be applied in order to ensure that new conditions do not revert back to old ways / states. Rewards and acknowledgement(s) are also applied to reinforce the new state and help cement it into the new norm. The unfreeze, change and re-freeze process is otherwise referred to as change-as-three-steps (CATS) (Hartzell, n.d.).

The following table 13 indicates how the D, V and F vectors would cross-refer against the Lewin notions of change as three steps (CATS) as per the analysis of Cummings et al (Cummings, et al., 2015). The CATS model has been criticised for over simplifying the change process. Cummings defends Lewin as never really having presented the CATS as a model, but that the early writings in Human Relations (1947) has having foundational significance to many change models that followed Lewin's work. Cummings goes on to propose that the CATS has influenced the work into change theory and that the approach can

be used as a baseline to compare the new models, and encourage further innovation within proceeding models.

	Model	D	V	F
Drivers for Change	Lewin	Unfreeze	Change	Refreeze
	Gleicher	Dissatisfaction with the current state	Clarity of the Vision of what the organization is trying to achieve	What the vision means to individuals, & clarity of the what the first steps will be
	Keller & Eaton	Compelling Stories / Pressure for Change	Role Modelling / Clear Shared Vision	Reinforcement Systems / Agreed Program Set and Implemented Skills for Change Consolidated / Internal Capability Upgraded
Resistors to Change	Lewin	Unfreeze	Change	Refreeze
	Gleicher	Dissonant dissatisfaction with the current state among the team	Poor clarity of the Vision of what the organization is trying to achieve	Poor clarity of the what the first steps will be & poor clarity of the what the first steps will be
	Keller & Eaton	Compelling stories, rituals that demonstrate an inability for change	Lack of Role Modelling (or negative role models) / No clear shared vision	Lack of Reinforcement Systems / Agreed Program Lack of skills for Change / Internal Capability

Table 15. Drivers and Resistors to Change Linked to Lewin's CATS model

Results

Using the data interpretation methodology, the comments were then tabulated against the modified equation in Figure 4, with a 'y' included under each of the variables where relevant. This data summary against each socio-technical context is given in Tables 16a, 16b and 16c, which also includes comments that identify common themes. It should be noted that at no point in the analysis was a nil-response noted in any of the columns.

Detailed perceptions and scores are contained with this Chapter's ANNEXES 1, 2 and 3.

Table 16a. Analysis of Results – Plant A

PRESSURE	Sub Total of Drivers & Resistors - Culture	3				16				There is an apathy developing about improvement and the importance of constructive feedback.
	STS Index: (sum D1 - sum D2) / (sum all)	-0.21								
VISION	Sub Total of Drivers & Resistors - Goals		1				8			There is confusion over the plant's goals; what they are and what are their priorities.
	STS Index: (sum V1 - sum V2) / (sum all)	-0.11								
CAPABILITIES	Sub Total of Drivers & Resistors - People				2				11	There are perceptions about a lack of time for CI and training, together with the resources to implement CI or the improvement ideas that are generated from CI activities.
	STS Index: (sum F1b(people) - sum F2b(people)) / (sum all)	-0.15								
	Sub Total of Drivers & Resistors - Building & Infrastructure				2				2	This plant has invested in technology to improve quality control and has a rich source of spare capacity (space) within which to develop comfortable working environments that are well-suited.
	STS Index: (sum F1b(bldg & infra.) - sum F2b(bldg & infra.)) / (sum all)	0.00								
	Sub Total of Drivers & Resistors - Technology				1				4	Supporting Information Systems and the support for such could be improved.
	STS Index: (sum F1b(tech.) - sum F2b(tech.)) / (sum all)	-0.05								
STEPS	Sub Total of Drivers & Resistors - Processes & Procedures			2				9		Some good practice being observed with a desire to use more local suppliers of minor goods/services, and a desire to simplify the procedures and audit documentation.
	STS Index: (sum F1a - sum F2a) / (sum all)	-0.11								

Table 16b. Analysis of Results – Plant B

PRESSURE	Sub Total of Drivers & Resistors - Culture	6				87				Lack of respect felt by shop-floor workers (MTMs) with accusations of a bullying / blame culture. There is a blend of anger, frustration, anxiety and helplessness.
	STS Index: (sum D1 - sum D2) / (sum all)	-0.46								
VISION	Sub Total of Drivers & Resistors - Goals		0				7			Right-First-Time (RFT) issues and a perceived lack of control of such has adversely affected goal alignment.
	STS Index: (sum V1 - sum V2) / (sum all)	-0.04								
CAPABILITIES	Sub Total of Drivers & Resistors - People				4				28	Lack of Job rotation, training, skills and time on task (or staff) are the most common themes
	STS Index: (sum F1b(people) - sum F2b(people)) / (sum all)	-0.14								
	Sub Total of Drivers & Resistors - Building & Infrastructure				0				9	Packing area is too small.
	STS Index: (sum F1b(bldg & infra.) - sum F2b(bldg & infra.)) / (sum all)	-0.05								
	Sub Total of Drivers & Resistors - Technology				1				16	A wide variety of improvement ideas provided for evaluation - the plant has the capability to experiment, but needs to consider if it has the courage or capacity to do so.
	STS Index: (sum F1b(tech.) - sum F2b(tech.)) / (sum all)	-0.09								
STEPS	Sub Total of Drivers & Resistors - Processes & Procedures			0				18		ODSs (working procedures) are felt to be inadequate and/or unrealistic. Improvement plans are considered to be rushed or unsustainable.
	STS Index: (sum F1a - sum F2a) / (sum all)	-0.10								

Table 16c. Analysis of Results – Plant C

PRESSURE	Sub Total of Drivers & Resistors - Culture	7				38				There seems to be a lack of encouragement and innovation; helplessness and frustration with people not feeling like they are listened to.
	(sum D1 - sum D2) / (sum all)	-0.27								
VISION	Sub Total of Drivers & Resistors - Goals		0				10			There is confusion over how goals are developed, and this leads to doubt about the suitability of the goals.
	(sum V1 - sum V2) / (sum all)	-0.09								
CAPABILITIES	Sub Total of Drivers & Resistors - People				3				14	Most common issues are a lack of training / information sharing, followed by a lack of career progression.
	(sum F1b(people) - sum F2b(people)) / (sum all)	-0.10								
	Sub Total of Drivers & Resistors - Building & Infrastructure				0				7	There is insufficient space for operational cells, some of which are left incomplete.
	(sum F1b(bldg & infra.) - sum F2b(bldg & infra.)) / (sum all)	-0.06								
	Sub Total of Drivers & Resistors - Technology				2				18	Shortage of the right software and hardware, plus materials.
	(sum F1b(tech.) - sum F2b(tech.)) / (sum all)	-0.14								
STEPS	Sub Total of Drivers & Resistors - Processes & Procedures			1				14		The bespoke CI systems (Lean variant) from the corporate owners are not grafting onto the extant organization. There is doubt about the suitability of these systems, and concern that projects are not being started or finished properly.
	(sum F1a - sum F2a) / (sum all)	-0.11								

Main Findings

Tables 17a, 17b and 17c provide a numerical representation of the scores from each socio-technical context from each study. These are supported by Figures 9a, 9b and 9c, which provide the factors under each socio technical node pertaining to each plant. By converting the qualitative perceptions from the employees into quantitative scores, the non-physical (non-technical behavioural) contexts are more easily visible and comparable with the physical (technical-rational) contexts. Each study produces a set of common themes for each plant to consider, and that are unique to their study. The dotted line in each of Figure 9's charts indicate the Maximum STS Balance-Index and the solid line indicates the Zero-Line.

Plant A

The following diagram in Figure 8a briefly identifies the different factors under each socio-technical node that a specific to the plant's current state.

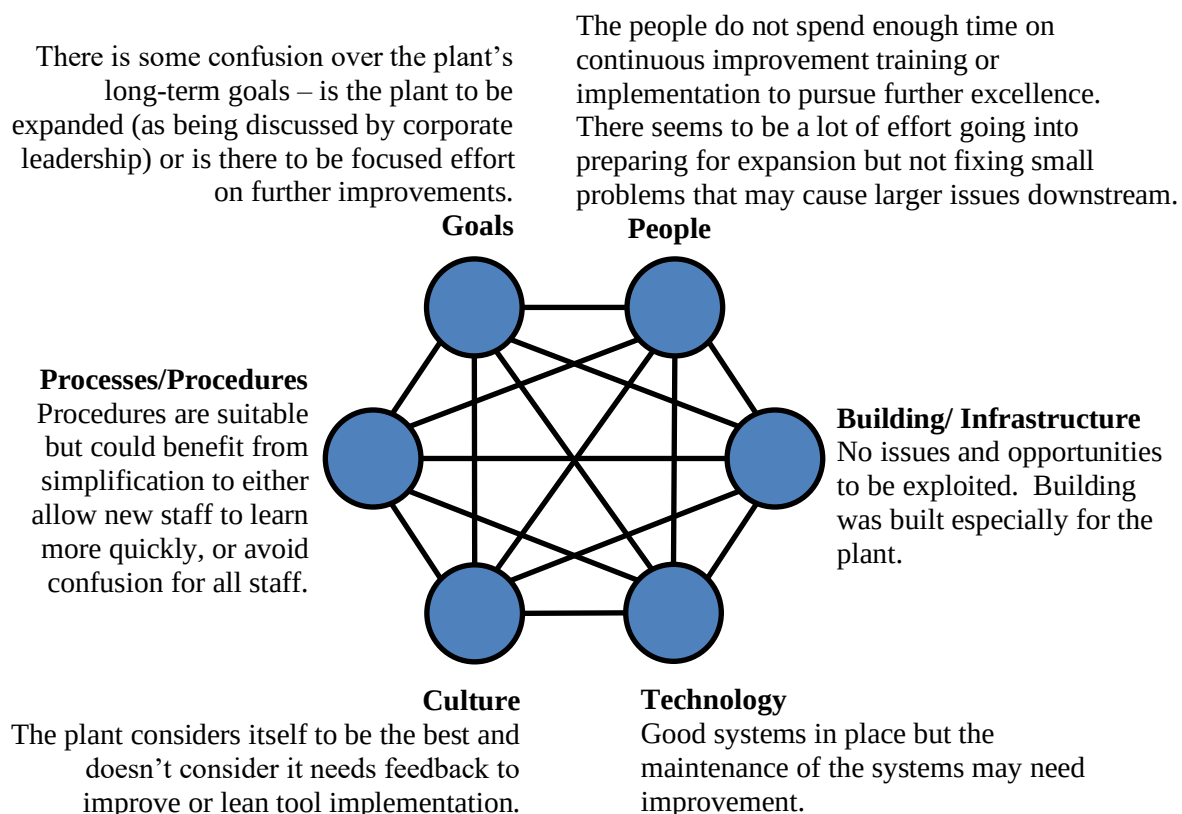


Figure 8a – Factors under each socio-technical node pertaining to the plant

Figure 9a shows that whilst the Plant A did not have a sufficient enough number of positive remarks provided to move beyond the zero line, it did result in STS indices that, with the exception of culture, did not breach the STS maximum-balance index. The plant scored well in the context of building/infrastructure. The most revealing aspect of the results is the score for culture, which breaches the balance index by a further 25% (100% being between the zero-line and maximum STS balance line). This indicates that this would be the context that represents the largest resistance to change success by comparison to the other socio-technical nodes/contexts.

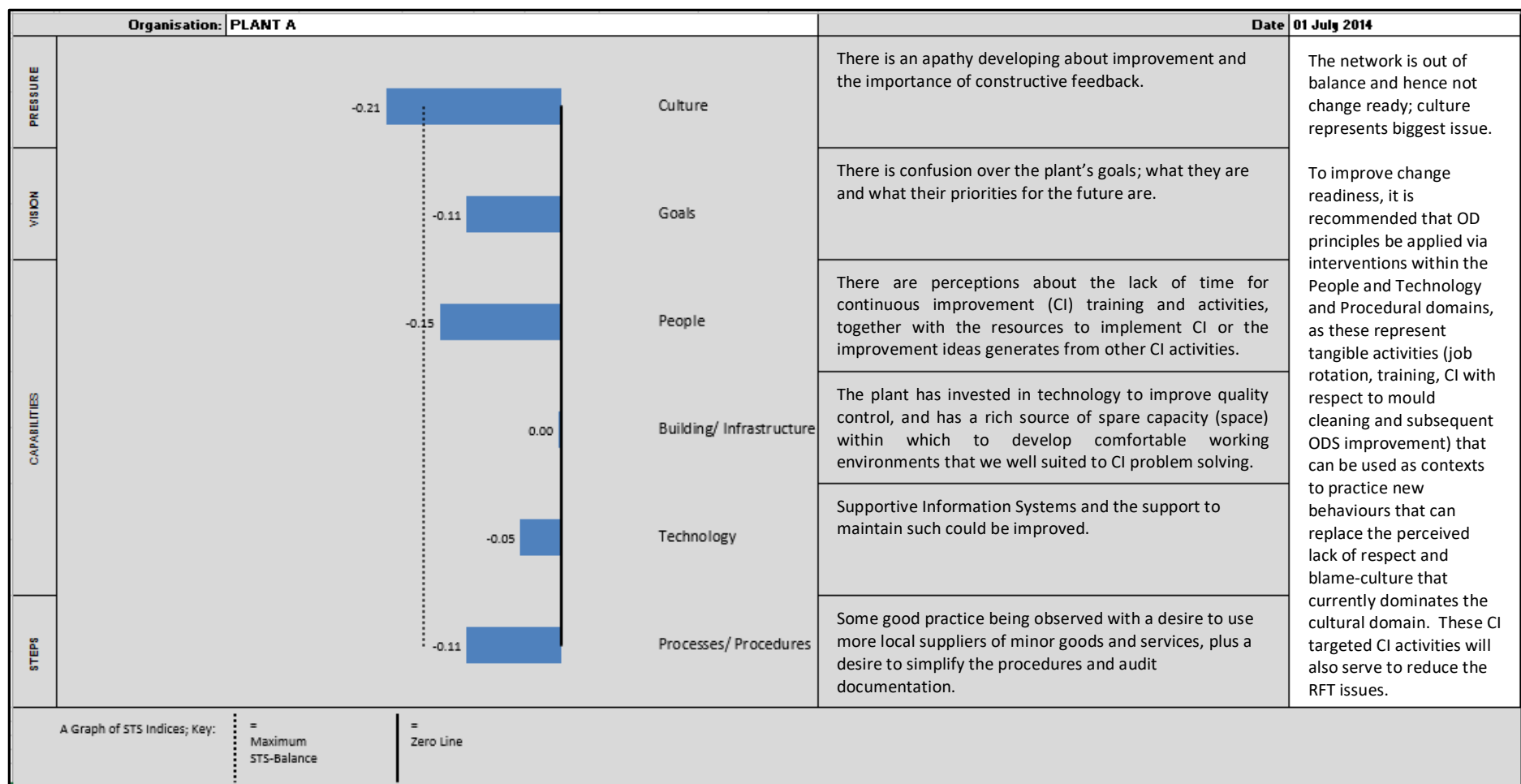


Figure 9a. Graphical Representation of Socio Technical Indices - PLANT A

In terms of change formulae, the STS indices average as follow:

Table 17a. STS Indices for Plant A

<i>Change Formula Context</i>	<i>STS Context (Node(s))</i>	<i>Ave. Index</i>
Pressure / Driver for Change	Culture	-0.21
Vision	Goals	-0.11
Steps for Change & Reinforcement	Processes & Procedures	-0.11
Capabilities	People + Infrastructure + Technology	-0.02

From the common themes, there is a tone of apathy developing in the plant with confusion over the plant's goals. This is de-prioritising the resources on improvement; a theme that may otherwise not be considered inherent in view of the plant meeting immediate financial targets. That said, this apparent 'satisfactory' position is subject to risk by either disruptive technologies (product or process innovation by a competing organization) or stagnation in the face of sister-plant improvements (i.e., increased investment and expansion that could be granted to sister-plants, leading to them making greater efficiency improvements and then eventually out-pacing the subject-plant's current performance). Arguably, a plant in stagnation, these themes suggest a lack of incentive to improve performance; a satisfaction with a status-quo that could be leading to complacency and apathy toward improvement.

Plant B

The following diagram in Figure 8b briefly identifies the different factors under each socio-technical node that a specific to the plant's current state.

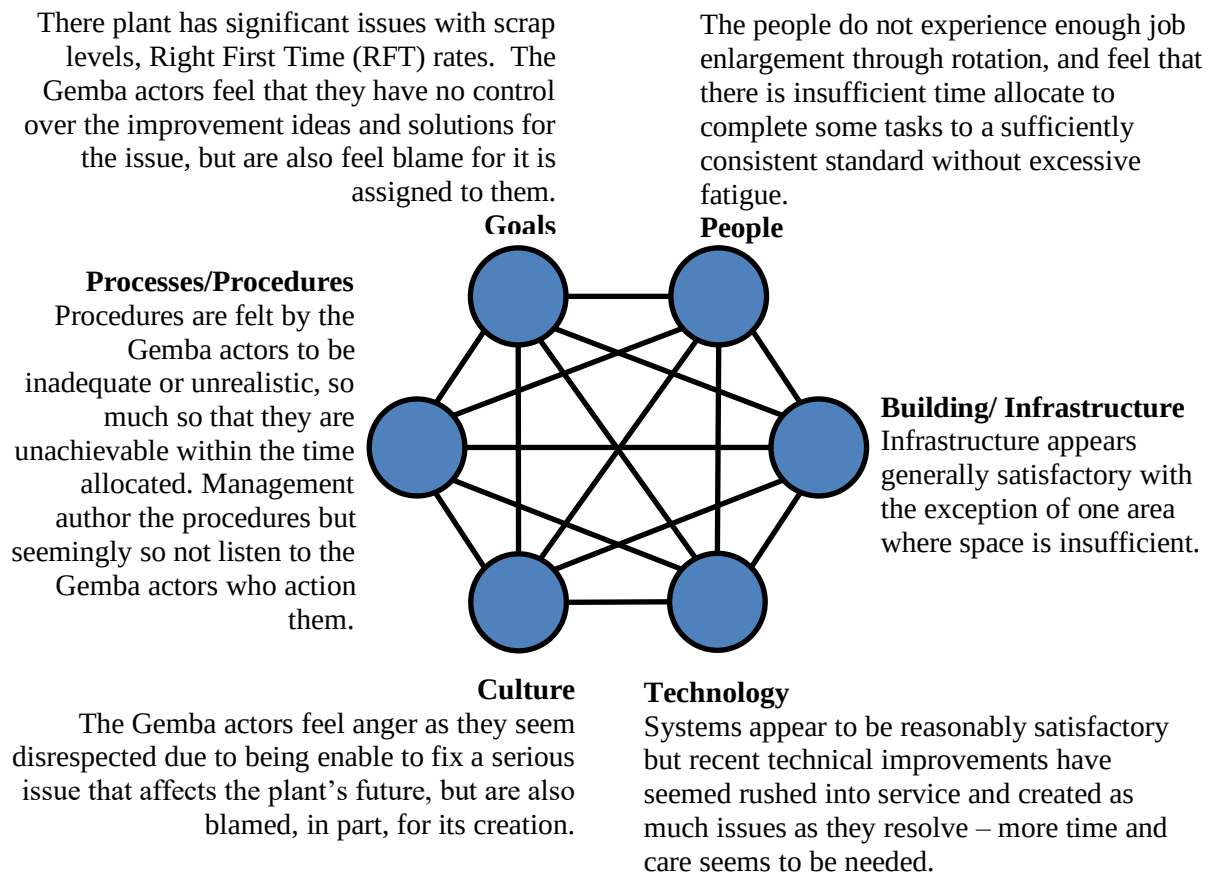


Figure 8b – Factors under each socio-technical node pertaining to the plant

Figure 9b shows that whilst the Plant B did not have a sufficient number of positive remarks provided to move beyond the zero line, it did result in STS indices that, with the exception of culture, did not breach the STS minimum-balance index. The plant did not score well in any context. The most revealing aspect of the results is the score for culture, which breaches the balance index by a further 175% (100% being between the zero-line and maximum STSS balance line). This indicates that this would be the context that represents the largest resistance to change success by comparison to the other contexts.

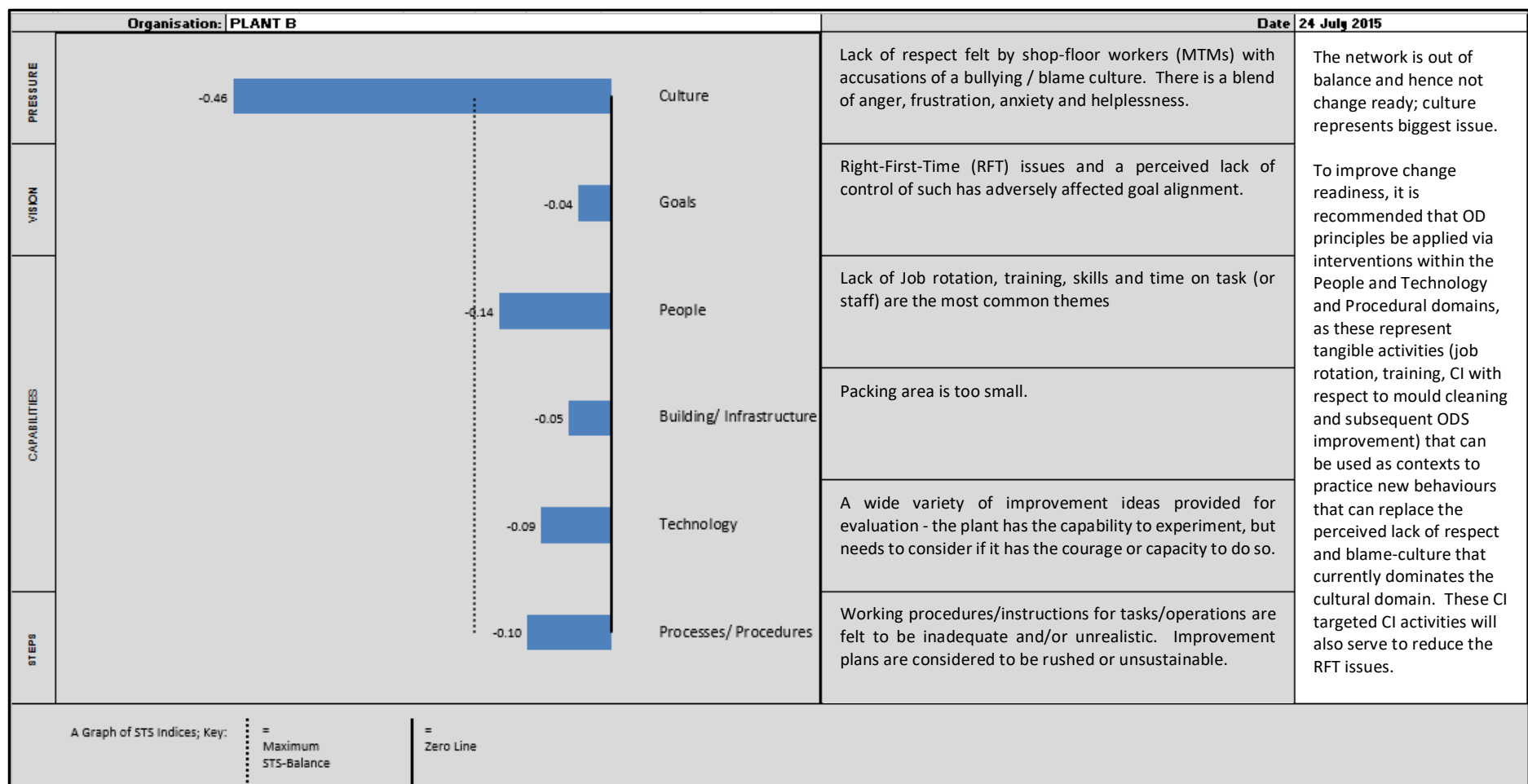


Figure 9b. Graphical Representation of Socio Technical Indices – PLANT B

In terms of change formulae, the STS indices average as follow:

Table 17b. STS Indices for Plant B

<i>Change Formula Context</i>	<i>STS Context (Node(s))</i>	<i>Ave. Index</i>
Pressure / Driver for Change	Culture	-0.46
Vision	Goals	-0.04
Steps for Change & Reinforcement	Processes & Procedures	-0.10
Capabilities	People + Infrastructure + Technology	-0.09

Figure 9b for Plant B shows a plant in trouble; extremely negative scores for culture reflect a poorly performing plant and negative change-readiness despite significant investment in Lean processes and techniques, which are apparently not sustaining or bringing about the competitive advantage that they are designed for. New philosophies are not sustaining, and the plant would need to consider fundamental changes in problem solving approaches (new behaviours) in order to improve employee perception, and hence attitudes, to improvement. There is anger, dissonance and helplessness at this plant; fuelled by a coercive power arrangement. As a consequence, leaders and subordinates have stopped learning with efficacy; hence operating procedures are now inadequate, which leads to poor quality work that, in-turn, fuels the blame culture. The plant was one of the worst in group 2-years before the survey, and had shown recovery to a moderate level of performance with the support of specialist consultants and a new plant manager. The consultants have since left, and a further new plant manager has taken over; since then, the plant performance has declined but not returned to the bottom of the group. The common themes suggest that the operational working procedures need addressing, in harmony with the shop floor, so that realistic activities/processes can be designed and training can be implemented. This results from such an activity would only be robust if the management take a new behavioural approach to working with the shop-floor, who feel disrespected and are hence disengaging from supporting the management.

Plant C

The following diagram in Figure 8c briefly identifies the different factors under each socio-technical node that a specific to the plant's current state.

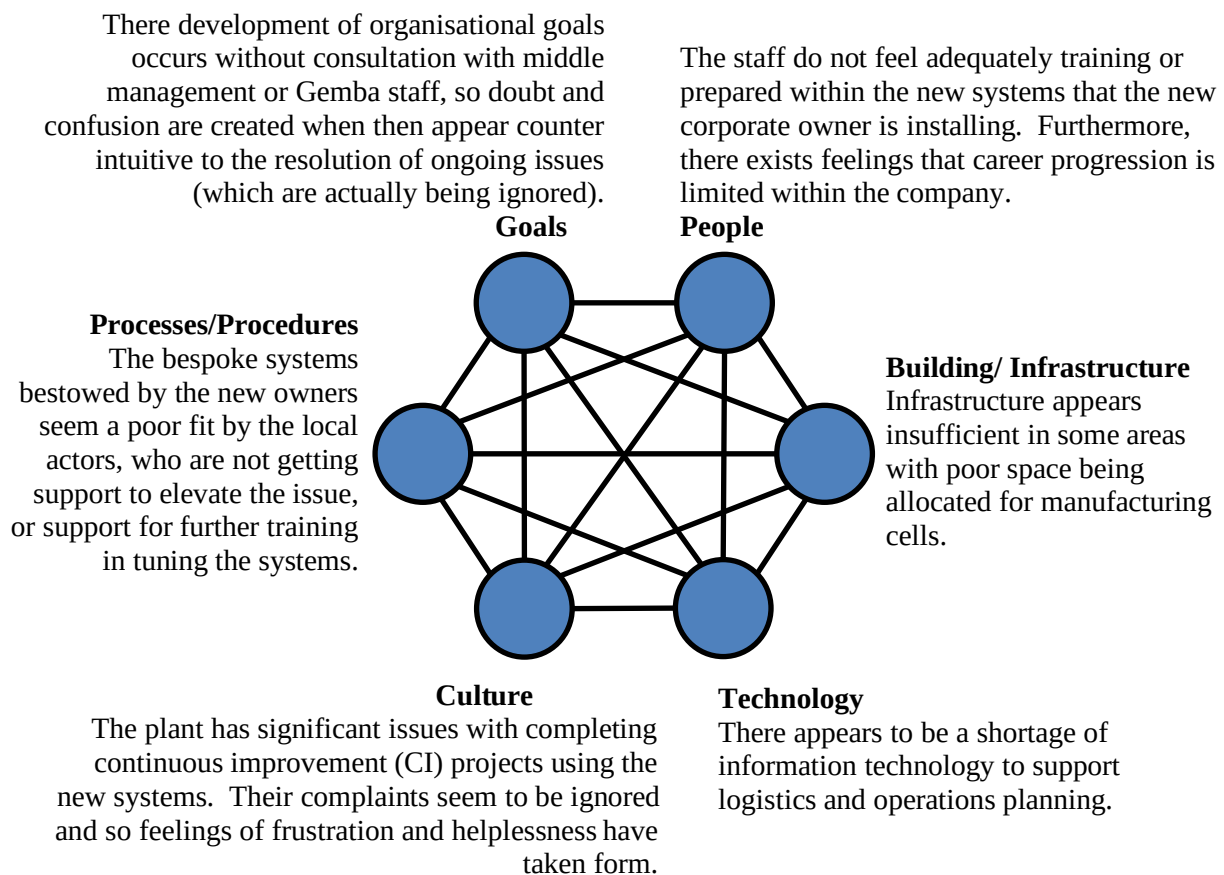


Figure 8c – Factors under each socio-technical node pertaining to the plant

Figure 9c shows that whilst the Plant C did not have a sufficient enough number of positive remarks provided to move beyond the zero line, it did result in STS indices that, with the exception of culture, did not breach the STS minimum-balance index. The plant did not score well in any context. The most revealing aspect of the results is the score for culture, which breaches the balance index by a further 158% (100% being between the zero-line and maximum STS balance line). This indicates that this would be the context that represents the largest resistance to change success by comparison to the other contexts.

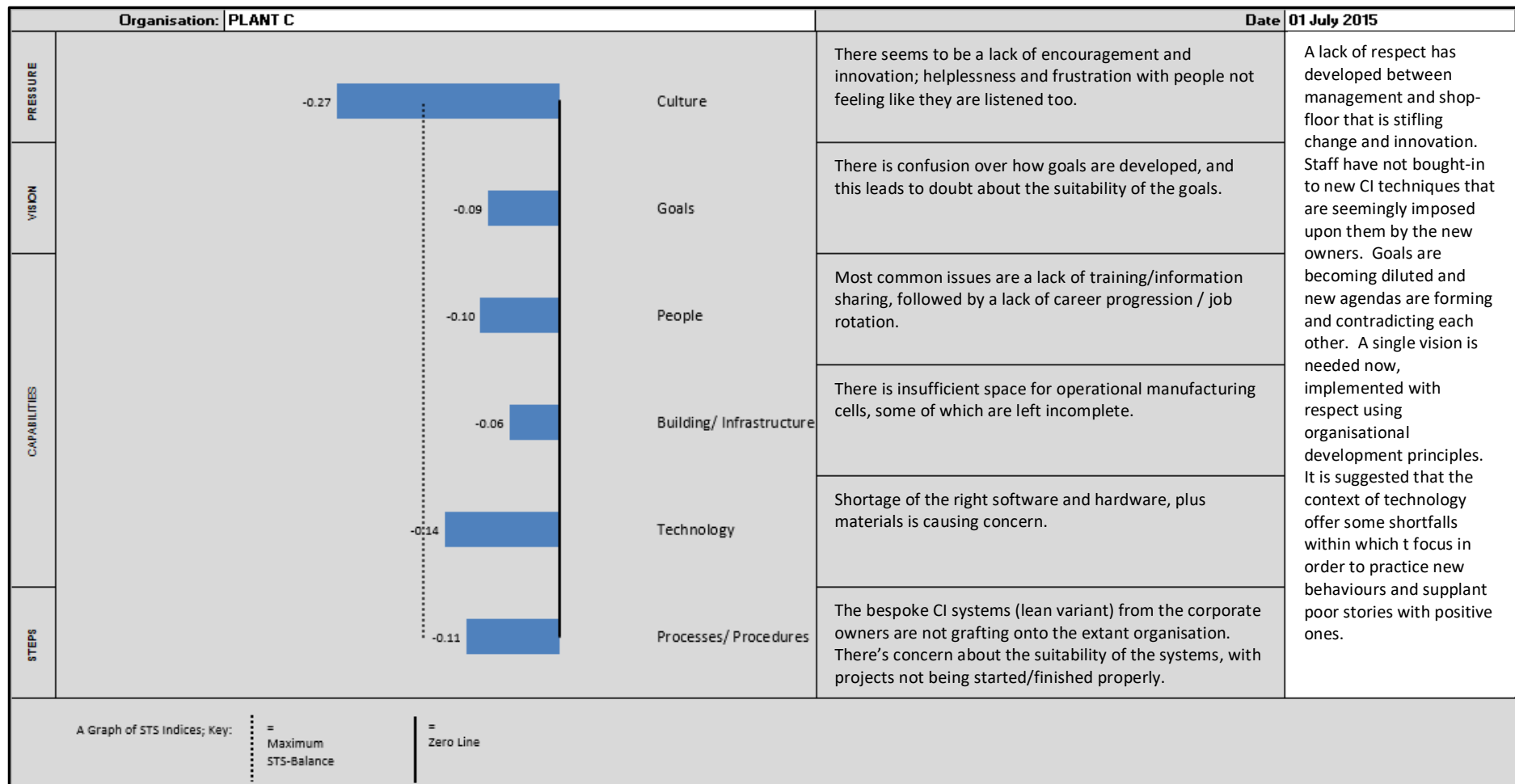


Figure 9c. Graphical Representation of Socio Technical Indices – PLANT C

In terms of change formulae, the STS indices average as follow:

Table 17c. STS Indices for Plant C

<i>Change Formula Context</i>	<i>STS Context (Node(s))</i>	<i>Ave. Index</i>
Pressure / Driver for Change	Culture	-0.27
Vision	Goals	-0.09
Steps for Change & Reinforcement	Processes & Procedures	-0.11
Capabilities	People + Infrastructure + Technology	-0.10

The staff do not believe or buy-in to the business processes and managing current levels of performance despite them. Ironically, the business processes are perhaps very established mechanisms that may bring benefit if integrated well; however, there is conflict with regard to their introduction and a firm belief that the plant is not appropriately investing in new product development (its future). It could be argued that a lack of investment (time and materiel) is being hampered by a lack of capacity, which in turn is being developed through inappropriate process or a mismatch between process requirement and activity (average processed relying on extra-ordinary people). Despite the low adaptation of corporate business improvement systems and hence lack of innovation, the plant is performing well against established KPIs for sales growth and quality, neither of which are facets that the STS survey are particularly testing for. Amongst the common themes, however, was a concern for lack of innovation; inferring that there is an element of stagnation at this organization.

Cross Plant Analysis

It is understood that in terms of performance, none of the plants are setting new standards, however, there is a clear order of performance in terms of KPI delivery (starting from the highest performance): Plant A, Plant C and then Plant B, as can be seen in Figure 9d.

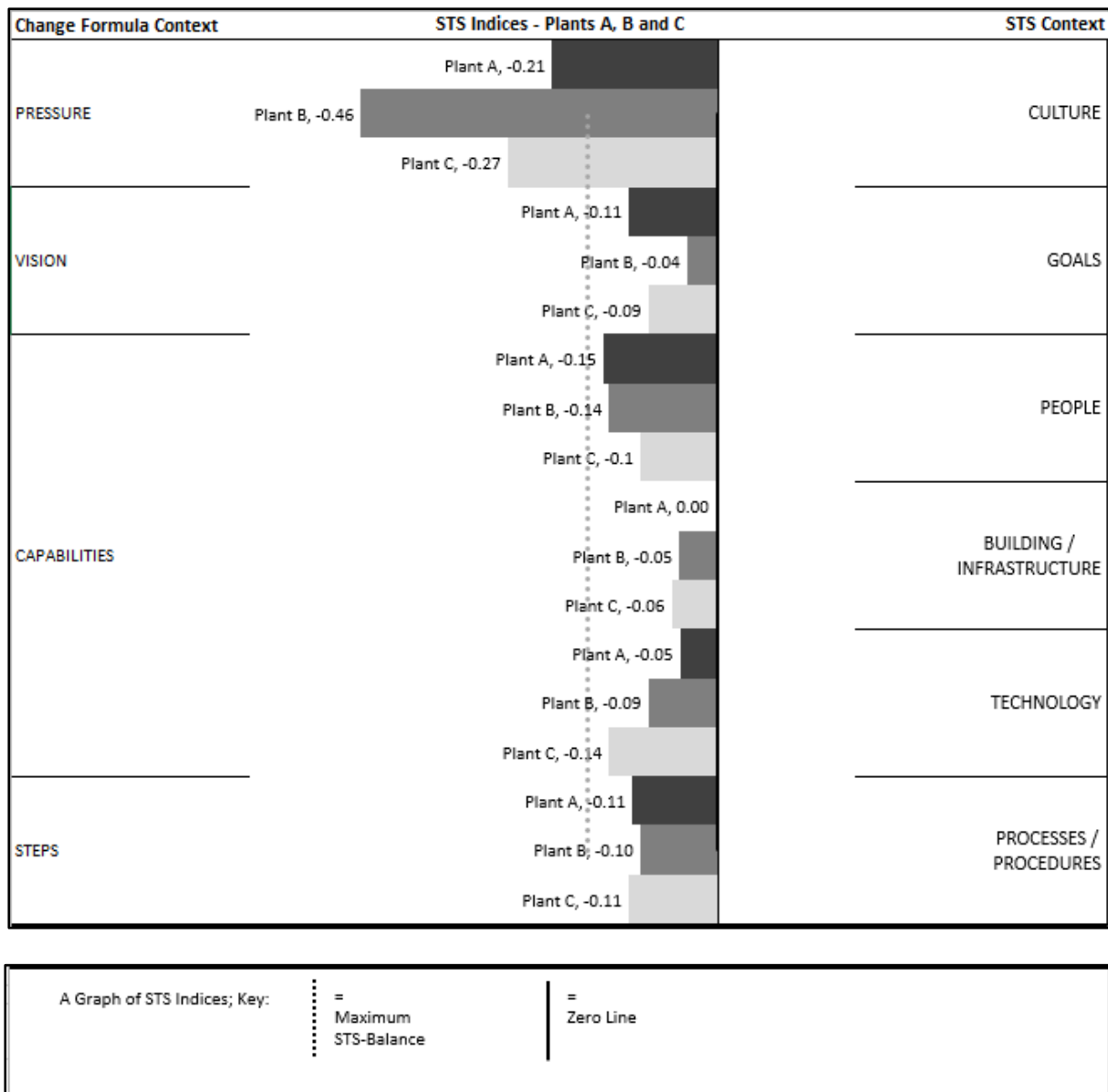


Figure 9d. Cross-plant analysis of Socio Technical Indices

This pecking order is reflected in the socio-technical indices (totals) for each plant, and would suggest that the survey is producing representative data when considering the qualitative remarks on the business-health for each plant. Plants A and C each have similar average indices profiles in places (particularly concerning culture) and each suffer with change implementation through stagnation. Plant B, however, is a plant in decline once again. The cultural index is significantly below those of plants A and C. It is noted that the indices remain negative; it is

suggested that this is likely due to human nature's response to a survey of this context (Argyris, 1985) who suggests that the data collection tool process itself will be seen as a force that is imposing productive dialogue, and will develop defensive routines from the staff. If these defensive routines are considered then the plethora of negative scores may not necessarily infer negative change readiness. The actual centre line for change readiness (i.e., the centreline threshold for positive or negative change readiness) may not be the zero line and instead be a negative-value. To this end, it is proposed that there is a baseline balance-index wherein change readiness can be assessed as adequate for large scale change; however, more surveys at organisations with differing levels of performance (such as high KPI performance) would be needed in order to define the numerical range for moderate change readiness.

Data Collection Tool Accuracy

Accuracy of the Tool – Plant A

Previous to the data collection, and for some time beforehand, the European Directors for the wider organization (representing multi-plant management at the executive level) had been considering options for increasing the subject-plant's throughput by installing a second core processing line; converting the subject plant from a single-line plant to a double-line plant. However, previous experience of installing a second line in plants with a similar starting-situation of apparent stability have proved problematic as the second line often brings an unforeseen and disproportionate amount of extra activity in terms of management, logistics, tooling, maintenance, training and quality control / assurance that ultimately have resulted in performance reductions in terms of both quality and delivery. As a result of these collective experiences, the executive management have held back from the decision to install a second line without prior intervention in the form of lean transformation in order to better prepare the

subject plant for significant change. These professional judgements by the executive team have thus been based on symptomatic experience with little empirical evidence to support the cause of apparently poor change-readiness. To this end, the analysis in Figure 9a would seem to support the notion that an apparently stable plant can still harbour change-readiness risk, and that culture (the invisible and non-physical) could be the determining factor. This would also support the emerging academic theory that the correct cultural conditions must be ensured before any improvement is commenced (Atkinson, 2010). In this particular case, the plant has adopted a culture that is sustaining current performance but also inhibiting its lines of enquiry and discovery, resulting in a cessation of subsequent growth, i.e., stagnation.

Accuracy of the Tool – Plant B

The new Plant Manager and Head Coach for the group consider profile, findings and recommendations accurately reflect the plant's issues. In particular, the Plant Manager observes and apparent lack of team problem solving and engagement with working procedures. The Head Coach considers that the middle and lower management endorse a blame culture at the plant, and that such is stifling collaboration and creativity; instead, production operators are circumventing working procedures that they consider impractical, but they do not engage in problem resolution as they consider nobody is listening. These activities create quality issues and Right-First-Time performance degradation. This, in turn, pressurizes the capacity of the facility and develops a cycle of destruction. This cycle creates a plethora of negative stories, which the STS data collection tool observed in abundance (reference Chapter 3 Annex Table A-1, A-2 and A-3). Employees, in general, do not feel appreciated or part of the solution to improvement. This is an unstable plant with a destructive culture and, according to the group's Head Coach, lacking the appropriate level of humility at key supervisory/management levels.

Accuracy of the Tool – Plant C

The site management all agreed that the results and profile accurately reflected the current position of the plant in terms of change-readiness strengths, weaknesses and issues (common themes). This is not a plant in fiscal difficulties, but a plant that is struggling to join the much-loved habits and rituals of its past, with the needs and direction of its future; new business processes are not gaining support from the employees and friction is generated – wasting resources needed to garner improvement and develop new products. The new owners are attempting to graft on their established improvement techniques without a transformational plan of care that would assist in changing the culture and be considerate of the people and extant beliefs in the outgoing process. As a result, the vision is not shared by all, and the employees are not considering themselves as involved in developing actions that support the goals of the ‘new’ organisation. This friction is adversely affecting a single KPI, and generating negative stories; feeding the emerging negative culture. This plant is enjoying a stable client base, but will need to address these issues in anticipation of competition.

Efficacy of the Tool in its Current Form

The tool is considered to have accurately identified the strengths and weaknesses of the plants up to that point in time, and done so rapidly using external researchers with no prior connection to the plant. Furthermore, the tool supports the notion that change readiness can be assessed and that this information may better inform management decision with respect to business process (lean) training and investment; ensuring that cultural conditions are prepared in advanced of such investment, and that new processes are thereafter given the best opportunity to sustain and develop value. The apparent ill-prepared nature (in terms of change-readiness) of these participating organisations would support the probability of high change failure; an already established notion (McKinsey, 2013).

The studies also indicate that culture represents one of the most significant barriers to lean implementation. It is not the intention to suggest that the common themes identified for addressing cultural improvement will repair the culture; however, it is suggested that the process of reviewing cultural concerns and the common themes within such would present an excellent opportunity to improve change-readiness and integrate this review into an improved Transformation Plan of Care (TPOC) process.

Improvements to the Benchmarking Process

It was noted that contributors immediately tended to report negative aspects of the organization/plant. In response to this, and to ensure a balanced set of data, presentations were made to all likely participants on how they could report on positive messages/aspects upon the 'Wall'. It is important to note that at no point during the initial introduction was it ever stated that only negative feedback was required; this was an immediate assumption by the contributing employees; supporting Argyris's (1985) research that such dialogue will often result in defensive routines. Comments regarding the culture can be quite diverse and obscure; whilst they mean something tangible to the contributor, then need more sense-checking. To this end, a supporting set of questions may be needed in order to inform survey contributions with respect to culture.

Impact of Culture

Hayes suggests that an organization's rules on how resources are obtained, grouped and used, together with the rules on how people are managed, rewarded and penalized both reflect the shared meanings and beliefs through which organizational members review and make sense of their experiences (Hayes, 2002). It is these beliefs that form the shared culture of the organization. Schein develops this further by explaining that the shared feelings of an

organization's members are contrived from assumptions and experiences that assist them in solving the problems of external adaptation and internal integration (Schein, 2010). Pardey's definition agrees on a fundamental level in that he considers that cultural norms are the set of social rules that guide the organization's behaviour; however, this is not to infer that a simple change in organizational rules always makes for simple change in organizational culture (Pardey, 2007). Atkinson goes on to articulate that the appropriate cultural conditions are essential for successful change implementation and sustainment (Atkinson, 2010), and that it is also arguably one of the hardest areas to get right when compared to more familiar and apparent areas such as technology and infrastructure (Repenning, 2001). This suggests that cultural conditions and change readiness are inextricably linked. The survey results all indicate that culture with the most negative response index. Considering that all subject plants are having varying problems with change implementation, the results suggest convergence with academic theory. The common themes within the cultural responses are group-psychodynamic in nature and would prove difficult to address without a technical-context as a medium for affected parties (i.e., leadership and management) to come together. The remaining socio-technical contexts within the survey (and the common theme identified from such) then provide the medium with which to apply interventions to support organizational development and wider learning (Senge, 2006). Improving the cultural STS indices through such should then improve the change aptitude of the organization whilst also improving the organizations wider change capabilities (People, Building & Infrastructure and/or Technology).

Identification of Common Socio-Technical Issues

The following shortfalls in socio-technical arrangements were identified across all plants; marked against the relevant socio-technical node.

- Plans, Processes and Procedures
 - Plant A. Some good practice being observed with a desire to use more local suppliers of minor goods/services, and a desire to simplify the procedures and audit documentation. The good practice specifically referred to the installation of a problem-solving hub on the Gemba for quick reaction quality control (problem solving). However, the information flow is considered to be inadequate and insufficient time is allocated to think about improvements as there is no official resource or cadence to problem-solving.
 - Plant B. Improvement plans are considered to be rushed or unsustainable with insufficient time being allocated for problem-solving. There is also a perception of poor communication / teamwork within and beyond sections/areas as nobody is specifically accountable for delivering any benefits from the improvement system. Operational description sheets (working procedures) are felt to be inadequate and/or unrealistic.
 - Plant C. The bespoke CI systems (lean variant) from the corporate owners are not grafting onto the extant organization. This has replaced a high-performance team-based approach that the Gemba understood and appreciated. There is doubt about the suitability of the new corporate systems, and concern that projects are not being started or finished properly. The Gemba does not feel ownership of the system or any of the goals / undertakings within or by the system.

A lack of commitment to structured problem solving (or any particular improvement system) may indicate that there is insufficient vision for what is trying to be achieved; perhaps the organisations may benefit from developing a business case for improvement strategies. Through such, their benefits or disbenefits could be reviewed against the business case in order to check the project is meeting requirements. Ultimately, the senior leadership would own this

business case. A system must be agreed and checked against the benefits. In order for any system to work it must be resourced with meeting routines for problem-solving, long with agreed workflow elevation for problems / issues and opportunities. With this extra accountability may come the need for improved financial remuneration or recognition; this should also be considered as part of any business case for an improvement system.

- Goals
 - Plant A. There is confusion over the plant's goals; what they are and what are their priorities. Some goals such as “no accidents” are felt to be unachievable, and that different departments do not share in the same goal. Plant metrics are not considered to be a Gemba goal-set.
 - Plant B. Right-First-Time (RFT) issues and a perceived lack of control of such has adversely affected goal alignment. The Gemba staff feel that quality metrics are not perceived as inherently for the plant employees to review, with data being reported late or not at all.
 - Plant C. There is confusion over how goals are developed, and this leads to doubt about the suitability of the goals. The Gemba feel that decisions are made without consulting responsible parties.

To avoid confusion over goals the company goals must be cascaded into departments with KPIs that are specific to an area's sphere of influence. KPIs needing Gemba cooperation to be agreed with the Gemba, and tracked accordingly. These KPIs must be steered by the business case for improvement and hence must be driven by senior leadership, but consulted / negotiated with the Gemba.

- People
 - Plant A. There are perceptions about a lack of time for CI and training, together with the resources to implement CI or the improvement ideas that are generated

from CI activities. Whilst there is a push for improvement, training is not available for problem-solving.

- Plant B. Lack of Job rotation, training, skills and time on task (or staff) are the most common themes. People are feeling over-worked to make up orders during what should be off-time. There is also a demand for training for wider skills and quality awareness in order to reduce defects from being passed onward.
- Plant C. Most common issues are a lack of training / information sharing, followed by a lack of career progression.

The Gemba seem to be pushing for the opportunity to develop improvements within their areas; they show a desire to learn new skills, champion improvement but do not have leadership support or encouragement beyond making a suggestion. These champions will need training with recognised skill certification, and guidance from local experts of the context that is needing to be improved (i.e., quality, safety or process-reliability contexts). The Gemba champions will need training that is specific to KPI monitoring / improvement through coaching practices to facilitate the local guides in better supporting Champions. Job rotation is important with job diversity, so an optimum team size with the ability to cross train could also be of benefit.

- Culture

- Plant A. There is an apathy developing about improvement and the importance of constructive feedback. It is running well-enough compared to its peers but ceased pushing for improvements. The attitude is one of sustainment, and the Gemba is confused about this position.
- Plant B. Lack of respect felt by shop-floor workers with accusations of a bullying / blame culture and insufficient support from salaried staff for shop floor issues. There is a blend of anger, frustration, anxiety and helplessness.

- Plant C. There seems to be a lack of encouragement and innovation; helplessness and frustration with people not feeling like they are listened to. It is felt that processes are not owned so nobody is held accountable for failure.

Leadership is seemingly poor at setting a vision, building alignment and championing execution; factors of transformational leadership. Perhaps having a feedback mechanism wherein leadership quality dispassionately measured will drive accountability and improvement. Similarly, so, the maturity of the Gemba team's socio-and-responsible dynamics also could benefit from measurement so that the vision for improved communication and prioritised improvement is shared.

- Infrastructure
 - Plant A. This plant has invested in technology to improve quality control and has a rich source of spare capacity (space) within which to develop comfortable working environments that are well-suited. The installation of Gemba-based operations hub and information centres for quick reaction quality control has been well received.
 - Plant B. There is insufficient space, or superfluous materiel taking up space – the packing area is too small. This leaves no space for problem solving. The building is also leaking.
 - Plant C. There is insufficient space for operational cells, some of which are left incomplete. The cause of this was put down to insufficient investment, but also incomplete cell-changes leading to otherwise available space being wasted.

Space for problem solving is an enabler. Environmental standards are an essential enabler to not only influencing the observer's opinions of the behaviours within the environment, but also for providing a facility for safe-space critical thinking, demonstrate issue ownership, showcase success and workflow elevation.

- Technology
 - Plant A. The plant is supporting and using new information systems; however, the technical support for such could be improved. There is a concern that this information technology will suffer the same issues as the manufacturing technology wherein the improvement ideas and repairs cannot be realised in a timely manner due to poor formal training and resource availability (time).
 - Plant B. A wide variety of improvement ideas provided for evaluation including: access to quality documentation; husbandry improvements; logistical improvements; and line balancing improvements. The plant has the capability to experiment, but needs to consider if it has the courage or capacity to do so. There is a lack of problem-solving tools / facilities at the Gemba.
 - Plant C. There is a shortage of the right software and hardware, plus materials. It is felt that the corporate tools do not fit the business or Gemba needs, which leads to planning issues and task failure.

There is a case for low-tech problem solving that focus on the business needs (from cascaded goals). This problem-solving solving must be driven by or with the Gemba; hence problem-solving techniques, tools and templates for simple-problem-solving need to be readily available at the Gemba.

Data to Inform the Next Chapter – Selecting Theories and Practices for Synthesis

Whilst the development of a data collection tool is interesting, and certainly relevant to the systematic review in Chapter 2, the aim of this research remains as the pursuit of mechanisms for rapid organizational culture change to support lean and CI. The data within the Chapter has indicated a gap in common socio-technical arrangements when considering change

readiness for Lean and CI. The explicit barriers identified from the new data are summarised as follows:

- A lack of commitment to structured problem solving is observed. Improved financial remuneration or recognition is also needed.
- There is confusion over the company goals at the Gemba, and the priorities that need to be applied. Company goals must be cascaded into departments with KPIs that are specific to an area's sphere of influence.
- The Gemba pushing for the opportunity to develop improvements and learn new problem-solving and operational skills, but do not have leadership support or encouragement. The Gemba see job rotation as important, along with job diversity, to enhancing wider skills and problem-solving opportunities; however, but is challenging to achieve as opportunity is sparse and skill development/mastery is challenging.
- It is claimed that there is no constructive feedback mechanism exists for Gemba staff to voice the issue. These manifest as feelings of frustration and helplessness at the Gemba. Furthermore, untidy or unfinished areas that are too small for problem solving result in feelings of apathy.
- Insufficient space for problem solving with areas left untidy or unfinished.
- There is a lack of problem-solving skills and techniques, reinforced by a lack of tools and support for creating and sustaining the access and exploitation of information (digital or paper-based) that the tools may exploit.

Using the socio-technical framework from Chapter 1, the above points can be matched against their socio-technical contexts as indicated in the following table.

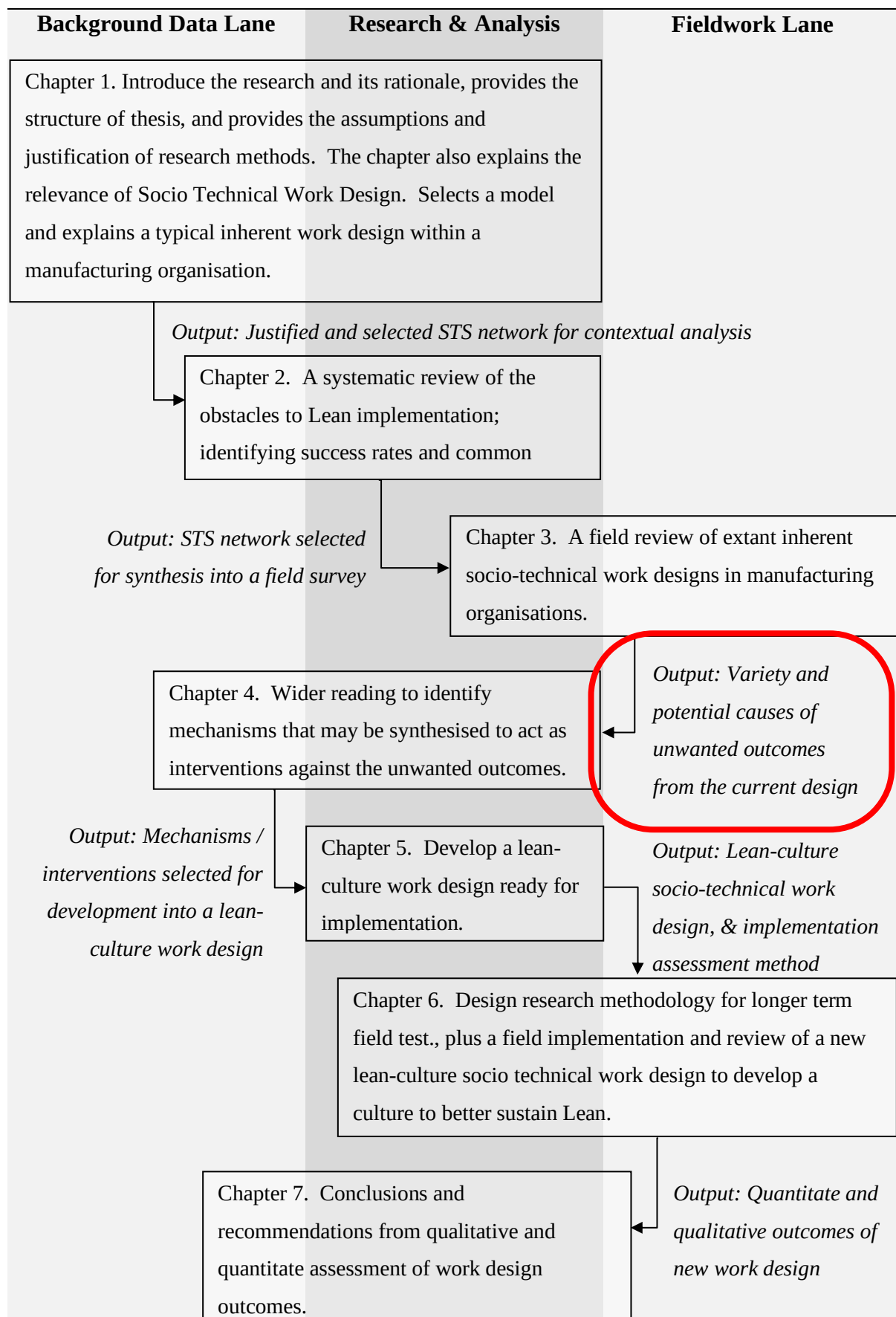
Table 18. Fieldwork Data to be taken into Chapter 4

STS Context	Fieldwork Observations (F)
Policy / Process	• F1. There is a lack of time given over to improvement, and a lack of rewards and recognition.
Goals	• F2. There is confusion over the goals
People	• F3. Job rotation can be challenging, with a high training requirement
Culture	• F4. There are feelings of frustration and helplessness at the Gemba. • F5. Untidy or unfinished areas that are too small for problem solving result in feelings of apathy.
Infra.	• F6. There is a lack of space. • F7. Areas are left unfinished and untidy.
Tech.	• F8. There is a lack of problem-solving skills and techniques

The above points are relevant as they inform what responses need to be sought to fill the gap as part of a lean-culture work design that has a specific purpose to develop the required organizational culture change. An academic review is now needed to identify the relevant wider scientific theories that could be used to fill the gap in the socio-technical design and become part of a new lean-culture design that will then need to be tested for impact.

For reference, the thesis flow diagram is repeated in Figure 10 in order to inform the reader how the outputs from the surveys of these inherent work designs can be used.

Figure 10. Thesis Flow Diagram – ‘You Are Here’



CHAPTER 4 – THEORIES FOR INCLUSION IN A LEAN-CULTURE DESIGN

Relevant theories for development and inclusion within a lean-culture socio-technical work design that could represent a schema / mechanism for rapid cultural change to support lean or continuous improvement

Summary

This document presents and reviews wider theories for relevance as part of inclusion into the development of a lean-culture socio-technical work design to measure and improve organisational culture to support Lean and Continuous Improvement (CI). The theories are reviewed against the common issues from previous field work and then either de-selected or selected into a new design that will be complimented with implementation instructions for application at Chapter 5. The work design will be tested through a collaborative link with a multi-national manufacturing organization supplying the worldwide automotive sector undergoing large-scale change through the implementation of a manufacturing excellence CI philosophy.

Background

The fundamental theory to this research is that lean implementation (or a large scale CI philosophy) requires appropriate cultural conditions (change-aptitude) in order to develop and sustain, and meet business case expectations (Achanga, et al., 2006) (Atkinson, 2010) (Benton & Shin, 1998). This research proposes a framework with which to establish a new work design that indirectly develops the appropriate culture and measures key cultural conditions. The overall output of this effort should be observable through improved CI implementation. Lean

and CI entail considerable change within an organisation to be effective. Preparing the organisation for this change is viewed as a cultural requirement; hence the implied requirement for culture change toward a lean culture (the same could said for a safety culture).

Preliminary fieldwork has been conducted at various manufacturing plants in order to identify key issues to change by using a socio-technical framework. The plants have since commenced the implementation of a corporate CI philosophy akin to lean. The philosophy is in the form of a manufacturing excellence system that seeks to develop competitive advantage through the implementation of a multi-level set of practices (deliverable outputs), the purpose of which is to reduce operational waste (through improvements in CI, quality and delivery) and corporate risk / exposure (through improvements in operational, environmental and safety practices). The company views the development and installation of the new socio-technical work design as an opportunity to generate further improvement by incorporating the work designing into their CI philosophy (the manufacturing excellence system). This work-design is hence required to develop high-performance through improved team-work and collaboration. The aim of this chapter is to hence identify and select the relevant theories and build such into a new work-design, for implementation as part of the manufacturing excellence system, using and merging the barriers and interventions identified from Chapters 2 and 3. These barriers and interventions were identified as follow.

Barriers and Interventions identified from Chapter 2.

- Most frequently occurring barriers:
 1. Culture unsuited to lean
 10. Lack of Lean/CI Knowledge
 11. Lack of Leadership Skills / Direction

12. Lack of Non-Human Resources including Finance – i.e., space, equipment and technology
 13. Lack of Non-Human Resources including Finance – i.e., rewards and recognition
- Most frequently occurring interventions:
 7. Training Provided with linkage to purpose
 8. Reward Schemes
 9. Management (Non-Executive) involved and in support

Barriers to be addressed by the Plant Data Collection from Chapter 3.

- Common barriers:
 - There is a lack of time given over to improvement, and a lack of rewards and recognition.
 - There is confusion over the goals
 - Job rotation can be challenging, with a high training requirement
 - There are feelings of frustration and helplessness at the Gemba.
 - Untidy or unfinished areas that are too small for problem solving result in feelings of apathy.
 - There is a lack of space.
 - Areas are left unfinished and untidy.
 - There is a lack of problem-solving skills and techniques

Combination and Allocation to Socio-Technical Context

Before wider scientific theories can be identified, the barriers and interventions identified within the conclusions of Chapters 2 and 3 must first be allocated to their socio-technical context in order to support the literature search for wider scientific theories and practices for

synthesis into a new lean-change socio-technical work design. Any barriers (B) that do not already have such will need an intervention (I) proposed in order to help identify any relevant scientific theory for the application of such (as a minimum) within the lean-culture socio technical work design. The fieldwork data (F) from Chapter 3 can then be used to either cross check / reinforce the barrier or intervention from Chapter 2. The allocated barriers, interventions and fieldwork data are thus combined, allocated to their socio-technical context, and presented in Table 19.

Notes for Further Literature Searches

Once the barriers and interventions are allocated into their socio-technical context within a single (tabular) row, then they can be reviewed for commonality and the simplest theme selected for either:

- a. transposing straight into a lean-culture work design; or,
- b. development into a simpler term of wider literary search in order to identify relevant theories that may offer an improved intervention design or response.

The 'Notes' column in Table 17 indicates which of the above has been decided, along with the simplified search term that has been selected (where relevant).

Table 19 – Barriers, Interventions, Fieldwork Observations and Further Search Notes

STS Context	Barriers (B) from Chapter 2	Interventions (I) from Chapter 2	Fieldwork Data (F) from Chapter 3	Notes for Further Literature Searches
Plans / Policy / Processes	• B1. Change Approach to Philosophy – wrong approach selected – resistance to change. • B2. Low rewards and recognition. • B3. A lack of commitment to structured problem solving.	• I1. Policy change driven by a local business case for improvement. • I2. Local Rewards and Recognition policy to be established • I3. Fixed meetings (time resource) with Gemba & management commitment.	• F1. There is a lack of time given over to improvement, and a lack of rewards and remuneration policy.	The theme across the columns is mostly about resistance, reward, and commitment. With this in view the predominant search term being taken forward and combined with the socio-technical node of policy, processes and procedures is: • Motivational mechanisms a part of business process, policy or plans.

Table 19 continued – Barriers, Interventions, Fieldwork Observations and Further Search Notes

STS Context	Barriers (B) from Chapter 2	Interventions (I) from Chapter 2	Fieldwork Data (F) from Chapter 3	Notes for Further Literature Searches
Goals	• B4. Lack of Leadership Skills / Direction. • B5. Company goals not cascaded with KPIs specific area of influence.	• I4. Training to establish a vision • I5. Goals fractally cascaded and measured / monitored on a scorecard	• F2. There is confusion over the goals	The themes across the columns seem to coalesce around aligning goals. The small aspect of leadership skill shortfall will be addressed under culture as part of the lack of leadership vision barrier. To this end the search term being taken forward will be: • Goal alignment in the workplace.

Table 19 continued – Barriers, Interventions, Fieldwork Observations and Further Search Notes

STS Context	Barriers (B) from Chapter 2	Interventions (I) from Chapter 2	Fieldwork Data (F) from Chapter 3	Notes for Further Literature Searches
People	• B6. Leadership not supporting Gemba-based problem-solving. • B7. Job rotation and diversity wanted.	• I6. Management roles explicitly defined and monitored. • I7. Inc. job certification and rotation	• F3. Job rotation can be challenging, with a high training requirement	The columns presented mixture of terms; however, when combined they inferred a lack of support/cohesion and/or team design, plus job enrichment and enlargement. Enrichment and enlargement can be included in the new lean work design (no search needed). So, the search term being taken forward will be: • High performing team design.

Table 19 continued – Barriers, Interventions, Fieldwork Observations and Further Search Notes

STS Context	Barriers (B) from Chapter 2	Interventions (I) from Chapter 2	Fieldwork Data (F) from Chapter 3	Notes for Further Literature Searches
Culture	• B8. No leadership vision with coercive or transactional leadership. • B9. No feedback for Gemba staff to raise leadership issues.	• I8. Training in appropriate leadership styles and coaching. • I9. Team maturity and transformational leadership reviewed.	• F4. There are feelings of frustration and helplessness at the Gemba. • F5. Untidy or unfinished areas that are too small for problem solving result in feelings of apathy.	A mixed bag of issues switching between workplace leadership quality and negative emotional responses to either insufficient change or the wrong change (but ineffective workplace or organisational development none-the-less). Terms taken forward: • Organisational development. • Workplace leadership.

Table 19 continued – Barriers, Interventions, Fieldwork Observations and Further Search Notes

STS Context	Barriers (B) from Chapter 2	Interventions (I) from Chapter 2	Fieldwork Data (F) from Chapter 3	Notes for Further Literature Searches
Infrastructure	• B10. Lack of equipment to access data. • B11. Insufficient space for problem solving.	• I10. Team area to include data access. • I11. Team area to provide the environment for problem solving.	• F6. There is a lack of space. • F7. Areas are left unfinished and untidy.	The data seemed quite comprehensive in that there is a requirement to include the need for space within the lean-change work design. It might be that the scientific justification for such a facility could be reinforced from suggested solutions as part of the wider searches for theories in response to the barriers pertaining to other STS Contexts.

Table 19 continued – Barriers, Interventions, Fieldwork Observations and Further Search Notes

STS Context	Barriers (B) from Chapter 2	Interventions (I) from Chapter 2	Fieldwork Data (F) from Chapter 3	Notes for Further Literature Searches
Technology	• B12. Lack of Lean/CI Knowledge • B13. A lack of problem-solving tools.	• I12. Provide PDCA² tools with training. • I.13. CI tool templates to be provided.	• F8. There is a lack of problem-solving skills and techniques	The data across the columns is reasonably consistent. Given the need for the work design to focus on the technology (techniques and tools) of lean rather than equipment, the terms taken forward were as follow: • Workplace improvement techniques / technology / tools. • Business improvement techniques / technology / tools.

² PDCA – Plan, Do, Check, Act – a cyclic approach to disciplined problem-solving.

A lean-culture design (see Figure 12) is now needed that expands on the inherent (priori design and assets) arrangements. The design and test of this work design contributes to the discourse regarding the wider applications of socio-technical work design. The following diagram represents the blank template into which the lean-culture arrangements will encapsulate the inherent arrangements within a manufacturing organisation.

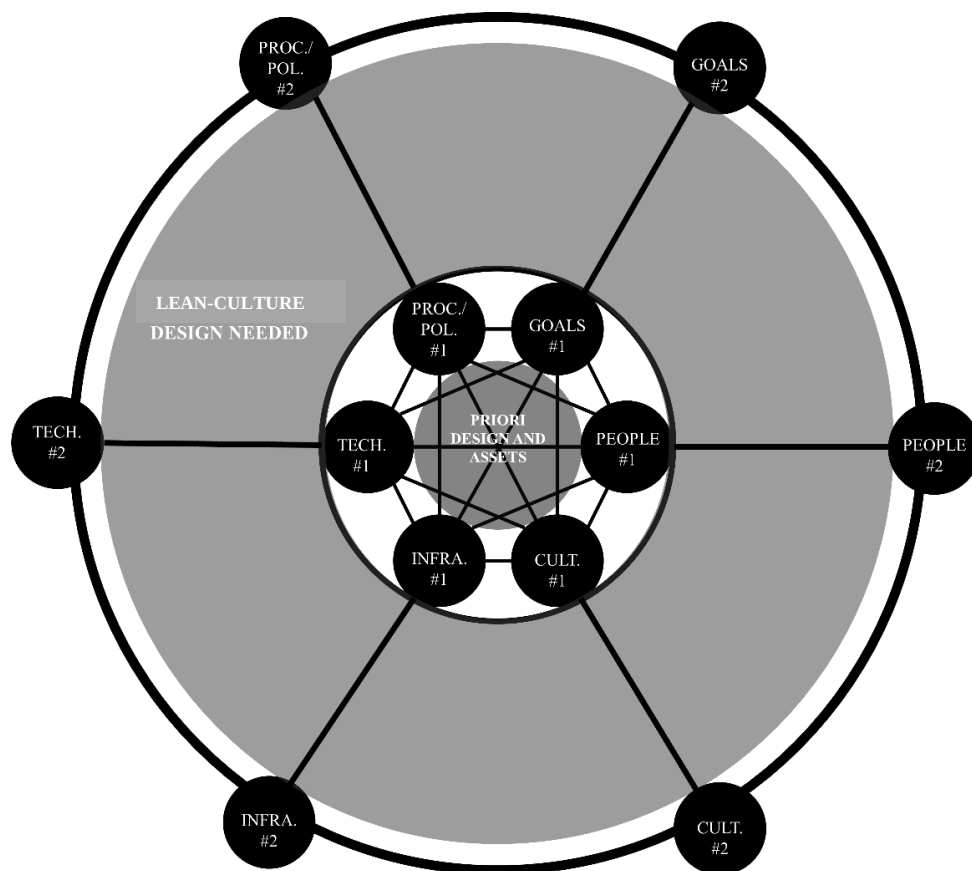


Figure 12 - Lean-culture Socio-Technical Design Template

The next step is to collate the barriers, interventions and data, and then match them up with a set of wider theories and practices that need to be reviewed for their suitability for inclusion and/or synthesis into a lean-culture socio technical work design.

Approach used to Identify Candidate Theories and Practices

University library resources for books and journal papers were examined using search terms derived from considering the socio-technical context, barrier and/or intervention description plus the data from the fieldwork (Table 19). The simpler search terms were lifted from Table 19, and the high-level findings that related to the details across each row within Table 19 were as follows:

- High performing team design. Practices and theories uncovered in this regard included:
 - Dunbar Team Number theory.
 - Dunbar numbers are optimum quantities of people with which humans can maintain a stable social relationship with. They offer an alternative consideration when designing teams in terms of their size.
 - Tuckman Team Maturity theory.
 - This theory identifies a five-stage development process that most teams follow to become high performing.
 - High Performance Teams.
 - The practices that high-performance teams use in order to develop significant business change within under one year.
- Motivational mechanisms a part of business process, policy or plans. Practices and theories uncovered in this regard included:
 - Herzberg Motivational theory.
 - Herzberg's Two Factor theory allocates aspects of employment into two groups: hygiene factors that must be satisfied less work dissatisfaction be created, and motivators factors that drive higher levels of satisfaction.
 - Learning/Goal Orientation theory.

- The learning orientation refers to a person's/individual's disposition towards their own development (i.e., whether or not they believe in their potential to learn) and how any achievement in that learning is validated.
- Sources of Influence.
 - The 6-sources of influence model states that three primary sources of behaviour (personal, social and structural) are equally spread between the 2 contexts of motivation and ability. The theory implies that if 4 or more sources of influence are applied as part of a change effort then the probability of the desired (targeted) behavioural change being sustained increases.
- Broken Windows theory.
 - The broken windows theory is a criminological theory that states that visible signs of civil disorder within an urban environment encourages further disorder.
- Goal alignment in the workplace. Practices and theories uncovered in this regard included:
 - Fractal Organisational theory.
 - This theory suggests that an emergent human approach to working relationships and operations mimics nature in its capacity for adaptation, and innovation in that when the conditions are suitable, the organisation grows from within using a same geometric (socio-technical) pattern.
 - Balance Scorecard
 - Balanced Scorecard model was developed in the early 1990's as an attempt to help firms measure business performance using both financial and non-financial data.
- Organisational Development. Practices and theories uncovered in this regard included:
 - Structural Conflict theory.

- This theory discusses the power of powerlessness. It infers that an inevitable part of growing up is a dominant acceptance that we may not fulfil all of our desires. The primary beliefs behind this are that we are either powerless and/or unworthy.
- Behavioural Control theories.
 - Following on from Structural Conflict, these theories help the research to better understand the 2 primary beliefs of Powerlessness and Unworthiness.
- Management Control (Power) theories.
 - These theories help in considering that two types of power arrangement predominantly exist within manufacturing:
 - i. Transformative – moral compliance through the use of symbolic rewards/rituals that build esteem and prestige to obtain a positive response;
 - ii. Coercive – alimentative compliance through the threat of sanctions / the removal of essential benefit / nourishment.

The theories provided insight of and how to change from Coercive to Transformative conditions.

- Workplace leadership. Practices and theories uncovered in this regard included:
 - Transformational Leadership theory.
 - Transformational leadership is a theory of leadership where a leader works with teams to identify needed change, create a vision to inspire and guide change, and execute the change in harmony with committed team members.
- Workplace improvement techniques / technology / tools; and, Business improvement techniques / technology / tools. Practices and theories uncovered in this regard included:

- Workplace Coaching practices.
 - Toyota Kata was identified as a valid and relevant coaching model within manufacturing.

Experienced colleagues within the continuous improvement directorate and improvement consultancy sector were also approached on an ad-hoc basis to sense check the researcher's thinking as candidate theories and practices became apparent. The following theories and practices were discovered through their recommendations and experience.

- Change Management theory.
 - The Kotter change model can be applied to most change requirements; it was hence suggested as having relevance to supporting the implementation of new work design.
- Problem Solving practices.
 - Common simple problem-solving techniques such as 5-Why's, Fishbone Diagrams, Problem Solving Decision Analysis (PSDA) have been recommended for inclusion into the new work design.

The following table 20 illustrates how the all barriers, interventions and field-work findings can be matched with potentially suitable theories and practices.

Table 20 – Barriers, Interventions & Data linked to Candidate Theory/Practice

Barriers - Chapter 2	Interventions - Chapter 2	Data from Chapter 3	Theory/ Practice	Actors – Chap' 2
B7 – a lack of job rotation and job diversity	I3 – change improvement routines from as/when daily	F1/3 – no time for improvement plus job rotation and diversity	High Performance Teams (HPT) Practices	Gemba, Managers & Leadership
B1 – a change in philosophy is needed – the wrong approach is selected	I5 – goals fractally cascaded and measured on a scorecard	F2 – need clarity of goals and targets	Fractal Organisational Theory	Gemba, Managers & Leadership
	I1 – develop local business case for improvement		Balanced Scored Practices	
B5 – goals not cascaded	I7 – training provided linked to purpose / goals / targets		Sources of Influence Theory	Gemba & Managers
B9/10/11 – a lack of non-human resource (technology & infrastructure inc. feedback mechanisms)	I8 – job rotation, certification and training			
B1 – resistance to change		F6/7/5 – a lack of space & untidy/ unfinished areas create apathy	Broken Windows Theory	Gemba
<i>To be continued</i>				

Table 20 cont'd – Barriers, Interventions & Data linked to Candidate Theory/Practice

Barriers - Chapter 2	Interventions - Chapter 2	Data from Chapter 3	Theory/ Practice	Actors – Chap' 2
↓ B1 – resistance to change continued			Change Management Theory	Leadership & Managers
B6/13 – a lack of teamwork in problem solving	I3/8 – coaching provided as well as coach-training		Coaching Practices	Managers
B4 – a lack of leadership skill			Management Control Theory	Leadership & Managers
		F3 – job rotation & training can be challenging	Learning Orientation	Gemba
	I4/8 – leadership training to help establish a vision		Trans-formational Leadership Theory & Practices	Leadership & Managers
B8 – a lack of vision			Behavioural Control Theory	Gemba
		F4 – there can be feelings of frustration, helplessness and anger at the Gemba	Structural Conflict Theory	Gemba
B9 – a lack of teamwork			Goal Orientation Theory	Gemba & Managers
To be continued ↓				

Table 20 cont'd – Barriers, Interventions & Data linked to Candidate Theory/Practice

Barriers - Chapter 2	Interventions - Chapter 2	Data from Chapter 3	Theory/ Practice	Actors – Chap' 2
↓ B9 – a lack of teamwork	I9/6 – both management and Gemba roles within improvement need to be defined, monitored plus team maturity measured on a scorecard		Dunbar Team Number Theory	Gemba
			Tuckman Team Maturity Theory	Gemba & Managers
B3/13/12 – a lack of problem-solving skills		F8 – there can be a lack of improvement technique skill	Problem Solving Practices	Gemba & Managers
B2 – a lack rewards and recognition	I2 – scheme established for rewards and recognition	F1 –a lack of reward and remuneration policy	Herzberg Motivational Theory	Gemba

Criteria for Selection of Relevant Theories for Synthesis into the Lean-culture Work Design

The array of wider theories can next be selected, explained and reviewed against the barriers, interventions and identified from Chapters 2 and 3 in more detail. The ease of synthesis into a new work design, and the familiarity/comprehensiveness to senior leadership can also contribute as criteria. Each criterion has a yes/no assessment; the theory should score at $\frac{3}{4}$ (75% or 3 out of every 4 criteria at 'Yes') or above in order to be considered for inclusion and synthesis into the lean-culture work design. The justification for this threshold is based upon the assumption that each of the 4 criteria are equally weighted (for the sake of simplicity), and hence a 75% threshold would represent a majority consensus. Table 21 below describes the criteria.

Table 21 - Barriers and Interventions

Criterion from Chapters 1,2, and 3	Description of Criterion
Relevance to Barriers (B) and/or Data (F)	The theory should ideally provide a response to identified barriers and/or the data from Chapters 2 and 3. This should mitigate the negative effect the barrier may have to the likelihood of the new work design being effective.
Relevance to Interventions (I)	The theory should ideally provide an opportunity to become part of or underpin an intervention identified as enablers to success from the knowledge gained within Chapter 2. This will improve the likelihood of the new work design being effective.
Ease of Synthesis to a lean-culture model	The theories need to be sufficiently developed to a point where they can be relatively easily synthesised without excessive complexity, and without dedicated expert/specialist support, when it comes to their application.
Familiarity / Comprehensiveness to Senior Leaders	The research exists within a political environment, in so much as it needs to meet with executive approval. This is more likely if the design is comprehensive with familiar features / theories underpinning or integrated into the design.

Relevant Theories and Practices for Synthesis into the Lean-Culture Work Design

High Performance Teams (HPT)

This practice has been identified for its potential to address the following barriers and field-data:

- B1 – a change in philosophy is needed – the wrong approach is selected and there is resistance to change. HPT can be fitted into organisational change strategy (Hanlan, 2000), but the effort to develop and sustain them would be extraordinary, and represent a change in approach and philosophy.
- B7 – a lack of job rotation and job diversity. Whilst HPT members are usually selected for the individual skills, as change gathers pace the members are sometimes required to develop cross-skills with other members (Hanlan, 2000).
- F1/3 – no time for improvement plus job rotation and diversity. HPT demands resources in terms of time for HPT routines.

This practice has been identified for its potential to provide the following interventions:

- I3 – change improvement routines from as/when daily. HPTs implement fluid high-quantity changes in order to meet new business targets. These are developed from daily/weekly routines and not periodic or gated project meeting routines for step changes.

First described in detail by the Tavistock Institute in the 1950s (Tavistock Consulting, n.d.), the concept of HPT is defined by Katzenbach as “*a concept within organization development referring to teams, organizations, or virtual groups that are highly focused on their goals and that achieve superior business results*” (Katzenbach & Smith, 2015). The implementations presented by Hanlan (2000) indicated that the teams are assembled and provided resources with which to generate targeted and significant improvement or business change within one year.

The teams are provided with the resources in terms of time, data and technology (tools and techniques) in order to identify and solve problems, or generate opportunities, that either prevent the business from improving, or enable the change / improvement. The change is often fluid as the improvement may require multiple cycles of problems solving and business change; the performance upgrade is not as a result of a project, but instead created through daily/weekly improvements akin to Kaizen. A facilitator is required to create and administer the HPT, as well as prepare the team. The success of the HPT relies on organisational support from leadership in order to ensure resources in terms of time, materiel and skill (socio-technical resources) are provided in a timely manner. The inclusion / exclusion assessment is given at table 22.

Table 22 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B1 – a change in philosophy is needed – the wrong approach is selected. HPT can be fitted into organisational change strategy, but the effort to develop and sustain them would be extraordinary, and represent a change in approach and philosophy. B7 – a lack of job rotation and job diversity. Whilst HPT members are usually selected for the individual skills, as change gathers pace the members are often required to develop cross-skills with other members. F1/3 – no time for improvement plus job rotation and diversity. HPT demands resources in terms of time for HPT routines.	Yes
Relevance to Interventions (I)	I3 – change improvement routines from as/when daily. HPTs implement fluid high-quantity changes in order to meet new business targets. These are developed from daily/weekly routines and not periodic or gated project meeting routines for step changes.	Yes
Ease of Synthesis to a lean-culture model	The key features of the HPT suggested by Hanlan (2000) seem well suited to being aligned within a socio-technical work design.	Yes
Familiarity / Comprehensiveness to Senior Leaders	Whilst they may not be as familiar with the work-design for HPT, senior leadership will be familiar with the phrase HPT and the branding associated with it.	Yes
Overall Inclusion / Exclusions Decision:		Included

Learning Orientation

This theory has been identified for its potential to address the following barriers and field-data:

- B4 – a lack of leadership skill. To learn any skill deeply requires a mindset for mastery and the ability to experience negative feedback and use such as an opportunity to learn whilst avoiding defensive routines (Dweck, 2012).
- F3 – job rotation & training can be challenging. Interventions such as: job certification and recognition of skill; and future skill possibilities shared/broadcast through job rotation apply here as they provide the members opportunity to broaden their learning and experiences.

The learning orientation refers to a person's/individual's disposition towards their own development (i.e., whether or not they believe in their potential to learn) and how any achievement in that learning is validated (VandeWalle, 1997). The learning orientation mindset predominantly takes one of two forms; goal orientated or performance/growth orientated. Adults with a growth mindset believe that intelligence and abilities can be developed through effort, persistence, trying different strategies and learning from mistakes. In such cases the learning journey is more important to the individual than the end result (i.e., the qualification or goal). Such individuals will not fear a challenge that infers complexity with a high chance of not achieving the goal as the learning journey is of primary importance. Adults with a performance orientated mindset see the target or the qualification as the goal, and can sometimes avoid more complex learning challenges if there is a higher possibility of not achieving the goal.

Schein (2010) emphasizes that education is a method of achieving culture change. This can be from the introduction of new technology (next generation equipment for communication, production processes etc.), or through developing the social-expertise amongst its members;

each requires a shift in an organization's ability to learn (Senge, 2006). In order to remain competitive, learning is an essential trait for a successful organization's culture (Edmondson, 2008), and to this end knowledge and ability are of little value unless the owners/holders of such resources are motivated to apply their knowledge and continue to develop such (Chadwick & Raver, 2012). The motivational theory that is particularly relevant to the domain of organizational learning is Achievement Goal Theory (Dweck, 1986), (C Dweck, 1988), which develops at the individual level and is then disseminated within and between groups, up to an organizational level (Chadwick & Raver, 2012), (Kozlowski, 2001). From the varieties of goal orientation, two dominant orientations from competing models appear suitably robust and opposite in nature: Learning Goal Orientation (LGO), demonstrating mastery orientation behaviours with effective task strategy, high initiation and persistence of effort; and Performance Avoid Goal Orientation (PAGO), demonstrating helplessness behaviours with low initiation, low persistence of effort and both risk/challenge avoidance (VandeWalle, 1997). For the lean-culture work design, a structure of qualifications may be beneficial wherein selected champions from the Gemba undertake specialist work-design training and tasks that, once completed, qualify them for a further bespoke skill (a Champion skill). As part of this training could be a measure of on-the-job monitoring that may need to be supported by a subject matter expert too as a guide and coach the Gemba employee to mastery.

In this study's context, a performance orientation implies that the organization's members on average try to avoid the challenging tasks that could lead to negative judgments or expose a lack of competence; it infers a high fear of failure, and causes a lack of the innovation that is needed for improvement. In this study's context, a learning orientation implies that the organization's members on average desire to develop themselves by acquiring new skills, mastering new situations and improving their competence; accordingly, they are less concerned with making mistakes and actively seek feedback to develop.

A neutral indicator implies that staff are, on average, equally likely to avoid challenging tasks (performance orientation) or seek such to develop themselves (learning orientation). It should be noted that, in such cases, the research indicates that the performance orientation usually spreads more easily than the learning orientation (Dweck, 2017). The work design will need to incorporate some sort of measure for team performance (maturity). Questions pertaining to problem solving, effectiveness and ownership could report issues and demonstrate improvement / mastery. This will need to be combined with some sort of training for any Gemba staff taking such ownership (champions). The inclusion / exclusion assessment is given at table 23.

Table 23 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B4 – a lack of leadership skill. To learn any skill deeply requires a mindset for mastery and the ability to experience negative feedback and use such as an opportunity to learn whilst avoiding defensive routines.	Yes
Relevance to Interventions (I)	F3 – job rotation & training can be challenging. Interventions such as: job certification and recognition of skill; and future skill possibilities shared/broadcast through job rotation apply here as they provide the members opportunity to broaden their learning and experiences.	Yes
Ease of Synthesis to a lean-culture model	A questionnaire or set of questions in a pre-existing team survey, could be easily synthesised using existing literature. It may be unlikely that the orientation assessments for individuals would be used, but the principles of job certification, rotation and enlargement could certainly be applied.	Yes
Familiarity / Comprehensiveness to Senior Leaders	This theory rests predominantly within the educational sector with some transfer into the context of organisational development. Most operations directors would arguably not be familiar with it.	No
Overall Inclusion / Exclusions Decision:		Included

Structural Conflict

This theory has been identified for its potential to address the following barriers and field-data:

- F4 – there can be feelings of frustration, helplessness and anger at the Gemba. From a technical perspective, the relevance here would be linked to the need for Gemba-based problem solving, scorecard KPIs and from the social perspective the ideal states of teamwork and leadership could apply; all working toward an overall vision.

Fundamental to this theory is that individuals collect primary beliefs from childhood that are generalised as adulthood is reached (Senge, 2006). The Primary beliefs are:

- Powerlessness; the more common of the two beliefs and symbolizes an inability to bring into reality the goals that are important to the individual.
- Unworthiness; the less common of the two beliefs and symbolizes the individual's belief that they do not deserve to achieve the goal.

Acting in the opposite direction to the primary belief is the creative tension developed as incremental steps are made toward achieving a vision (moving toward a goal/target). The Primary beliefs constantly pull individuals away from achieving the vision (as illustrated in Figure 13).

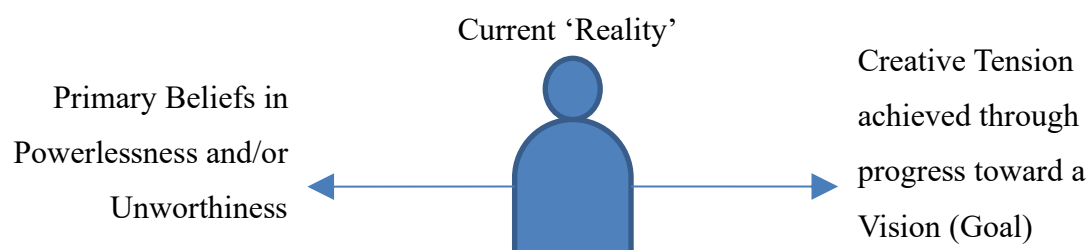


Figure 13. An Illustration of the Mechanism that is Structural Conflict

The primary beliefs work contrary to the creative tension; the closer the individual gets to reach the vision, the stronger the pull from the primary beliefs. This mechanism is known as structural conflict. This manifests in a number of ways such as: a loss of energy; questioning the validity of the vision; questioning the desire to reach such; and/or more readily identifying obstacles to the vision. Whilst the awareness of such can assist in reducing the effect of such, there are three common approaches to overcoming structural conflict that do not require an awareness of the dynamic:

- Vision erosion; overwhelmed by helplessness, visions and goals are changed into something that is easier to obtain / more achievable.
- Conflict manipulation; artificial conflicts are developed that pull focus away from the vision (creating anti-visions), toward the consequences of not achieving such. This relies on fear and develops constant anxiety. The emotional anxiety of the organization can eventually be glorified, with achievements then adding the anxiety through a fear of losing what has been obtained.
- Will-power; motivation through heightened volition and common in successful people with little regard to the cost of success (little economy of means). Individuals invested in this strategy may become addicted to new challenges with often unintended social consequences such as poor team morale and damaged personal relationships.

Whilst the aforementioned coping strategies can produce effective results to satisfy the ‘self’, they fall short in terms of efficacy (achievement) and/or efficiency (success at any price). Furthermore, none of the strategies address the underlying issue; the reduction of primary beliefs and altering the underlying system of structural conflict. The theory suggests that it is only through the pursuit of truth and fact from data, and avoiding conjecture, that the underlying systems of structural conflict can be addressed. In work design terms, this infers that the problem-solving techniques need to have integrity/honesty, and that failure is an option

as part of experimentation. A scorecard or other visual method of demonstrating progress toward and achievable (agreed) goal would develop the creative tension needed to generate the progress (success breeding success). Furthermore, any success would need to be very visible, and so a physical area (process and infrastructure) may be required to present the progress.

It is argued that organizational culture is constituted by and constitutive of the souls participating in everyday life within the organization (Prior, 2004). Within this domain, it is argued that language and text associated with power will shape how we view the world. Through identifying coercive or transformative arrangements, it is proposed that the cultural assessment of an organization needs to consider how power is employed. Central to coercion is the structural conflict mechanism of conflict manipulation; using fear of negative consequences should the vision not be achieved. This will result in anxiety from the staff feeling coerced, or calmness/appeasement from the staff operating under a normative structure. This will be particularly pertinent to perceptions regarding the vision of what is to be achieved and the plans/processes/procedures. To utilise this theory could mean trying to find a way to survey the which of the following feelings about their work from is predominant within the employees:

- Anxious – in terms of structural conflict: using conflict manipulation to create anti-visions that motivate the staff toward the real vision. Conflict manipulation is said to occur when the consequence of action or inaction are represented as something to generate negative emotional responses.
- Disagree/uninterested – in terms of structural conflict: using vision erosion to convert the vision to something that is considered more achievable. Vision erosion is said to occur when a person is overwhelmed by helplessness, so in response the vision of what is to be achieve (goals) is changed into something that is easier to obtain / more achievable

- Relaxed – truth is accepted and internalized
- Agreeable – content to seek truth and/or agrees with truth

Used in this context, a coercive power structure ultimately means that staff do not believe the organization's vision/plans; resulting in poor engagement/efficiency due to disagreement and anxiety. Used in this context, a transformative power structure represents harmony between organizational members and the organization's vision/plans; they are believed to be true and content to participate in the actions supporting such. A marginal response in this context will infer that staff feel neutral on average; there is equally enough harmony and dissonance to organizational vision and plans.

For the work design, this aspect may be better surveyed from the perspective of the Gemba, and how they receive their leadership. Alongside a survey pertaining to team maturity (within the team, a survey for leadership quality (to the team) may be beneficial. A survey that identified coercive behaviours could then be reviewed by a steering committee for consideration and adjustment. The inclusion / exclusion assessment is given at table 24.

Table 24 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	F4 – there can be feelings of frustration, helplessness and anger at the Gemba. From a technical perspective, the relevance here would be linked to the need for Gemba-based problem solving, scorecard KPIs and from the social perspective the ideal states of teamwork and leadership could apply; all working toward an overall vision.	Yes
Relevance to Interventions (I)	The theory does not link to identified interventions.	No
Ease of Synthesis to a lean-culture model	Whilst the correct adoption of lean tools and techniques is anchored in the pursuit of truth/fact toward a vision/preferred-condition (similar to Structural Conflict), it is largely concerned with technology as opposed to personal development. It could be argued that the mechanism is better replaced with facets of transformational leadership, coaching and a team/leadership assessment.	No
Familiarity / Comprehensiveness to Senior Leaders	Structural Conflict has been linked to the theories within Organisational Development (OD). However, the organisation does not have any OD-specific skills or mobilisation, so the theory is likely to be unfamiliar.	No
Overall Inclusion / Exclusions Decision:		Excluded

Behavioural Control

This theory has been identified for its potential to address the following barriers and field-data:

- F4 – there can be feelings of frustration, helplessness and anger at the Gemba. Poor cultural indicators from inherent existing designs infer a frustration at the Gemba, along with a lack of leadership skill.

Behaviours link to structural conflict, in which the 2 primary beliefs of powerlessness and unworthiness are the dominant forces for concern. Feelings of powerlessness are more commonly adopted, and the one the organization will likely espouse as it is akin to goal orientation in that it spreads across 3 levels of an organization (Gemba-level, middle-management level and higher management level). In terms of significant control losses, any survey would need to be concerned with those structural conflict mechanisms that either support or reduce the primary beliefs of powerlessness or unworthiness (helplessness). To this end, the following behaviours relating to helplessness (and its antonym of support) and the behaviours could be significant.

- Abandoned or helpless – in terms of Structural Conflict: letting one of the primary dominant beliefs take control.
- Angry - in terms of structural conflict: using will-power to overcome obstacles or seek new problems to demonstrate prowess OR demonstrate anger that the staffs view of what should be achieved isn't being realised.
- Supported – compelled to seeking (further) truth.
- Calm – not threatened by the truth or reacting through a defensive routine.

For the purposes of this research, a dominant indicator for unhelpful behaviours might imply that staff, on average, feel powerless to affect change, or identify that the resistance is so great that it demands excessive aggression. Either way, the truths (facts) needed to bring about

change are being ignored or not pursued efficiently. A dominant indicator for helpful behaviours might imply that the truths (facts) are pursued and accepted with minimal defensive routine; members, on average, feel encouraged to seek these truths (facts) and are supported whatever the results of such investigation. A neutral indication might imply that staff, on average, feel equally that truths (facts) are ignored and pursued; of primary concern would be the different impact that apparently ignoring certain facts can have on the differing STS contexts.

It may be too difficult to directly and accurately survey for the behavioural disposition of each person involved in the design. Instead, questions may be best inserted as some sort of team maturity assessment that can directly survey the level of involvement, dependence (upon supervisors and leaders) and supervisor behaviour that the team members experience.

It is widely accepted that the changes required for robust lean implementation require adjustments to routine behaviours and responses (Rother, 2010), (Liker, 2014) and that self-discipline in maintaining behavioural control is an essential part of re-building behavioural contexts that support change (Beer & Nohria, 2000). Whilst most texts offer guidance on lean behaviours, they do not necessarily address the issue of underlying psychological attitudes. Hayes proposes that altering behaviours and values/attitudes in parallel is more likely to secure success than addressing either individually (Hayes, 2002). To this end, and given the wealth of guidance on lean behaviours, the focus has been on the psychodynamic mechanisms associated with change management. Schein (1985) does not consider that culture as a whole cannot be changed, but that key elements such as behavioural norms can be. However, it is argued that successfully changing the behaviours and artefacts can then lead to a change in values/attitudes (Fang, 2005) provided the cognitive dissonance (representing resistance and reactance) can be overcome within the staff (Festinger, 1957). Kirmayer identifies dissonance, reactance, helplessness and emotional exacerbation as failures in behavioural control

(Kirmayer, 1990), and that these cognitive mechanisms of resistance (resistance in this case meaning to 'maintain a stand') can be caused/chosen and controlled/resolved through a blend of the self and others (working as the team). Furthermore, the following mechanisms, that will be either positively or negatively mediated and informed by the culture (Zeffane & McLoughlin, 2006), will produce separate symptoms that can be identified as part of an STS survey (not directly a requirement of this research) (Kirmayer, 1990):

- dissonance causes irritability;
- reactance leads to anger;
- exacerbation leads to anxiety; and,
- helplessness leads to depression.

With respect to the work design, there is likely benefit of ensuring that artefacts of success are on display for all to see and shared between teams on a regular basis, and possibly as part of new team development (so new teams may see the benefits that were hard won by existing teams). This displays and problem-solving tools would need some type of dedicated space/area or infrastructure in order to be widely presented for any person entering the work area. Furthermore, if the results of a team and/or leadership survey could be shared and displayed within that area, then the resolution could be formed through team actions and cooperation (a blend of the self and others). The inclusion / exclusion assessment is given at table 25.

Table 25 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	F4 – there can be feelings of frustration, helplessness and anger at the Gemba. Poor cultural indicators from inherent existing designs infer a frustration at the Gemba, along with a lack of leadership skill.	Yes
Relevance to Interventions (I)	Only in as much as leadership training is needed, otherwise not directly linked to any intervention.	No
Ease of Synthesis to a lean-culture model	This theory could arguably need specialist expert knowledge in order to synthesise and implement / monitor results and actions. Given its psychological mechanism, amateur activity could be argued as potentially harmful. In response to the opportunity for team cooperation to identify and address adverse behaviours, then this may be better integrated (at a very basic level) as part of the question framework within a team maturity or leadership assessment.	No
Familiarity / Comprehensiveness to Senior Leaders	This theory is unlikely to form part of much previous experiential or academic learning within the operations directorate.	No
Overall Inclusion / Exclusions Decision:		Excluded

Management Control (Power)

This theory has been identified for its potential to address the following barriers and field-data:

- B4 – a lack of leadership skill. Lack of leadership skills / direction inferred as a barrier; insights into this theory could increase awareness and help avoid inappropriate leadership styles being adopted.

Given the similarities in social contexts between the STS and Organisational Development (OD) theories (Beer & Nohria, 2000), contributing factors and emerging trends for cultural conditions within OD were reviewed. From this, the arrangements of how power is wielded/controlled within the organization (Sisaye, 2005) were identified as relevant in view of the Pfeffer's argument that the use of power is essential for change (Pfeffer, 1992). Two bases of Management Control System (MCS) and associated forms of compliance were identified (Etzioni, 1961), (A Etzioni, 1980) as relevant to the manufacturing environments within the scope of the research. These bases were as follow:

- transformative – moral compliance through the use of symbolic rewards/rituals that build esteem and prestige to obtain a positive response; and,
- coercive – alimentative compliance through the threat of sanctions / the removal of essential benefit / nourishment.

For this research, some sort of reward and recognition policy may be beneficial. The aim of this would be to recognise skill-achievement as well as performance improvements (achievement against targets). This could shift the emphasis from a coercive arrangement into a transformative arrangement by simultaneously having management recognise the achievement by being part of the rewarded employee's guidance and review processes, to be explicitly define as part of the work design. The inclusion / exclusion assessment is given at table 26.

Table 26 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B4 – a lack of leadership skill. Lack of leadership skills / direction inferred as a barrier; insights into this theory could increase awareness and help avoid inappropriate leadership styles being adopted.	Yes
Relevance to Interventions (I)	No explicit intervention that links to this theory. Setting a vision as part of transformational leadership is the closest remark, but arguably better addressed through transformational leadership training including the skills to set and build a vision.	No
Ease of Synthesis to a lean-culture model	Not simply assessed or evaluated. A light amount of synthesis could be implemented through some sort of arrangement where leadership / management employees coach and support (serve) the Gemba employees with specific activities or empowerment roles. This may be better reviewed for integration via any candidate-implementation theories pertaining to team design.	No
Familiarity / Comprehensiveness to Senior Leaders	May not be familiar with the theories.	No
Overall Inclusion / Exclusions Decision:		Excluded

Herzberg Factors

This theory has been identified for its potential to address the following barriers and field-data:

- B2 – a lack rewards and recognition. The lack of suitable rewards and recognition can adversely affect the hygiene conditions associated with the theory.

This practice has been identified for its potential to provide the following interventions:

- I2 – scheme established for rewards and recognition. It could be relatively simple to implement an array of low-cost rewards and recognition opportunities.

Herzberg's Two Factor theory extends beyond Maslow's theory by allocating aspects of employment into two groups: hygiene factors that must be satisfied less work dissatisfaction be created; and motivators that drive higher levels of satisfaction. The factors are indicated in Figure 14. The key point is to address the hygiene factors before the motivators can take full effect. The two are independent phenomena, and an increase in one (motivational factors) will not necessarily decrease dissatisfaction caused by poor hygiene factors (F Herzberg, 1959). The following table lists the hygiene and motivators accordingly.

HYGIENE FACTORS	MOTIVATORS
Base wage, salary	Achievement
Supervisor Quality	Recognition
Policies and Rules	Responsibility
Work conditions	The work itself
Co-worker relations	Advancement
Security	Personal Growth

Figure 14 – Herzberg's Two Factor Theory of Motivation

Of key focus here is the hygiene factors, and of note the base wage and salary. The hygiene factors represent a greater risk to the success of the work design. The plants targeted for implementation and test of the work design often reside within low-cost countries. In such cases the basic pay for factory work is often low, and this may drive a behavioural pattern of self-interest wherein the strategic priorities of the company (in terms of quality and efficiency) may not be easily shared as employee job security is constant due to the reliance for the work to be carried out within that particular geographic location. In contrast to this, employees within high cost countries are likely to be more aware of the risk to job security that low cost country manufacture (off-shoring) can present, and so job security is risked. Furthermore, employees in high-cost countries may enjoy the benefits of tighter legal employment regulation and unionisation.

The hygiene factors such as policies, conditions and relations are part of the scope for improvement by the work design and the CI system that the work design is aimed at supporting. However, neither job security or base-wages would necessarily be contexts that are open to change from the CI system. The work design needs to operate within both low and high-cost countries, and so a rewards and recognition policy may need to be linked to bonus payments or similar financial remuneration within low-cost countries. If such is needed then the business case for HPT implementation would need to be robust (i.e., the fiscal benefits would need to outweigh the fiscal disbenefits). Furthermore, the rewards policy for high-cost countries may need to employ more discrete, less costly but more thoughtful mechanisms of reward (such as a free breakfast, pizza for the team or gamified response such as a free spin on a prize wheel). The inclusion / exclusion assessment is given at table 27.

Table 27 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B2 – a lack rewards and recognition. The lack of suitable rewards and recognition can adversely affect the hygiene conditions associated with the theory.	Yes
Relevance to Interventions (I)	I2 – scheme established for rewards and recognition. It could be relatively simple to implement an array of low-cost rewards and recognition opportunities.	Yes
Ease of Synthesis to a lean-culture model	Rewards and recognition policy arrangements should be included as part of the work design. Supervisor quality should also be assessed as part of a leadership assessment.	Yes
Familiarity / Comprehensiveness to Senior Leaders	The operations directors may arguably have encountered this theory as part of conventional lean or management training.	Yes
Overall Inclusion / Exclusions Decision:		Included

Tuckman Team Maturity

This theory has been identified for its potential to address the following barriers and field-data:

- B9 – a lack of teamwork. The theory can help team members understand the efficacy of cooperation between each other. If a questionnaire could be structured so that facets of teamwork could be individually assessed, potentially making it more logically to address teamwork shortfalls on an item-by-item basis.
- F8 – there can be a lack of improvement technique skill. This theory could improve awareness of team performance, and through this address the lack of commitment to structured problem solving and Gemba based problem solving.

This theory has been identified for its potential to provide the following interventions:

- I9/6 – both management and Gemba roles within improvement need to be defined, monitored plus team maturity measured on a scorecard. A way of measuring team maturity and transformational leadership has been identified as a required intervention.

Bruce Tuckman developed a theory outlining the phases a group must go through in order to grow and develop (Tuckman, 1965). This theory is still used within the latest bodies of knowledge for both the Association of Project Management Body of Knowledge Issue 7 (Association of Project Management, 2019) and Project Management Institute (Project Management Institute, 2020). The phases are indicated as follows in Figure 16.

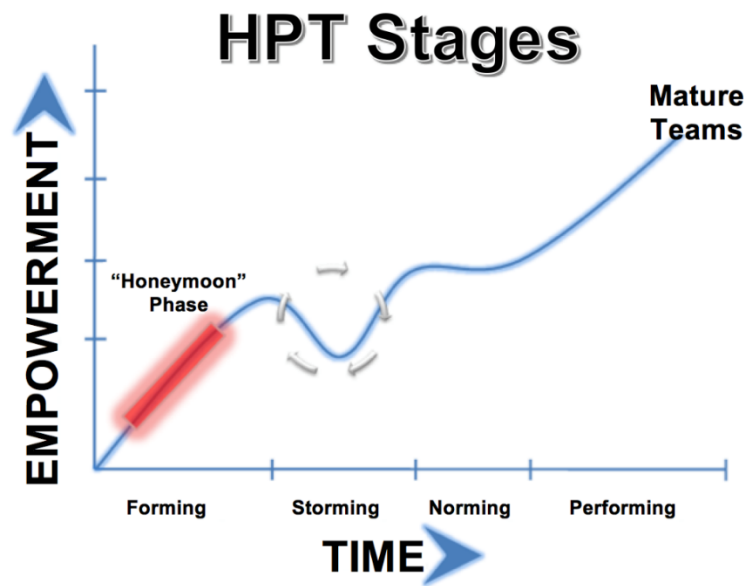


Figure 16 - An Illustration of the first 4 Phases of Tuckman's Team Development Curve

The phases are explained as follows:

- **Forming.** The team is constructed and agrees goals, rules and behaviours whilst not risking conflict (and hence restricting ambition) as they orientate to each other. The team is reliant on the supervisor to lead the group.
- **Storming.** Trust is built in storming but often after conflict as true working styles are shown when the challenges increase from opinions being formed and expressed. Members can feel excitement or anxiety as progress is made and questioned. It is essential that mechanisms to resolve conflict are found and new ways of cooperating are established so that all team members can participate comfortably. The supervisor is still leading at this stage but the leadership challenge is greater as a balance must be struck between brokering peace and allowing conflict. More importantly, during the storming phase it is essential to lead teams into the norming phase through good leadership or risk continued downward performance and employee complications through a prolonged storming phase period.

- Norming. Resolved conflict leads to greater harmony or intimacy between team members as they begin to automatically prepare for competition and accept each other as they are. The conflict is now at the level where it no longer dominates the agenda and shared goals become the main focus. Controversial ideas must still be encouraged, however, otherwise the team cannot move into the performing stage. The supervisor can start to stand aside as a participant rather than the leader.
- Performing. In the performing stage the teams enjoy the benefits of extra knowledge and dissent is allowed by being challenged through acceptable means. Team members are now technically and socially competent and able to autonomously handle decision making without supervision; the supervisor is now either a participant or standing aside the team managing the team boundary. As personnel change within the team, it is expected that the teams will revert to previous stages as new relationships are formed.

A fifth stage, adjourning, was included in 1977 and pertains to breaking teams up that are needed for fixed periods of time i.e., for a project. Whilst the theory is old, it is still taught as core curriculum within project management fundamental and intermediate training (Association of Project Management, 2019) (Project Management Institute, 2020). Given this work design is aimed at being perpetual (for at least as long as the plant exists) the fifth phase is not considered within this research.

Much of the aforementioned theories have discussed the need to measure team maturity. A scalable survey could be designed linking each level of behaviour to a Tuckman phase, whilst considering the needs of structural conflict, goal orientation, management control and learning orientation. Through identifying an agreed team score for each, shortfall could be identified for further discussion and action planning, with the agreement of the team members. The inclusion / exclusion assessment is given at Table 28.

Table 28 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B9 – a lack of teamwork. The theory can help team members understand the efficacy of cooperation between each other. If a questionnaire could be structured so that facets of teamwork could be individually assessed, potentially making it more logically to address teamwork shortfalls on an item-by-item basis. F8 – there can be a lack of improvement technique skill. This theory could improve awareness of team performance, and through this address the lack of commitment to structured problem solving and Gemba based problem solving.	Yes
Relevance to Interventions (I)	I9/6 – both management and Gemba roles within improvement need to be defined, monitored plus team maturity measured on a scorecard. A way of measuring team maturity and transformational leadership has been identified as a required intervention.	Yes
Ease of Synthesis to a lean-culture model	The theory can be synthesised into a self-scoring survey across the team members in order to identify the current-state with respect to stage of the Tuckman curve.	Yes
Familiarity / Comprehensiveness to Senior Leaders	The Tuckman theory is reasonably familiar to the operations directorate.	Yes
Overall Inclusion / Exclusions Decision:		Included

Change Management

This practice has been identified for its potential to address the following barriers and field-data:

- B1 – a change in philosophy is needed – the wrong approach is selected and there is resistance to change. If the change is failure due to mismanagement, then the adoption of change management techniques may help address the barrier.

The implementation of the work design represents a change to the organisation and its members. To this end, the work of Dannemiller and Kotter are reviewed.

Established change formulae (Dannemiller, 1992) states that there are four items need in order to generate change, and this research responds to each as follows:

- *Pressure for change (positive or negative pressure in terms of a dissatisfaction with the current state).* The organisation's head office has approved the implementation of a new work design. This negative pressure may suffice in the absence of the plant management understanding the ultimate benefits of the new work design. Whilst not explicitly the aim of this research, further development into a rapid tool to assess cultural current state may in some cases shock plant management in to action. However, whilst this research has indicated the how the develop of such an assessment may be further developed in Chapter 3, the development of such is not explicitly part of this research or approved by the organisation to be integrated into any new work design implementation. The pressure for change at the management level may, instead, need to be developed by either a need to a improve profit or improve employee relations and/or client focus (i.e., a specific fiscally-based business case for change). In stable plants with what is considered to be good profits and relations, the only hope for positive change-pressure would be either the desire to improve even further (again, a fiscal business case), or the desire to discover what they don't know about the business (uncover new risks or opportunities).

- *A vision of what is trying to be achieved.* The implementation requires a rationale, a desired future state. This can come in one of two ways, but preferably a mixture of the two: a fiscal business case that has a balanced view of internal revenue savings, waste reduction and increased fiscal benefit (in terms of financial rewards and job security); an imagined future state of empowered employees that have ownership (almost a freedom) to improve their own circumstances (rewards and environment) whilst being supported and or served by a wider team at all levels.
- *The steps needed for change.* A detailed set of instructions with training resources will be needed for the implementers and actors within the new work design. The researcher will need to act as an ad-hoc consulting resource to each plant for any queries and support with training for the earlier parts of the implementation.
- *The skills and capacity to carry such activities through.* Dedicated staff and resources including time for implementation and new routines will need to be set aside and included as part of the work design in terms of meeting rhythm, workflow (elevations) and a list of the responsibilities of all the actors.

The work design implementation in itself will represent change, and so change management should be considered as part of the implantation design. Using Kotter's 8 step change model (Kotter, 1995) for leading change:

- *Step 1 - Create a sense of urgency.* The purpose of the manufacturing excellence framework, that the work design is designed to support, is to improve the organisations competitive situation within a very aggressive marketplace (automotive manufacturing). However, there may be resistance to linking the formation of the work design to the excellence system. The business case should provide a fiscal purpose, but plant management may need support in developing a vision beyond what they are used to experiencing.

- *Step 2 – Form a powerful coalition.* Improvements will need champions that have an interest in the specific aspects for improvement (i.e., the work design champions and actors directly see the benefit from any improvement within their aspect of accountability). The champions will also need a network of support from subject specialists and workflow mechanisms to leadership in order to trigger support from wider departments (i.e., maintenance, human resources, administrative or IT).
- *Step 3 – Create a vision for change.* If any leadership training is to be provided, then allocation may be advisable for developing a vision for the work design as a vocational exercise within the training/lesson plan.
- *Step 4 – Communicate the vision.* The vision may need to be developed as part of leadership training, but once established integrated into further work design training for all actors. Any metrics for improvement will need to be targeted along with an arrangement for discussing metric improvement, briefing routines for all employees and a visual display mechanism.
- *Step 5 – Remove obstacles.* Consideration will need to be given for the influence that champions may have in terms of geography (physical locations / areas of the plant) and time (shift patterns). The plants will need to set the geographical and metrified boundaries of improvement responsibility according to these constraints. Staff selection, rewards and recognition, approach to simple problem solving.
- *Step 6 – Create short-term wins.* Initial problems or issues to be addressed will need careful selection so that improvement can be both assured and valuable to all stakeholders. This will need to be established within the communications step via whatever tracking approach is utilised (i.e., a very publicly posted scorecard with routine meetings / wider briefings).

- *Step 7 – Build on the change.* Consideration must be given to how the work design is implemented across the plant. Only once an initial implementation has achieved some baseline level of success should proliferation be approved and the work design spread throughout the geographic and time-based boundaries with new teams and champions.
- *Step 9 – Anchor the change.* In order to homogenously set the work design across the organisation, the roles of champions and guides should be proliferated so that the majority of all employees have acted as either one of the other at some point. A rotation could be considered to spread the workload and opportunity.

The inclusion / exclusion assessment is given at Table 29.

Table 29 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B1 – a change in philosophy is needed – the wrong approach is selected and there is resistance to change. If the change is failure due to mismanagement, then the adoption of change management techniques may help address the barrier.	Yes
Relevance to Interventions (I)	No specific interventions are supported by this theory.	No
Ease of Synthesis to a lean-culture model	Whilst implementing the lean-culture work design may require change management skills, the work design itself is not a change management process/framework. However, the implementation will require a champion and a set of instructions to unfreeze, change and re-freeze the changes. Furthermore, the new Gemba routines will need to empower the Gemba to implement lean changes, and must hence must consider the needs of change management.	Yes
Familiarity / Comprehensiveness to Senior Leaders	The change management process and underpinning theories could be well known by the operations executive.	Yes
Overall Inclusion / Exclusions Decision:		Included

Transformational Leadership

This practice has been identified for its potential to address the following barriers and field-data:

- B4 – a lack of leadership skill. Appropriate leadership is essential to the success of lean (Liker, 2014).
- B8 – a lack of vision. Transformational leadership requires leaders to establish a vision first before alignment and execution can be action. Vision creating requires big-picture thinking, testing assumptions and boldness (Straw, 2013).

This practice has been identified for its potential to provide the following interventions:

- I4/8 – leadership training to help establish a vision. The following interventions were identified and relevant to the theory: training in appropriate leadership styles and transformational leadership measured and reviewed.

Leadership is about helping others to make decisions and set/achieve goals for a wider benefit (MindTools, 2020); leaders establish a vision, build alignment and champions execution (J Straw, 2013). The importance of a establishing a vision has already been identified within this chapter. Furthermore, CMI research indicates that only 20% of line managers are rated highly by their employees (CMI, 2015). Part of the cause for this deficiency is considered to a lack of investment in leadership training. With this in view it is reasonable to assume that many plant leaders will be unprepared to establish and test a vision (and build alignment) without some additional training. The work design could hence benefit from integrated leadership training. The aims of the work design are transformational in nature, and requires leadership staff to become commensurately more transformational in their approach to leadership. Whilst leadership training can help fill in the leadership theory knowledge gap, a mechanism will be needed to monitor the quality of leadership in order to ensure leadership review and make

adjustments to move toward and maintain the appropriate leadership behaviours. A leadership survey could be created to co-exist with the team maturity assessment. The survey could use the global transformational leadership model (Sally Carless, 2000) and survey performance across the seven behaviours of transformational leadership: articulating a vision, developing employees, offering support, empowering employees, being innovative, leading by example and having charismatic qualities. In harmony with the transformational leadership approach is that of servant leadership (S Sendjaya, 2002), which implies that the leader's goal is to improve the skills of their employees; empowerment plays a major role in developing and achieving goals. The work design needs a routine where Gemba champions are supported by experts normally above their supervisory level, with the supervisor gradually stepping from leading, to collaborating and then to managing the scope / boundary of the team as the teams become autonomous (C Manz, 2000). The inclusion / exclusion assessment is given at Table 30.

Table 30 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B4 – a lack of leadership skill. Appropriate leadership is essential to the success of lean (Liker, 2014). B8 – a lack of vision. Transformational leadership requires leaders to establish a vision first before alignment and execution can be action. Vision creating requires big-picture thinking, testing assumptions and boldness (Straw, 2013).	Yes
Relevance to Interventions (I)	I4/8 – leadership training to help establish a vision. The following interventions were identified and relevant to the theory: training in appropriate leadership styles and transformational leadership measured and reviewed.	Yes
Ease of Synthesis to a lean-culture model	Leadership training could be integrated as a requirement of the new work design, with transformational leadership assessments being synthesised from the work by Carless.	Yes
Familiarity / Comprehensiveness to Senior Leaders	Whilst they may not be experts, it could be argued that operations leadership may have a measure of familiarity with different leadership styles including transformational leadership.	Yes
Overall Inclusion / Exclusions Decision:		Included

Balance Scorecard

This practice has been identified for its potential to address the following barriers and field-data:

- B5 – goals not cascaded. Barriers concerned with a lack of company goals and KPIs being cascaded relate to this theory.
- F2 – need clarity of goals and targets. Gemba actors and managers undertaking lean need to make decisions based upon a good awareness of company targets (Labovitz & Rosansky, 2012).

This practice has been identified for its potential to provide the following interventions:

- I5 – goals fractally cascaded and measured on a scorecard. This practice can help Gemba managers and actor to prioritise effort, and understand / track the impact of their effort.
- I1 – develop local business case for improvement. Setting up a new design with new routines will require effort and hence financial investment (time and materiel); a local business case for improvement linked to scorecard KPIs could be used to justify this investment and help maintain effort.

The design needs a way of measuring current performance and performance trends against goals that have been set from corporate requirements (the business case) and, through analysis, concentrated to the variables within the circle of influence of the Gemba. The balance scorecard (Robert S Kaplan, 1992) model was developed in the early 1990's as an attempt to help firms measure business performance using both financial and non-financial data. Initially the design will need a steering group to establish and explain the scorecard categories and targets of interest, whilst also catch-balling (G Labovitz, 2012) these targets to identify specific and quantifiable aspects that the team is being empowered to control and influence. As the

team matures and performance improves then scorecard KPIs and weighted targets will need to be adjusted in harmony with the performance of each Gemba team. This could become a keystone in the work design as it will be the basis upon which rewards, success and work-design effectiveness are judged at plant level. To this end the scorecard will need to be balanced with not only outwardly looking KPIs (quality cost etc.) but also inwardly looking KPIs such as team and leadership maturity, leadership quality and safety. The inclusion / exclusion assessment is given at Table 31.

Table 31 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B5 – goals not cascaded. Barriers concerned with a lack of company goals and KPIs being cascaded relate to this theory. F2 – need clarity of goals and targets. Gemba actors and managers undertaking lean need to make decisions based upon a good awareness of company targets (Labovitz & Rosansky, 2012).	Yes
Relevance to Interventions (I)	I5 – goals fractally cascaded and measured on a scorecard. This practice can help Gemba managers and actor to prioritise effort, and understand / track the impact of their effort. I1 – develop local business case for improvement. Setting up a new design with new routines will require effort and hence financial investment (time and materiel); a local business case for improvement linked to scorecard KPIs could be used to justify this investment and help maintain effort.	Yes
Ease of Synthesis to a lean-culture model	The theory is simple to synthesize into the work design.	Yes
Familiarity / Comprehensiveness to Senior Leaders	Scorecards are a familiar aspect of operations management and quality assurance.	Yes
Overall Inclusion / Exclusions Decision:		Included

Dunbar Team Design

This theory has been identified for its potential to address the following barriers and field-data:

- B9 – a lack of teamwork. Dunbar (1993) proposes that considering the most effective team sizes is an essential step in establishing effective teams

This theory has been identified for its potential to provide the following interventions:

- I9/6 – both management and Gemba roles within improvement need to be defined, monitored plus team maturity measured on a scorecard. The fractal cascading of goals would have to be based by functional area at the Gemba, and hence denote a limit upon the personnel within the functional area.

The Dunbar number system (Dunbar, 1993) and team design (R Karlgaard, 2015) suggests that there is an optimum number for team size. This is based upon the cognitive limits to the number of people that the human being can hold differing types of relationship with. Larger groups require more restrictive rules and smaller team sizes allow for greater social contact and the possibility of teams breaking through to the norming stage (Tuckman, 1965) on the Tuckman curve more rapidly. Given that the purpose of the work design is to enable rapid cultural change, the speed and efficacy advantages of focusing on a smaller team at one point in time is advantageous. To this end, the work design needs to consider size of the champion grouping (champions equating to a hunting party) within the wider team boundary (wider team members equating to the tribe). The inclusion / exclusion assessment is given at Table 32.

Table 32 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B9 – a lack of teamwork. Dunbar (1993) proposes that considering the most effective team sizes is an essential step in establishing effective teams	Yes
Relevance to Interventions (I)	I9/6 – both management and Gemba roles within improvement need to be defined, monitored plus team maturity measured on a scorecard. The fractal cascading of goals would have to be based by functional area at the Gemba, and hence denote a limit upon the personnel within the functional area.	Yes
Ease of Synthesis to a lean-culture model	The theory is simple to synthesize into the work design.	Yes
Familiarity / Comprehensiveness to Senior Leaders	It is unlikely that the operations directorate would be explicitly familiar with the theory; however, most would understand the notion of optimum team numbers as part of their experiential learning.	Yes
Overall Inclusion / Exclusions Decision:		Included

Fractal Organisational Theory

This theory has been identified for its potential to address the following barriers and field-data:

- B1 – a change in philosophy is needed – the wrong approach is selected – and there is resistance to change. Focusing on the wrong goals may not bring the necessary performance improvement that will sustain growth.
- F2 – need clarity of goals and targets. Fractally defining goals will require leadership to reconsider the company goals and their relevance.

This theory has been identified for its potential to provide the following interventions:

- I5 – goals fractally cascaded and measured on a scorecard. This theory demonstrates the mechanisms of how company goals can be cascaded with KPIs specific area of influence.

Fractal organisation theory (Raye, 2014) suggests that an emergent human approach to working relationships and operations mimics nature in its capacity for creativity, adaptation, and innovation in that when the conditions are suitable, the organisation grows from within using a same geometric (socio-technical) pattern. The qualities of a fractal organisation include shared purpose and values that create a universal participation in ideas and solutions for continuous improvement. If socio-technically (geometrically) established for such, then decision making at functional levels and competition energy is directed outwards instead of inwards. Organisational cultures that hold true to the values of survival of the fittest (Spencer, 1964); an over-simplification of the works of Darwin. They may often expend lots of energy and waste as individuals and departments compete for seemingly scarce resources in order to secure survival. Information-sharing is hence reduced and the hierarchy grows upward as oppose to being flattened as it is nature. Living systems in nature tend to flatten their hierarchies and share responsibility with front-line members, which is part of the ultimate aim of this lean-

culture work design given that that Chapter 2 identifies a lack of information as a cultural barrier. Information should be shared through the following:

- Cascaded goals within the Gemba circle or influence; enabling strategic issues to become something more familiar and scalable. The balance scorecard will enable the metrification of these cascaded goals.
- Bi-directional briefings and meetings between management levels.
- An emphasis on servant leadership, where the Gemba is served by the leadership (the bottom of the hierarchy becomes the top as the pyramid-like hierarchy is flipped). Some form of terms of reference and/or explicit explanation of the role, responsibilities and routines/behaviours of actors guiding champions will be required within the design.
- Transformational leadership training and/or conflict management training for supervisors as aligning members with a shared purpose and values is best undertaken by leaders who are trained in using conversation tools that facilitate group decision making.
- Succession planning for supervisors and middle management (through multi-HPT leadership or CI team expansion) as the Gemba teams become autonomous.

The inclusion / exclusion assessment is given at Table 33.

Table 33 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B1 – a change in philosophy is needed – the wrong approach is selected. Focusing on the wrong goals may not bring the necessary performance improvement that will sustain growth. F2 – need clarity of goals and targets. Fractally defining goals will require leadership to reconsider the company goals and their relevance.	Yes
Relevance to Interventions (I)	I5 – goals fractally cascaded and measured on a scorecard. This theory demonstrates the mechanisms of how company goals can be cascaded with KPIs specific area of influence.	Yes
Ease of Synthesis to a lean-culture model	Cascaded goals will need to be synthesised as part of the work design into each Gemba-area (separate team).	Yes
Familiarity / Comprehensiveness to Senior Leaders	Whilst the directorate will be familiar with sharing strategic goals or daily organisation-wide targets, they may be less familiar with breaking up targets into smaller areas with measures within the team's circle of influence.	No
Overall Inclusion / Exclusions Decision:		Included

Sources of Influence

This theory has been identified for its potential to address the following barriers and field-data:

- B1 – a change in philosophy is needed – the wrong approach is selected – and there is resistance to change. This resistance to change could infer issue pertaining to motivation, which this theory may help address (J Grenny, 2013).
- B9/10/11 – a lack of non-human resource (technology & infrastructure inc. feedback mechanisms). Applying the theory correctly would require infrastructure and technology to be installed driven by a local business case for improvement (personal motivation) (J Grenny, 2013).

This theory has been identified for its potential to provide the following interventions:

- I7 – training provided linked to purpose / goals / targets. This intervention would demand the deliberate practice of new techniques. Intrinsic to this practice would be training.
- I8 – job rotation, certification and training. Certification and rotation could be viewed as positive aspects to working arrangements, and could hence contribute to personal and peer motivation (J Grenny, 2013).

The 6 sources of influence model (J Grenny, 2013) states that there are six sources of influence equally spread between the contexts of motivation and ability. The theory implies that if 4 or more sources of influence (i.e., four out of the six) are applied as part of a change effort then the probability of the desired (targeted) behavioural change being sustained increases by a factor of ten (J Grenny, 2013). Given the need of this work design to change behaviours, and hence beliefs and culture, then arrangements to exploit these sources should be weaved into the work design. With this in view, the following Figure 17 breaks up the personal, social

and structural arrangements that are design to trigger motivation and ability (sources of influence) toward sustaining HPT.

Figure 17 - The 6 Sources of Influence Relevant to the Work Design

	MOTIVATION	ABILITY
PERSONAL	<i>Make the Undesirable Desirable.</i> An area needs to be established so that new HPT actors can go and see the benefit through scorecard performance, visual controls and impact; a place where success stories shared and advertised.	<i>Surpass Personal Limits</i> Through coaching and plenty of deliberate practice HPT actors should become good at solving problems and managing improvement initiatives. The coaching and practices are best supported within neutral area (neutral to all actors).
SOCIAL	<i>Harness Peer Pressure</i> Use and HPT area to hold a wider team meeting to show off and discuss success and ideas. This will identify good practice so others can follow / emulate the routines of respected peers. This should include leadership involvement too so that their behaviours can be role modelled.	<i>Find Strength in Numbers</i> Use the ‘ceremony’ of HPT meetings within the HPT area to garner the wider support of others with specialist skills to support improvement. The meeting and location (along with leadership support) should stand as an event to discuss problems, elevate issues with respected colleagues and generate support.
STRUCTURAL	<i>Rewards that Drive Accountability</i> The design will need to ensure that hygienic remuneration (F Herzberg, 1959) is accounted for before requesting each plant to develop a rewards and recognition policy to drive the right behaviours toward KPI improvement.	<i>Change the Environment</i> The environment should support the HPT routines and behaviours. The other sources find the HPT AREA of value in supporting their applications. Changing the environment is also a signal of the plant’s commitment to the process.

The inclusion / exclusion assessment is given at Table 34.

Table 34 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B1 – a change in philosophy is needed – the wrong approach is selected – and there is resistance to change. This resistance to change could infer issue pertaining to motivation, which this theory may help address (J Grenny, 2013). B9/10/11 – a lack of non-human resource (technology & infrastructure inc. feedback mechanisms). Applying the theory correctly would require infrastructure and technology to be installed driven by a local business case for improvement (personal motivation) (J Grenny, 2013).	Yes
Relevance to Interventions (I)	I7 – training provided linked to purpose / goals / targets. This intervention would demand the deliberate practice of new techniques. Intrinsic to this practice would be training. I8 – job rotation, certification & training. Certification & rotation could be viewed as positive aspects to work arrangements, & could contribute to personal & peer motivation (J Grenny, 2013).	Yes
Ease of Synthesis to a lean-culture model	Many of the sources can be easily synthesized into the work design through the processes, infrastructure and technology nodes.	Yes
Familiarity / Comprehensiveness to Senior Leaders	The theory could arguably be familiar to the operations executive, and the features of the interventions should also be so.	Yes
Overall Inclusion / Exclusions Decision:		Included

Problem Solving Techniques

These practices have been identified for their potential to address the following barriers and field-data:

- B3/13/12 – a lack of problem-solving skills. An array of simple problem-solving tools is readily available, but need coaching and practice to master.
- F8 – there can be a lack of improvement technique skill. With the implementation of such tools, and regular use as part of an HPT routine, the skills for using the tools should improve.

In order to generate improvement, the work design will need to include the facilitation, or at least assume a pre-existing competency, of an array of simple problem-solving techniques that could be beneficial. The emphasis is to be upon empowerment and improvement, so highlighting and sharing relevant and meaningful KPIs without facilitating improvement and/or improvement techniques/technology could have an adverse effect on the actors. The following simple problem-solving techniques are easy to coach and facilitate.

- *Five-Why* (Ohno, 1988). The 5 Why technique is an iterative interrogative simple and visual approach used to explore the cause-and-effect relationships underlying a problem. The aim is to determine the root cause of an issue or problem by repeating the question "Why?" at least 5 times. Each answer forms the subject of the next question.
- *Ishikawa / Fishbone Diagram* (Ishikawa, 1986). The fishbone diagram is a visual way to look at cause and effect of a problem or issue. It is a structured for brainstorming causes of a problem (more structured than the 5 Why tool). The problem or effect is displayed at the head or mouth of the fish and the bones are broken off into editable cause-categories that may typically include: Equipment, Processes/Methods, People, Materials and Environment; more bones or difference categories can be used. Sub-

branches for root-causes (sub bones) can be added to as many levels as required in order to identify more or less likely causes and hence prioritise lines of inquiry.

- *PSDM (Problem Solving & Decision Making)* (C Kepner, 1976). Also referred to as KT (Kepner Tregoe), the PSDM is a problem analysis model in which the “problem” is disconnected from the “decision”. A situation analysis framework is provided with an array of actions under three headings to be processed in a serial fashion:
 - *Problem Analysis.* The problem is defined, specified and then possible causes are identified with tests arranged to prove the true cause.
 - *Decision Analysis.* The decision is stated and objectives classified and weighed against generated alternatives. Risks are considered and a decision confirmed.
 - *Potential Problem Analysis.* Potential problems are identified with causes, preventative actions and notification triggers.
- *Toyota A3* (Durward Sobek II, 2008). The A3 approach is a templated form of problem solving, analysis and progress tracking that fits onto an ISO-A3 sized sheet of paper. It provides a simple and strict procedure to guide problem investigation, solution and wider dissemination. It is traditionally comprised of a minimum of 7 sections based around the Plan, Do, Check, Act (PDCA) cycle:
 - *PLAN - Background, Current Situation, Set-Targets / Goals, Root Cause Analysis.* %-Why or Fishbone diagrams can also be used in this section.
 - *DO – Countermeasures.* Action plans can be included here.
 - *CHECK – Implementation.* Run charts and evidence of impact.
 - *ACT - Follow-Up.* Any failure modes to monitor with a potential to repeat the cycle, or sharing of fixes to be undertaking.

The inclusion / exclusion assessment is given at Table 35.

Table 35 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B3/13/12 – a lack of problem-solving skills. An array of simple problem-solving tools is readily available, but need coaching and practice to master.	Yes
Relevance to Interventions (I)	F8 – there can be a lack of improvement technique skill. With the implementation of such tools, and regular use as part of an HPT routine, the skills for using the tools should improve.	Yes
Ease of Synthesis to a lean-culture model	Lean tools and techniques could be relatively easy to synthesize into the work design through the technology node.	Yes
Familiarity / Comprehensiveness to Senior Leaders	The theory could arguably be very familiar to the operations executive, and the features of the interventions should also be so.	Yes
Overall Inclusion / Exclusions Decision:		Included

Coaching Practices

These practices have been identified for their potential to address the following barriers and field-data:

- B1 – resistance to change. An evidence based coaching technique can help remove bias from the learning process (Rother, 2009).
- B6/13 – a lack of teamwork in problem solving. This could infer lack of support for Gemba actors attempting to solve problems. If middle management subject matter experts (e.g., quality or safety management) could undertake a coaching role to the Gemba actors undertaking the problem-solving then the problem-solving process could be better supported.

These practices have been identified for their potential to provide the following interventions:

- I3/8 – coaching provided as well as coach-training. This training could take the form of coaching that has already been successful within the manufacturing environment, such as Toyota Kata coaching.

The journey toward empowered Gemba employees will likely require coaching from supervisors and salaried subject matter experts (principle-leaders such as quality and safety managers). The absence of any formal training in providing adult-learning could prove an issue as subject leaders or champions grow impatient with coaches who may bypass the learning opportunity by prematurely providing solutions to issues. Furthermore, should any prematurely enforced solutions prove to be ineffective then the Gemba actors are likely to grow disillusioned with the new work design arrangements. In response to this a coaching methodology needs to be integrated within the work design. In particular, a coaching method for improved problem-solving routines such as Toyota Kata (Rother, 2009). Toyota Kata is set of fixed teaching routines that helps a coach quickly develop coaching skills through

undertaking a coaching pattern specifically aimed to teach the coached employee improvement. To become an established coach can typically take several thousand hours' worth of practice; Kata is useful in this case as the routines and rules of behaviour are explicit, and hence easy to train. Training in such techniques would need to be provided to supervisory and Principle-leadership as part of the lead-in to implementation. The inclusion / exclusion assessment is given at Table 36.

Table 36 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	B1 – resistance to change. An evidence based coaching technique can help remove bias from the learning process (Rother, 2009). B6/13 – a lack of teamwork in problem solving. This could infer lack of support for Gemba actors attempting to solve problems. If middle management subject matter experts (e.g., quality or safety management) could undertake a coaching role to the Gemba actors undertaking the problem-solving then the problem-solving process could be better supported.	Yes
Relevance to Interventions (I)	I3/8 – coaching provided as well as coach-training. This training could take the form of coaching that has already been successful within the manufacturing environment, such as Toyota Kata coaching.	Yes
Ease of Synthesis to an lean-culture model	A coaching model and coaching routine could be relatively easily synthesised and part of the new work design.	Yes
Familiarity / Comprehensiveness to Senior Leaders	Coaching techniques such as GROW and Toyota Kata are very familiar to most operations directors.	Yes
Overall Inclusion / Exclusions Decision:		Included

Broken Windows Theory

This theory has been identified for its potential to address the following barriers and field-data:

- F6/7/5 – a lack of space & untidy/ unfinished areas create apathy. Amongst the barriers is a lack of space for problem solving, and feelings of apathy as work areas are left untidy or unfinished.

The broken windows theory is a criminological theory that states that visible signs of crime, anti-social behaviour, and civil disorder within an urban environment encourages further crime and disorder (James Q Wilson, 1982). With this in view the work design will need to explain and set the visual standards that the facilities used as part of the work design will need to adhere to. There is a risk that the facilities could be under-funded or under-provisioned with poor standards that could ultimately influence the actors in a negative way. Once the team is launched, a focus on the 5S (McFadden, n.d.) improvement could be an ideal first KPI targeted for improvement as this directly improves the immediate environment for the team, whilst also facilitating improvements in safety and efficiency. The inclusion / exclusion assessment is given at Table 37.

Table 37 – Inclusion / Exclusion Assessment

Inclusion / Exclusion Assessment		
Criterion from Chapters 1,2, and 3	Assessment Explanation / Rationale & Adoption Approach / Alternative Approach	Inclusion/ Exclusion Y/N
Relevance to Barriers (B) and/or Data (F)	F6/7/5 – a lack of space & untidy/ unfinished areas create apathy. Amongst the barriers is a lack of space for problem solving, and feelings of apathy as work areas are left untidy or unfinished.	Yes
Relevance to Interventions (I)	No specific interventions are supported by this theory.	No
Ease of Synthesis to a lean-culture model	Easy to synthesise through the addition of visual standards as part of the work design.	Yes
Familiarity / Comprehensiveness to Senior Leaders	Operations directorate will be aware of the importance of good husbandry through the lean tool 5S.	Yes
Overall Inclusion / Exclusions Decision:		Included

List of Theories to be Included / Synthesised

From the reviews above, the Table 38 below summarises the theories that have been selected for synthesis and application into the lean-culture work design.

Table 38 – Inclusion / Exclusion Assessment

Theory Context	Inclusion / Exclusion
Structural Conflict	Excluded
Behavioural Control	Excluded
Management Control (Power)	Excluded
Change Management	Included
High-Performance Teams	Included
Learning/Goal Orientation	Included
Herzberg Factors	Included
Tuckman Team Maturity	Included
Transformational Leadership	Included
Balance Scorecard	Included
Dunbar Team Design	Included
Fractal Organisational Theory	Included
Sources of Influence	Included
Problem Solving Techniques	Included
Coaching Techniques	Included
Broken Windows Theory	Included

Synthesis of Selected Theories into a socio-technical work design

The research expands the science of Socio-Technical Systems work design by taking the conventional socio-technical network design from Clegg et al (below in Figure 18), wherein all work systems comprise of interconnected 6 nodes that influence each other.

- PROCEDURES, POLICY & PLANS
- GOALS
- PEOPLE
- CULTURE
- INFRASTRUCTURE
- TECHNOLOGY & TOOLS

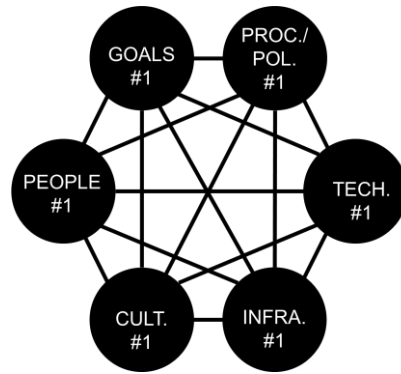


Figure 18 - The Inherent Socio-Technical Arrangement

At the inherent level (level #1) the nodes could typically comprise of the following:

- PROCEDURES, POLICIES & PLANS. This node contains the documented procedures for organisational management i.e., for maintain operations and adding value to their product or service compliant with PESTEL (Political, Economic, Social, Technological, Environmental and Legislative) requirements.
- GOALS. This node contains the organisational mission and aims pertaining to PESTEL opportunities and threats, often with a specific focus on business development and/or sustainability/continuity.
- PEOPLE. This node contains an appropriate blend of people and skills needed in order to meet the requirements of GOALS and PROCEDURES, POLICY & PLANS.
- INFRASTRUCTURE. This node contains the building, services, welfare and communications fabric (facilities) needed to support the social and technical needs of the network.
- TECHNOLOGY. This node contains the technologies used to either generate or convey value-added products and services.

- CULTURE. This node contains the learned pattern of beliefs and assumptions that support people to internally adapt to external problems / shortfalls in other nodes (culture as an output) that are considered valid enough to be passed from person to person in order to inform their behaviour and decisions (culture as an input).

This research is testing the application of wider scientific concepts / theories in how this network can be used to generate culture change to support lean (Continuous improvement). At the lean-culture level (level #2), shown at Figure 19, the wider concepts are indicated and linked to their socio-technical nodes (all of which are still interconnected and influence each other). At the lean-culture level (#2) the nodes expand as follow:

- PROCESSES / POLICIES (PROC/POL.). Wider scientific theories and practices to be synthesised for this node are as follow:
 - Herzberg Motivational Theory will be applied in order to develop a rewards and recognition process to recognise either success within the fractal goals, or considerable effort toward achieving a complex goal.
 - The rewards and recognition scheme also recognises a small part of management control theory, in that the scheme is a transformative mechanism.
 - HPT practices will be applied to establish a high-level steering group to develop and own the business-case and vision for that is relevant to that particular plant. The same HPT practices will also establish the workflow elevations and enforce the new meeting routines. Furthermore, the HPT policy must also enforce the methodical approach to problem solving, so techniques and subsequent training will need to be outlined within such as the new way of doing business.

- Terms of reference for different actors will be provided to support the fractal approach to HPT implementation and management of multiple teams across the organisation along with team information sharing and proliferation.
- Sources of influence will also be used as part of this STS context within instructions and hence de-facto policies and set routines for:
 - Training with deliberate practice and resources (time) for implementation and sustainment routines for HPT.
 - Training in simple problem-solving tools (problem-solving practices).
 - Infrastructure (facilities)
 - Training and coaching.
 - Goal sharing, setting and sharing in success against such goals.
 - Rewards and recognition.
 - Peer dialogue and assessment via a team and leadership maturity assessment, the results of which are tracked via the balance scorecard.
 - Sharing of performance data between teams (peer support and competition).
- GOALS. Wider scientific theories and practices to be synthesised for this node are as follow:
 - Fractal Organisational Theory will be used to develop team-level goals. There must be a quantifiable way for the team to track the key performance indicator of each goal.
 - Balance Scorecards will be applied to display and track progress against the fractal goals.
 - HPT will be used to ensure that plant steering group take an active interest in setting and monitoring progress against the fractal targets that fall out of the business case.
 - Transformational Leadership will be applied to set a vision for the plant, what the work design is aiming to achieve, plus why.

- Elements of goal and learning orientation theory are at least respected in part by way of setting a scorecard within the influence of the Gemba, and publishing results and progress (addressing elements of Structural Conflict).
- Through developing a vision for HPT, change management theory will be respected in the following ways:
 - Vision to be developed
 - Boundaries for implementation(s) will be set in terms of geography and KPIs.
 - A business case for change will be established and managed through the scorecard.
 - Training will be provided for guides and champions (all employees).
- PEOPLE. Wider scientific theories and practices to be synthesised for this node are as follow:
 - Transformational Leadership training will be provided to the relevant leaders and managers.
 - Fractal organisational theory is respected, as managers and non-Gemba specialists will be used as guides for the Gemba champions across multiple teams. The steering group will also oversee implementation and score-card setting. Finally, organisational support functions (such as maintenance) will supply services to each team and be present as guests in meetings (with a supplier role).
 - Kata coaching training and nominated coaches and Gemba champions will also be expedited.
 - The Dunbar number system will be used to identify team boundaries and the number of Gemba champions to be active.
 - HPT terms of reference will be established for plant operational leaders and principle-leaders (Principle-SMEs), scorecard champions, wider Gemba operators, technicians

and wider support actors all with a view to driving accountability at all levels. Training will be mandated for HPT skill certification (champions and guides), coaching skills certification and job skill certification for all Gemba team members.

- Management control theory will be respect in a small way as management guides will be expected to build and develop Gemba champions as part of their HPT terms of reference and emerging annual appraisal targets.
- Learning and goal orientation theory will be respect in part with the establishment of HPT champion skill certification and champion rotation.
- CULTURE. Wider scientific theories and practices to be synthesised for this node are as follow:
 - Tuckman Team Maturity via an assessment for team and individual performance that takes cues from the following other theories:
 - Learning orientation and Goal orientation by probing the Gemba actors' perceptions on their team's problem solving, effectiveness and ownership as well as their ability to apply the new skills.
 - Coaching through adopting a Toyota Kata coaching model using the subject matter expert salaried staff as coaches and Gemba actors as the coached.
 - Herzberg Hygiene Factors such as supervisor and co-worker relationships, social working conditions are monitored for improvement and sustainment via team and leadership maturity assessments and monitored to improve people skills via the balance scorecard.
 - Transformational Leadership will also be monitored using an extension to the Team Maturity mechanism. This will give the Gemba actors a feedback mechanism on the quality of the leadership they receive, whilst also providing leaders an insight into their transformational leadership areas for improvement.

- **INFRASTRUCTURE.** Wider scientific theories and practices to be synthesised for this node are as follow:
 - The Sources of Influence through the establishment of new routines within a dedicated area that is well presented. A dedicated HPT area is to be established to defined minimum visual standards. The area is to accommodate and provide easy access to the TECHNOLOGY aspects of the design. The space is also to display headline information and success stories, as well as the fabric/furnishings for one-to-one meetings as part of coaching and liaison with wider employees. The area is to be as close the Gemba team as possible in order to ensure that ownership is not assigned to salaried staff or plant leadership. The HPT area is required to be a safe space to: practice problem-solving; discuss experiences and gains support by adverting good practice (overt role modelling); and present success. It is to be owned by the Gemba
 - Broken Window Theory through the setting and adoption of visual standards for the HPT area within each plant.
- **TECHNOLOGY.** Wider scientific theories and practices to be synthesised for this node are as follow:
 - Problem Solving tools; the HPT area should contain the tools and technologies to support HPT improvements. These can include specialist IT and software-access, performance reports, charting-equipment, trend charts, problem solving tools / templates, team & leadership assessments and PDCA-trackers.
 - Sources of Influence also link into this node as the tools facilitate problem-solving ability.

A visual depiction of the lean-culture socio-technical network is given overleaf at Figure 19, and ready for research design and implementation planning within Chapter 5.

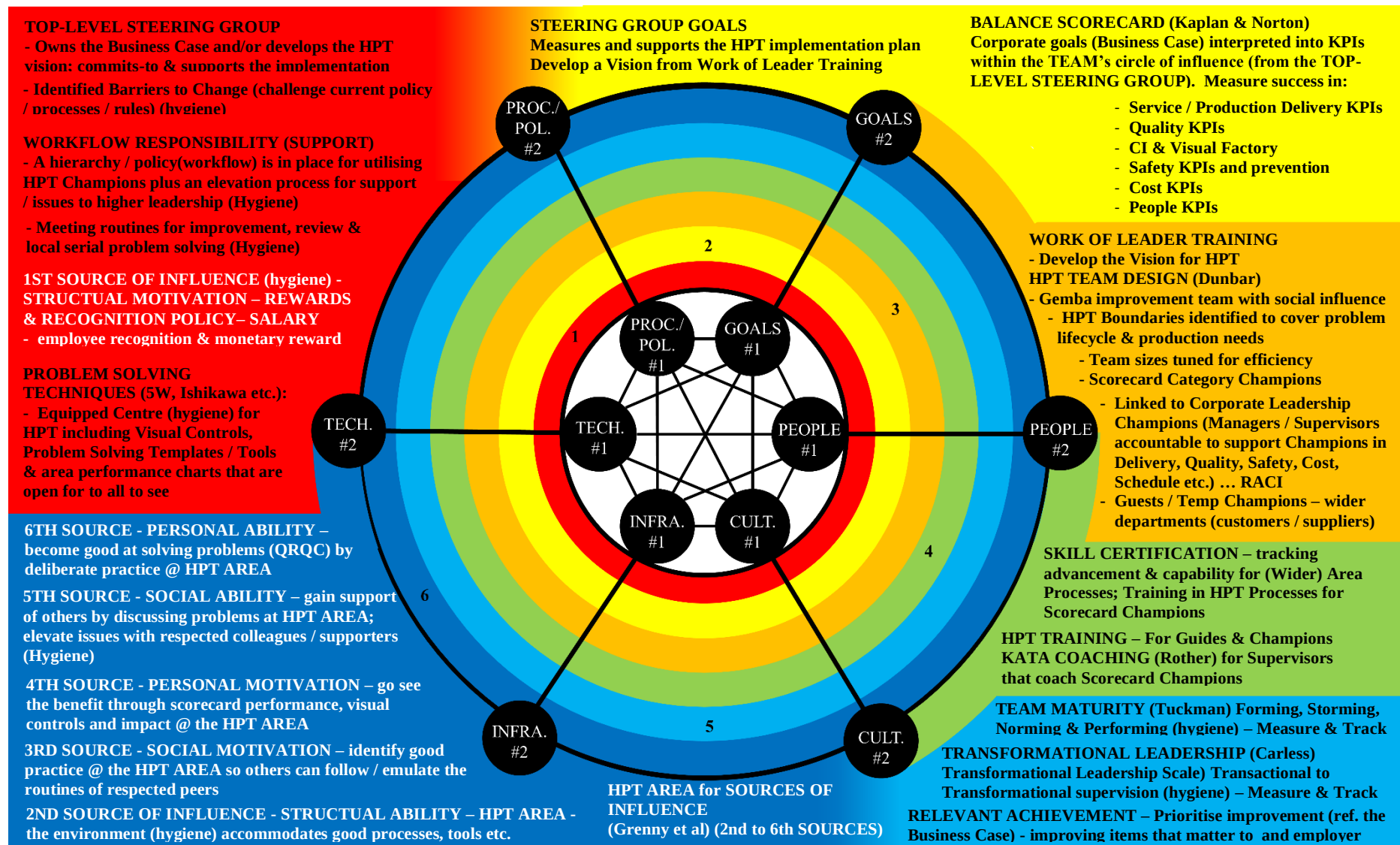


Figure 19 - Visual Representation of the Lean-culture Socio-Technical Work Design for HPT

CHAPTER 5 – A LEAN CULTURE WORK DESIGN

The synthesis of practices and wider scientific theories into a lean-culture socio-technical work design to develop high-performance teams

Summary

The Chapter presents a lean-culture socio technical work design that uses a synthesis of the practices and scientific theories identified within Chapter 4. The theories are arranged and integrated within a new work design that has a particular purpose of generating a high-performance team environment (culture) to specifically support lean and continuous improvement.

Background

The thesis began with Chapter 1 explaining the definitions and origins of lean, as well as the high failure rate associated with its implementation and sustainment. The anecdotal cause of these failures was implied to be within the organisational culture needed to sustain lean. Chapter 1 also provided a justification for the research and the methods used, and reviewed the field of socio-technical work design, and analysed its relevance to indirectly affect organisational culture by directly reviewing and improving the socio-technical features that feed into organisational culture. An appropriate framework was selected and used in Chapter 2 to analyse over 1000 cases of lean implementation for barriers and interventions to lean implementation. The knowledge gained from the literature survey and systematic case study review was then cross checked in the field using a rudimentary data collection exercise in

Chapter 3 that reviewed the inherent socio-technical arrangements within three manufacturing plants. The data collection was used to validate and improve upon the knowledge from the literature survey and systematic review so that a definitive list of socio-technical barriers and interventions to lean sustainment could be developed. The barriers and interventions were then structured into a list of research search terms in order to explore the relevance of wider practices and scientific theories. These theories and practices were surveyed and selected in Chapter 4 based upon their relevance to addressing the barrier or supporting the intervention. Chapter 4 also then indicated how each practice and theory may be synthesised into a lean-culture work design. This is summarised in the following table 39.

Table 39 – Summary of STS Synthesis of Practices and Theories

Theory /Practice	Lean-Culture Work Design Synthesis
High-Performance Teams	HPT practices will be applied to establish a high-level steering group to develop and own the business-case and vision for that is relevant to that plant. The same HPT practices will also establish the HPT meeting durations and frequency, workflow elevations and enforce the new meeting routines. Furthermore, the HPT policy must also enforce the methodical approach to problem solving, so techniques and subsequent training will need to be outlined within such as the new way of doing business. HPT will be used to ensure that plant steering group take an active interest in setting and monitoring progress against the fractal targets. HPT terms of reference will be established for plant operational leaders and principle-leaders (principle-SME³s), scorecard champions, wider Gemba operators, technicians and wider support actors all with a view to driving accountability at all levels. Finally, the branding for the corporate initiative will adopt the name High Performance Team implementation as this sounds more familiar and easier for

³ SME – Subject Matter Expert i.e., quality manager, HR manager, safety manager, operations manager etc.

	everyone to understand than ‘lean-culture work design’. Hence, plants will see and refer to this implementation as HPT.
Herzberg Factors	Herzberg Motivational Theory will be applied in order to develop a rewards and recognition process, or at least demand that plants establish one in accord with regional employment differences. The aim of the policy is to recognise either success with regard to achieving the fractal goals, or considerable effort toward achieving a complex goal. Herzberg Hygiene Factors regarding supervisor and co-worker relationships, social working conditions will be monitored for improvement and sustainment via team and leadership maturity assessments. The steering group will review these assessments so that they can observe improvement or stagnation/decline, and demand action accordingly. The Gemba will also monitor these assessments as part of their balanced scorecard.
Tuckman Team Maturity & Learning / Goal Orientation	An assessment to identify what Tuckman Team Maturity stage the team is occupying will be developed and tracked as part of the balanced scorecard and plant-level KPIs. The assessment for team and individual performance will take cues from Learning orientation and Goal orientation by probing the Gemba actors’ perceptions on their team’s problem solving, effectiveness and ownership as well as their ability to apply the new skills. Training will be mandated for HPT skill certification (champions and guides), coaching skills certification and job skill certification for all Gemba team members. Wins and results will be published in order to generate pull toward the vision and motivate actors into further improvement.
Transformational Leadership	Transformational Leadership training will be provided to the relevant leaders and managers. Transformational Leadership will also be monitored using an extension to the Team Maturity mechanism. This will give the Gemba actors a feedback mechanism on the quality of the leadership they receive, whilst also providing steering group and individual leaders an insight into their transformational leadership areas for improvement. Leaders will be asked to set a vision for the plant - what the work design is aiming to achieve, plus why; then gain alignment and champion execution for that vision.

	Management control theory will be respected, in part, with the inclusion of a transformative rewards and recognition system, as well as the facilitation of management guides serving and building Gemba champions.
Balance Scorecard	Balance Scorecards will be applied to display and track progress against the fractal goals. The fractal goals will be dropping out of the business case for the change; hence the vision cannot be eroded, and the truth must be maintained. The scorecards will be set up and tested by leadership in consultation with the Gemba. Once launched the teams will own their scorecard and can request adaptations or additions. Team maturity and leadership assessment scores form part of the scorecard. The scorecard is used to prioritise actions and track performance trends.
Dunbar Team Design	The Dunbar number system will be used to identify team boundaries and the number of Gemba champions that are to be active at any one point in time. The design will not only reflect the boundaries in terms of 'tribe' number, but also the geographic dispersal of the Gemba.
Fractal Organisational Theory	Fractal Organisational Theory will be used to develop team-level goals. There must be a quantifiable way for the team to track the key performance indicator of each goal. Plant-wide goals will be fractally processed into a sub-set of goals that are specific to the HPT area and within the team's influence to affect improvement. Fractal theory requires that the HPT approach to goal setting must be consistent, although goals for each time may differ, they must be aligned to the organisation's wider and fundamental requirements. Therefore, managers will act as guides and the steering group will lead score development for each team. As teams are established, they will need to identify if they serve external or internal customers and develop a scorecard with greater customer focus as their HPT ability grows. Team proliferation will expand in accord with the principles of fractal organisational theory, with group reporting / sharing and support being enabled to duplicate stronger and better HPTs.
Sources of Influence	The 6 Sources of Influence will be used as part of a dedicated HPT area (established to defined minimum visual standards) that will accommodate a venue for the sources as follow.

	- Structural Motivation (improve the Gemba economy) – Establish a rewards and recognition policy. - Structural Ability (help the Gemba and Managers to do what they can't) – through the HPT area create an environment that accommodates good processes, tools etc. - Social Motivation (share stories of success) – identify and present good practice within the HPT area so others can follow / emulate the routines of respected peers. - Personal Motivation (help the Gemba and Managers to see what can be done) – the aim will be to allow Gemba to go and see the benefit through scorecard performance, visual controls and impact within their own area, and the areas that belong to others. - Social Ability (win support from others) – the aim is to gain support of others by discussing problems at the HPT area in groups; and elevate issues with respected colleagues/supporters. - Personal Ability (improve Gemba and manager skill) – training and coaching to allow Gemba and management become good at team-based solving problems by deliberate practicing with problem solving tools (within the HPT area).
Problem Solving Techniques	Problem Solving tools will be made available within the HPT, along with plant of such resources to support multiple of improvement initiatives at any point in time. These can include specialist IT and software-access, performance reports, charting-equipment, trend charts, problem solving tools / templates, team & leadership assessments and PDCA-trackers.
Coaching Techniques	Toyota Kata coaching training will be provided to nominated coaches and Gemba champions. Coaching through the adopted Toyota Kata coaching model will be done by using the subject matter expert salaried staff as coaches and Gemba actors as the coached. This will ensure that guides have a consistent approach to coaching, ensuring the behaviour dynamic is set to allow the coached to learn and feel support.
Broken Windows Theory	Broken Window Theory through the setting and adoption of visual standards for the HPT area within each plant in order to ensure that despite whatever other housekeeping issues may prevail within the plant, the HPT area remains visually appealing and act as a reminder of what is possible.

Change Management Theory	The implementation of the work design will adopt the recommendations of Change Management Theory. Firstly, a vision must be established for the destination (true north) of what the HPT system is seeking to achieve and why; a business case will be established. Champions and Guides, across both the Gemba and Management levels, will be appointed for both the implementation and the sustainment of lean improvement. Boundaries for implementations will be established to help refine the scope for each implementation, as well as aspired timings for such so training and coaching resources can be planned / facilitated. Furthermore, implementation instructions will be developed in order to help plants understand the change requirements. The instructions will also mechanisms to appoint an implementation champion, maintain stakeholder communication / engagement, as well as mechanisms to anchor the change.
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The following sections are contained within the implementation instructions and linked to the theories that apply to each area. The following includes *transparent notes* of how the derivation of the design was also synthesised using the researcher's experience.:

- HPT System Overview.

Theories that apply: High Performance Team Practices, Fractal Organisational Theory, Dunbar Number System, Balance Scorecard, Sources of Influence, Coaching Techniques, Problem Solving Techniques. *The researcher understands that the plant staffs will not have the experience to design their own empowered-team implementation, and so a change plan will need to be developed that integrates HPT routines into standard shift practices, of which the researcher is also familiar with due to his experience in manufacturing.*

- HPT Roadmap & Implementation Plan.

Theories that apply: Change Management Theory, Fractal Organisational Theory. *The researcher understands that change and project management are not necessarily skill sets that will formally exists within the plant management structure. To this end, separating the implementation into 'products' and providing a sequential (waterfall) implementation will support the plants. The researcher is also a qualified project manager, and hence is familiar with the product breakdown approach to waterfall project-type implementation.*

- HPT Coordinator / Manager (Plant-level).

Theories that apply: Change Management Theory, Coaching Techniques, Fractal Organisational Theory *The research understands that the plants each have a management structure, and a senior management team that ultimately decides or is subject to business KPIs. These staffs also represent local principal leadership. Without their support, nothing will happen.*

- Team & Pilot Line Selection.

Theories that apply: Dunbar Number System, Fractal Organisational Theory. *The researcher understands typical technology-staff (Gemba team) sizes and how the science can be accommodated.*

- Scorecard Development.

Theories that apply: Balanced Scorecard, Fractal Organisational Theory, Sources of Influence, Problem Solving Techniques. *The researcher is familiar with how KPIs are already used and misused within engineering environments – especially how Gemba staffs tend to support the KPIs that are understood by them and within their influence whilst also having an effect of their economy or welfare.*

- Category Champion System.

Theories that apply: Change Management Theory, Coaching Techniques, Transformational Leadership, Problem Solving Techniques. *The researcher has experience of local Gemba team leadership, as well as the influence that informal but influential (socially influential) staff can have on local team-members. Such influencers do not get the coaching they could readily adapt to and support a business, but are instead sometimes marginalised by leadership as they have more social influence than the leadership are able to generate.*

- Skill Certification.

Theories that apply: Balanced Scorecard, Sources of Influence, Problem Solving Techniques (element of learning and goal orientation). *The researcher is aware of skill certification for specific machine types and equipment. Such certification often infers power, capability, and hence local influencer within Gemba teams. To this end, the researcher is looking to adapt this approach toward HPT behaviours.*

- HPT Visual Standards.

Theories that apply: Broken Windows Theory, Sources of Influence, High Performance Team Practices. *The researcher has experience of Gemba teams being kept too busy to clean their areas and see first-hand the cultural erosion this causes. Hence the visual standard will be based upon military standards (researcher being an ex-engineering officer) that not only have origins within engineering-safety, but also link to standards of professional behaviour and ultimately then morale.*

- HPT Meetings.

Theories that apply: Change Management Theory, Sources of Influence, Coaching Techniques, Transformational Leadership, Problem Solving Techniques. *Being an ex-manufacturing engineer and manufacturing manager, the researcher is aware of typical manufacturing and operational shift patterns, as well as the opportunities where problem solving activities could be supported within the weekly routines.*

- Team Support.

Theories that apply: Sources of Influence, Change Management Theory, Coaching Techniques, Transformational Leadership, Problem Solving Techniques. *The researcher has been taught the fundamentals of transformational leadership through his military training & understands how to apply it within a military engineering/operations context.*

- Rewards & Recognition.

Theories that apply: Herzberg 2-Factor Theorem, Sources of Influence. *The researcher is familiar with typical budget constraints and suggestion scheme initiatives within manufacturing. However, his military training has also taught him how recognition can be metered in other ways, as well the importance of providing recognition.*

- HPT Norming Stage and Successive Launch.

Theories that apply: Tuckman Team Maturity, Transformational Leadership, Sources of Influence, Coaching Techniques, Problem Solving Techniques. *The questions pertaining to the Team Maturity assessment will be derived from researcher experience and skills as a manufacturing manager, but also a qualified military officer that has been subjected to significant leadership and team-dynamic training.*

The next section includes the implementation instructions and identifies the practices and theories where appropriate.

HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO PARTICIPATING PLANTS

HPT System Overview

Overview - Core Elements

Each plant's HPT system will include four core elements: Scorecards, HPT Meetings, Scorecard Category Champions and Skill Certification. The plant management team will create a culture of high performance utilising the system elements to leverage the greatest performance possible from the plant employees at all levels in order to achieve operational excellence

Overview - Scorecards

Each HPT within a plant will have a customised scorecard with team-level KPIs that show team performance across different categories that align with organisational operational excellence principles (categories):

- Production & Service
- Safe Workplace, and Environment & Sustainability
- Total Quality & Design for Manufacturing
- CI Culture & Visual Factory
- Empowered People
- Cost

Within each of the principle-categories each team will have circa three (3) to five (5) KPIs for which they are measured on the HPT scorecard. Those KPIs must be measured performance that team members have direct and tangible control over.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

Cost control/savings should be reflected in KPI assignment within each category. The ultimate goal is to drive team KPI performance toward business better practice and world class achievement, and the scorecard should include KPIs that have the potential to change the business for the better.

The CI category contains aspects and measurable KPIs pertaining to Total Productive Maintenance (TPM). Any other aspects of maintenance that fall outside the realm of Total Productive Maintenance should be regarded as Production and Service KPIs.

Some KPIs may require back-office data such as scrap costs or work-in progress costs. In these cases, a plant may consider using a gamified notional figure per item (i.e., HPT-coins for Work-In-Progress (WIP) or scrap) to speed up local accounting.

Overview - HPT Meetings

It is necessary for team members to have time to review performance together as a group and decide how to best improve performance. Regular and consistent HPT meetings provide the opportunity for continual performance improvement.

Overview - Scorecard Category Champions and Guides

Gemba team members will represent the principle-categories. In this role they are called Category Champions (Cat-Champs). Category Guides (Cat-Guides) or Principle-Managers (e.g., CI Manager or Safety Manager) train Cat-Champs. The support and training provided by Guides creates an advocate for that principle in the Cat-Guide, which provides the foundation for enabling empowerment to employees on the shop floor.

HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO PARTICIPATING PLANTS continued

Overview - Skill Certification

Team members must maintain technical proficiency in their respective job skill. HPT skill certification ensures that a system of standardized training is established for all employees. Job skill training (training in core Gemba technology and value-add processes) must include aspects of health and safety, quality, environmental impact, operational/process descriptions/instructions, and maintenance (basic attention to equipment). Cat-Champ training and Cat-Champ HPT skill certification is in addition to Job Skill Certification.

Overview - Work Flow

An escalation process must be integrated for issues / support regarding HPT problem solving and resolution. The workflow for analysis is as follows.

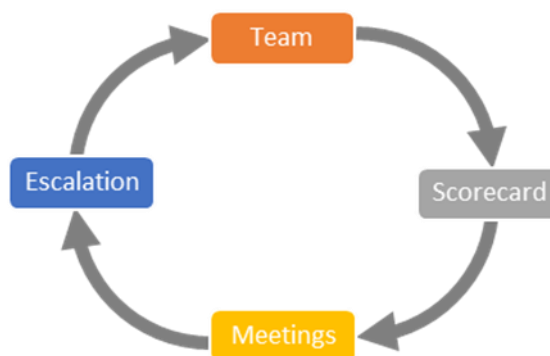


Figure 22 – A diagram of Workflow

Overview - Team Design

The following guidance on team design applies from the Dunbar number system:

- The HPT boundary is established by value stream, technology, and then area (for example: specialist production / process line + inspection/rework; and packing + dispatch etc.).

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- The HPT consists of more than just the Cat-Champs; the Cat-Champs are the HPTs Representatives that lead development & improvement within Scorecard categories. The HPT represents the entire number of people within the HPT boundary. HPTs (boundaries) may range in size e.g., 6-to-9, or 30-to-50 people (including Cat-Champs).
- Ideally, 6 Cat-Champs (6 Categories) represent the entire team within the boundary, but Champ-deputies can be used when training/rotating new team members.
- Once in the Performing Stage of Maturity, Cat-Champs should be active for a part of the year, and rotated out / replaced with other HPT members if available.
- 100% of employees participate over the course of the fiscal year, provided the active-HPT members have reached the Performing stage of the Team Maturity Assessment. Resist rotating team members until Team Maturity is in the 'Performing' stage.
- Smaller team size (bigger boundaries) equates to better oversight and development, but may not sufficiently cover the geography between where issues are discovered, and where issues are created.
- Bigger team size equates to less percentage impact to production areas i.e., as HPT Cat-Champs, 6 out of 30 people is easier to remove for a meeting than 6 out of 12 people (half the team from the production-line; hence possibly stopping the line/area from producing).
- Bigger team sizes also allow for more team members; combining more experience for look for solutions to problems and opportunities to change the business.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- Support departments such as maintenance can form their own team, and/or join other HPTs where they have a routine relationship or technical specialism.

Overview - Scorecard

The following guidance on scorecard design applies:

- Daily, weekly, and monthly KPIs should be tracked by Gemba staff (Cat-Champ or deputy) team members, so information must be made easy to obtain either directly by the Cat-Champ or through the Cat-Guide – a quick check: if it's within the circle of influence, it should be easy for the Cat-Champ to obtain.
- Balanced Scorecard measures the team's effectiveness against the business case and/or vision, and drives ownership and engagement.
- A daily review in pre-shift or start-shift meeting; daily shift meetings can be modified to discuss essential Cat-Champ items on a rotational basis so shift meetings should be relevant to the HPT agenda. The categories can be covered on a rotational basis or included by exception where key news or instructions is needed to be openly disseminated to the wider HPT members.
- To this end, the scorecard must be carefully designed by the HPT Steering Committee in order to create an objective understanding of performance and improvement; metrics eventually should become about changing the business and not just running the business.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

Overview - Meetings

The following guidance on HPT meetings applies:

- A 5-to-10-minute pre-shift / start of shift stand-up meeting that reviews current conditions and headlines for all HPT members (so best incorporated in daily shift meetings).
- A 30-minute weekly meeting for Champions to deeply review KPIs, identify top issues, and problem solve using an array of tools (8D, A3, KT, Fishbone/Ishikawa, 5-Why, Is & Is-not, SIPOC etc.) Countermeasures are developed here for gap closure, and corrective action planning.
- Learning through training and doing; perfectly normal to spend more than 1 meeting to solve a problem (develop an opportunity to change the business).

Overview - Escalation

The following guidance on meetings and attendees applies:

- Cat-Guides and Steering Committee; there must be sufficient Cat-Guides (and deputies) so there is capacity to respond in a timely manner to serve HPT Cat-Champs.
- Use a tracking tool, or record, to identify opportunities identified by, and implemented with, the HPT in order to identify and broadcast direct benefits.

**HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS *continued***

HPT Roadmap and Implementation

Implementation - Roadmap

The following roadmap provides the necessary steps for completing an implementation. The timeline should be adjusted to incorporate known initiatives, holidays, and volume related constraints. An HPT Coordinator / Manager is the suggested resource for acting as the internal (in-plant) project manager and updating the plant roadmap with specific dates and progress. The roadmap will outline key milestones or phases of progress that lead the plant to and through implementation as per Table 40.

Table 40 - HPT Implementation Roadmap

Implementation Pre-Work	Define Pilot Area (boundaries) for launch, and develop scorecard metrics and test (<i>Dunbar Number System</i>). Define meeting areas/rooms, times and communication Scoreboard (HPT Portal) (<i>Sources of Influence and Broken Window Theory</i>) Train Cat-Guides, supervisors, and shop floor employees in HPT concepts (<i>Sources of Influence</i>) Develop Skill Certification processes and training materials: roles and competences (<i>Learning Goal Theory and Sources of Influence</i>). Develop Cat Champ Certification processes and training materials: Cat-Champ role explanation, tasks, and KPIs. Perform team building activity with Pilot Area. Hold Plant HPT implementation kick-off meeting with operators.
Team Launch	Complete Cat-Champ nominations. Launch kick-off team meetings.
Certification Process	Train and complete Job Certification for all team members. Train and certify team members as Cat-Champs. (<i>Transformational Leadership, Kata Coaching</i>)

**HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS *continued***

Norming Stage Conditions	Team Scorecard $\geq 80\%$ for 2 months within a fiscal year-quarter (before scorecard is adjusted by the team for new challenges that change their business). See later section on Scorecard development (<i>Kaplan et al</i>). 90% of team members certified in Job Skill (with a 3-month grace period for new team members). 90% of team members certified as Cat-Champs (with a 3-month grace period for new team members). Team maturity assessment recognizes the team is in the $\geq$ Norming stage. Consider holding an HPT Norming Stage Recognition Event. (<i>Tuckman Team Maturity</i>)
Mature HPT Conditions	Team scorecard $\geq 90\%$ 100% of team members certified in Job Skill (with a 3-month grace period for new team members) 100% of team members certified as Cat-Champs (with a 3-month grace period for new team members) The Team Maturity Assessment at Chapter 5's ANNEX A recognizes team in Performing Stage. The Transformational Leadership Assessment at Chapter 5's ANNEX B supports team development. Through encouraging the Cat-Guides and senior leadership to improve their leadership performance toward transformational leadership, higher HPT team maturity (performing) will likely be realized more rapidly. Lower leadership performance will act as a barrier to team maturity.
Continuous Roll-Out	After pilot team achieves Norming Stage status, then continue the implementation of successive teams within the plant, auditing progress via the HPT Standard Assessment in Chapter 5's ANNEX C.

Implementation – Stability

The plan for implementation should be developed in collaboration with the Operations Director to ensure the plant is provided the best opportunity for stability during the implementation of HPT.

***HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued***

The plant or pilot area should be free from other major initiatives unless they are complimentary and have been integrated into the HPT system launch (i.e., expansion or new manufacturing lines).

Implementation - Employee and Staff Preparation (Training)

The plant will determine the best strategy for preparing their employees and launching the HPT system. Unionised plants should carefully consider the strategy for communicating the value in a manner that leverages union support for the implementation and launch of HPT. Plants should plan for completing the following training to prepare for implementing HPT (see Table 41). The training is developed by the researcher. Implementation resources are given a Table 42, and implementation times are provided in Table 43.

Training	Description	Time & Audience
HPT On-boarding: - Train the Trainer - HPT Management	Instructor Led Training (Ops Academy & HPT Regional Lead). Complete first	1 day (8 hours) Mandatory: HPT Coordinator and EP Principle-Champion
Introduction to High Performance Teams	e-Learning (pptx) module for all employees Complete prior to any other activity	30-45 min completed as a group. Mandatory: HPT Steering Committee, Champions, Guides, Supervisors, Facilitators, Pilot Area team, all plant employees
Creating Successful HPTs	Instructor Led Training Complete prior to any other activity	4 hours Mandatory: HPT Steering Committee and Champions
Leading HPTs Transformational Leadership / Kata Coaching	Classroom training Supervisors/Team Leads	3 days Mandatory: HPT Steering Committee, Champions, Guides, Supervisors, and Facilitators
Being a Part of HPTs & Teambuilding activities	Instructor Lead Training for hourly employees to convey the benefits of HPT	4 hours Mandatory: Champions, Guides, Supervisors, Facilitators, and Pilot Area team members

Table 41 - HPT Training Time

***HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued***

The following indicates the resources needed for implementation at each plant location.

Table 42 - Implementation Resources

HPT Coordinator	A full-time resource will be needed to act as a resident expert on the HPT objectives, project manager for the HPT implementation, and administrator for ongoing maintenance of the HPT system.
Team Leader	An optional resource to relieve the Supervisor of the time requirements of attending, leading, and coaching teams.
Trainer	A technical trainer for job skill training that will administer and maintain progress toward job skill certification.
Plant Category Champions	A plant management resource that is able to fully guide, coach, and mentor all aspects of the HPT system.

The following indicates the time needed for implementation at each plant location.

Table 43 - Implementation Time

Managers	• All functional managers contribute to developing Cat-Champion training materials, exams, and audits. During the design phase of implementation managers can expect to dedicate 5-10 hours a week toward HPT development work. • Once teams are launched salaried team members train Champions, attend HPT meetings, and assist teams in action planning for performance gap closure. This time dedication depends upon the progress and maturity of the team; however, subject specialists (non-Gemba managers) members should assume a minimum of 2 hours a week to review metrics and participate as described.
HPT Coordinator	• Coordinators will act as project managers for the implementation process. Prior to launching the first team coordinators will organize and conduct the meetings required to obtain all functional elements of the HPT system (scorecards, Champion certification materials, HPT Cat-Champ skill certification materials). Expect a full-time commitment over three months. • Once teams are launched coordinators take on an administrative role that depends heavily upon the maturity and ownership of the plant management staff. At minimum coordinators can be expected to experience a 20-30 hours workweek to oversee team progress and administrative work.

***HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued***

Table 43 continued - Implementation Time

Job Certification Team	• During skill certification implementation pre-work, a multi-disciplinary team with Production, Maintenance, HSE, Quality, Manufacturing, and Training representatives should expect a 5-10hr workweek for reviewing current process instructions / specifications, creating roles and competences, variation matrix and updating specifications with "I own" visual aid, warranted quality at origin and successive inspections. • Once documentation has been updated this team works in training and certifying operators.
Supervisors Team Leads Production Managers	• Prior to team launch Supervisors or Team Leads should expect 2-3 hours per week in developmental preparation. • After team launch Supervisors or Team Leads should expect a minimum of 1 hour per week developmental follow-up with Production Managers.
Plant Manager	• Prior to team launch Plant Managers should expect 2-4 hours of weekly planning and discussion meetings with their staff to: prepare and check the vision; develop and design alignment, plan and implement execution. • After team launch Plant Managers should expect a minimum of 30min-1hr per week for follow-up with their staff on HPT progress and support.

Implementation – Cost Consideration

The following are considerations for implementation costs and must be considered as costs versus the benefits of the business case: HPT coordinator; time for meetings; training time; physical assets (room/media/etc.); and software/HPT Portal (optional). To cover the meeting time during shift, overtime may be needed to cover direct operation (Gemba staff) absence for HPT meetings. Holding meetings in-shift indicates that HPT is to be a part of the daily routine.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

HPT Team Assessments, Pilot Line Selection, HPT Boundaries & Standard Assessment

HPT Team Maturity Assessment

Determining the readiness of employees within a work area to participate on a team is an essential function of planning and team success. Additionally, supervisors are considered part of their team when considering the overall team maturity. Teams should be assessed for their current state of maturity and ability to contribute as a team. Additional coaching and development may be required before some employees are able to contribute constructively to a team dynamic. The Team Maturity Assessment and Leadership Assessments in Chapter 5's ANNEXES A and B help to identify the strengths and weaknesses of the potential team members and their supervisor. The assessment should be done by an unbiased party that is able to assess the team's interactions dispassionately. The management team should use the assessment not only as a measurement but also as a first step in outlining further team development needs. Individual details pertaining to the Team Maturity Assessment are to be maintained locally / confidentially and not required for research purposes. The Assessments must be carried out by the Cat-Guides for the Empowered People Principle (see scorecard) once a per quarter for each HPT; however, this pattern can be changed to every 6 months if the plant has a high quantity of HPTs.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

Pilot Line Selection

Selecting the first line or area to implement HPT is a key decision in the HPT system. The first step is completing a team maturity assessment for each prospective team in the area being considered for the pilot. In conjunction with the assessments the considerations below will help to decide which team provides the best opportunity for success as an HPT. If there are no teams ready, according to the assessment or considerations below, the management team should consider further development of the best possible team before committing to implementation.

Key considerations for selecting the plant's pilot, Cat-Champs, and first boundary for HPT are as follows:

- Team should already demonstrate a tendency toward collaboration (teaming) – identify the innovators and early adopters in the boundary; consider a test for such as knowledge of manufacturing wastes (Transportation, Inventory, Movement, Waiting, Over-processing, Over-producing, Defects and Skills)
- Team should demonstrate the ability to be constructively critical of issues and open to feedback
- Team should be one of the higher performing teams within the area/plant.
- Team should not have any upcoming initiatives that will interfere with HPT implementation
- Team membership should be forecast to remain stable for the next 3-6 months
- Team's supervisor/team lead should be a reasonably competent leader, with potential talents suited to coaching and mentoring their team members
- Once the team assessments have been compared, the criteria above considered, and the decision is made in selecting a pilot

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

HPT Boundaries

When selecting HPT boundaries, it is important to consider the following:

- *Team size (number of people in the boundary).* The HPT represents the entire number of people within the HPT boundary including the Cat-Champs. Where possible consider that some team sizes work better than others (such as 6-10 and 20 to 50).
- *Value stream & Technology-type.* Technology (such as a dedicated manufacturing moulding line, assembly line, weaving machinery, press and welding equipment) makes for an ideal boundary; however, consideration can be given to including the operations before and after the process (the value stream) if this supports greater collaboration for problem solving (i.e., problems can start or end up in the areas immediately before and after the technology). This can also include support functions such as logistics and dedicated (most-frequently responding) maintenance staff.
- *Flow.* The 2nd and 3rd principles of Lean are concerned with removing waste and generating single piece flow within the value stream. Inventory and storage represent huge wastes to a business, so aiming for one-piece flow is common for all. If an HPT achieves one-piece flow (or close to such) for an internal customer (i.e., not making items for storage before going to the next department) then consideration can be given to widening the boundary to include what used to be a customer/supplier (2 x HPTs) arrangement into one single HPT.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- *Geography for Interaction.* Members within an HPT often need opportunity to interact informally between meetings, so having a reasonable co-location is an advantage.
- *Inspection Functions.* Having inspection functions that are associated with a technology-type included in the HPT brings a distinct advantage as this function can often collect valuable data to help solve problems and rapidly test new ideas. Furthermore, the team members within the inspection function would not be able to solve problems easily if they were outside of the technology-boundary (where some of their problems may occur) and part of another team.
- *Sustainability.* Each HPT Cat-Champ must be supported by Guides. Increasing the number of HPTs through poorly considered boundaries increases the number of Champions and hence the working commitment of the Guides. Large plants in particular should carefully consider boundaries in order to develop a practical quantity that can be effectively supported by their available Guides.

HPT Standard Assessment

The HPT Coordinator and Empowered People (EP) Category Guides are responsible for conducting the HPT Standard Assessment twice per year, and compile evidence for the senior leadership and researcher. The results of the standard assessment must be reviewed by the Steering Committee for action planning.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

Support staff may be used by the HPT Coordinator and EP Guides provided they are fully briefed on the HPT implementation instructions, and have the competency to score the assessments consistently with the HPT Coordinator and EP Guides. The following direction applies:

- The Standard Assessment and its grading criteria are provided at Chapter 5's ANNEX C.
- The Assessment is carried out twice-yearly, as a plant-wide audit of the HPT system via the Standard Assessment, an assessment calendar is to be established by the plant and provided to / approved by the Steering Committee. The Assessment Calendar will also include a window for HPT annual review against the business case.
 - The researcher can advise what evidence can be collated and used to demonstrate Assessment scores/performance to plant management.
 - The results of the first Assessment carried out by all plants will be subject to review by the researcher (this can be conducted through a visit or by Skype) in order to:
 - Calibrate assessment scores with supporting evidence.
 - Provide further clarity on what evidence can be utilized.
 - Establish a view of HPT implementation quality and performance.
 - Steering Committee Actions Plans developed in response to the first Assessment are also to be reviewed by the researcher for all plants (this can be conducted through a visit or by Skype) in order to:

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- Validate plans Action Plans for gap closure.
- Provide advice and guidance.
- Identify training requirements.
- In accord with the Assessment Calendar, the results of one of following bi-annual audits will be shared with the researcher (this can be conducted through a visit or by Skype – once per year) and thereafter managed by exception in order to:
 - Check progress against plans.
 - Identify performance improvements or issues.
 - Review and agree new plans.
 - Check assessment calibration is maintained.
- This assessment is used to inform the Steering Committee for follow-on actions
- The Assessment is for the entire plant HPT implementation regardless of commodity variations within the plant.
- A separate final Assessment for each commodity within the plant is not needed to be presented; one management team equals one plant-assessment.
- For plants with multiple HPT teams, including those across shifts, the survey is to be conducted at team-level for/with each HPT and the average score calculated for the plant-level report so that it can be reviewed by the researcher on an annual basis. Therefore, scores from HPTs across commodities within plant will be combined. Fluctuations within this calculation (low scores) are to be reviewed at steering committee level for root-causes and action plans are to be developed.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

HPT Scorecard Development

Scorecard – Cascading Goals

Scorecards are developed for teams as a reflection of overall plant goals. Plant goals are converted to team goals that are tangible to team members' daily work. It is important that team goals are tangible and in direct control of team members. It is also necessary to ensure that the performance data is readily available and as close to real-time as possible for team member review. This allows the greatest chance of corrective action against performance gaps.

Scorecard – Scorecard Structure

The HPT Scorecard is expressed in terms of points awarded for KPI performance. The total points available in an HPT scorecard is 100. Each KPI will have a range of performance expectations assigned to the HPT points, creating a graduated scale of HPT points for shop floor performance in each KPI. Following is an example:

Table 44 - Scorecard – Example of Fractally Setting a Scorecard KPI

KPI	Real Performance	HPT Points
Production (Throughput)	100 units/shift	10pts
	90 units/shift	5pts
	80 units/shift	0pts

***HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued***

KPIs will be established in this manner for each Principle-category with no more than three (3) KPIs per category. Following is only an example of a team scorecard KPI assignment.

Table 45 - Scorecard – Assignment of KPIs

Principle Category	KPI
Production & Service	Units/Shift or Units per person-hour (Option - use overall Efficiency provided it is made simple for the Star Point) Machine Utilisations (MU)%
Safe Workplace and Environment & Sustainability	Safety Audit Safety/Ergonomic Suggestions, or wider support ideas to other teams Incident / Accident is a KNOCK OUT
Total Quality and Design for Manufacture	Defects/Rejects Rework Layered Process Audit (LPA - 3-lap audit)
CI Culture and Visual Factory	5S Audit Number of Suggestions/Improvements (that change the business)
Empowered People	Absenteeism within the HPT (not just the Cat-Champs) Team Maturity % Completion to training plan
Cost	PPE Expenditures Scrap Amount of Work in Progress (3 lap audit)

**HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS *continued***

HPT Points are assigned to each KPI in the scorecard. An example follows.

Table 46 - Scorecard – Assigning Points to KPIs

Principle Category	KPI	Max HPT Points
Production and Service	• Units/Shift or Units per person-hour (must be made simple for the Cat-Champ)	10pts
	• Machine utilisation (MU)%	7pts
Safe Workplace and Environment & Sustainability	• Safety Audit	10pts
	• Safety/Ergonomic Suggestions	7pts
	• Incident / Accident	KNOCK OUT
Total Quality & Design for Manufacture	• Right-First-Time (RFT) %	6pts
	• Rework	6pts
	• LPA Audit (3-lap audit)	5pts
CI Culture & Visual Factory	• 5S Audit	9pts
	• Number of Improvements (that change the business)	7pts
Empowered People	• Attendance within the HPT (all members)	4pts
	• Team Maturity	8pts
	• % Completion to training plan	5pts
Cost	• Personal Protective Equipment (PPE)	5pts
	• Expenditures inc. losses/damage	6pts
	• Scrap	5pts
	• Amount of Work in Progress (3 lap audit)	
	Total HPT Points:	100pts

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

It is important that the distribution of HPT points across all metrics reasonably evenly balances all principles. Each category must balance against the others to create performance excellence in a holistic manner. In the example above, all categories total 17pts, except Cost and CI Culture that each total 16pts; a 1-point differential is a reasonable balance across 6 categories. A KNOCK-OUT represents an event where the entire scorecard pts within the category for that period is set to zero in view of the severity of the event. An example of the above balance scorecard set within the radar display is included within ANNEX D. Within each value for 'weight' are comment boxes that demonstrate how scores can be assigned/modified. The data and values within the sample scorecard at ANNEX D are for demonstration purposes only.

Scorecard – Baseline/Simulation of Scorecards

Before team scorecards are presented to the team, the management team should simulate the scorecard using historical data (where available). This allows management to evaluate whether the scorecard will accurately reflect true performance progress yet still challenge the teams to strive for greater performance. This process provides a baseline of data showing the scorecard has been vetted for the team. This also allows the Operations Director an opportunity to review the scorecard for alignment with plant goals and organisational expectations. Baselineing the scorecard should ideally include 3 months of historical data to provide full quarterly view of HPT scoring attached to true performance.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

An additional benefit of baselining is that it allows managers to create the most efficient process for data population in daily, weekly, and monthly KPIs. Once the scorecard is activated with the team the data must be reliably available each day, week, and month to ensure the team has timely and accurate information to measure their performance. Gaps in data availability provide an inability for teams to improve.

Scorecard – Review and Revision

Scorecards should be continually reviewed to ensure they reflect current performance and drive performance improvement. The oversight of scorecard revision is important to ensure there is a standard of performance expectation and improvement from all plants and their respective teams. The process for revising a plant or team scorecard is as follows:

1. Plant prepares the new KPIs and conducts a baseline/simulation.
2. After baseline/simulation is complete and accepted by the plant manager the researcher will review the scorecard for HPT standardisation approval.
3. The Plant reviews the proposal with the Gemba and may begin using the scorecard.
4. Category Guides establish the mechanisms for Category Champions to obtain their data with minimal disruption to their working routine.
5. HPT Coordinators and Facilitators should meet with Champions to identify any issues that they may like to have added to the Scorecard. These will need to be checked for relevance by the Steering Committee; however, consideration should be favoured as this mechanism will enable the HPT to feel they better own their scorecard – allowing for choice and enabling them to change their environment (amongst the 6 key sources of influence).

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

It is suggested that plants review the scorecards for all teams at least once per year to ensure they are aligned with annual fiscal year goals, and that the focus is maintained in further ‘change-the-business’ challenges/improvements once high performing levels are achieved.

- *Training.* Unless otherwise directed, managers will be trained either by the Plant Manager or HPT Coordinator in the following areas:
 - HPT implementation instructions (reading).
 - Training:
 - Creating Successful HPTs (Instructor/researcher Lead Training – HPT Coordinator).
 - Leading High-Performance Teams (Instructor/researcher Lead Training – HPT Coordinator).
 - Kata coaching training.
 - Transformational Leadership training.
- *Demonstrated applied learning.* Guides are required to demonstrate their ability to function as a Guide according to the training and concepts provided. This drives accountability, and should form part of their annual objectives. The following outlines the minimum requirements for satisfying this section:
 - Develop training for their respective Cat-Champs, to include:
 - An understanding of KPI development and functionality within the scorecard within the Champion’s functional category.
 - General awareness of the business case for HPT.

HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO

PARTICIPATING PLANTS continued

- Develop Cat-Champ routine tasks and task-audit process for scorecard assessment.
- Demonstrate practices learned in the coaching course.
- Demonstrated ability to convey the vision or business case for HPT to the Cat-Champs.
- *Certification.* Upon completion of the training, tasks, and coaching course the Guide will be reviewed by the Plant HPT Coordinator and/or the Plant Manager who will determine whether the Guide is certified or not. Once certified Guides are able to subsequently certify Cat-Champs. Plants will have at their discretion the right to de-certify a Guide that fails to consistently provide the level of leadership, coaching, and mentoring expected to support and develop Champions.

Champions – Champion Certification

All active team members will certify and function in Champion roles within their team.

Each Champion represents one of the following Principles:

- Production and Service
- Safe Workplace
- Total Quality
- CI Culture
- Empowered People
- Cost

The following requirements must be met in order to certify Category Champions (Cat-Champs / Champions):

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- *Training.* Each team member pursuing their Champion certification will be trained, coached, and mentored by their Guide. That training will include the following at a minimum:
 - The Role of Category Champions
 - Category Champion Tasks
 - KPIs
 - Escalation and Support process
 - Communication process
 - KT or Simple Problem Solving (A3, Fishbone/Ishikawa, 5-Why, Is & Is-not, SIPOC⁴ etc.).
- *Demonstration of applied learning.* Champions will need to demonstrate their understanding of training by passing a written (multiple choice) exam. Their HPT tasks will be audited by the Guide to ensure they are being completed consistently, and Guides will attend meetings to review the Champion's interaction with the team.
- *Certification.* Star Points must achieve all the following to certify:
 - Pass written test with a score of 80% or greater.
 - Complete 100% of tasks over consistent period to include:
 - Consistently communicate KPI results in all HPT meetings.
 - Communicate all Champion messages provided by the Guide.
 - Conduct themselves in accordance with organisation fundamental values (where explicitly stated).

⁴ SIPOC – Supplier, Input, Process, Output, Customer (6-sigma process analysis tool)

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- Champions must continue to perform tasks consistently or they may be de-certified. Guides will continue to audit Champion tasks to ensure consistent and timely completion.

Skill Certification

Skill Certification – System overview

Job skill certification ensures that each employee has been provided training to perform basic job skill functions in their assigned position on the shop floor. Employees validate training through both written and practical exams to ensure that training materials have been understood and demonstrated to a satisfactory level that ensures skill proficiency expected in line operation. Additionally, job skill certification takes into account employee behaviour to ensure that they complement the area with a team mindedness attitude that will allow collaborative work and innovative approaches to continual improvement during their employment.

Job skill proficiency is identified in three levels of operator competency:

- Basic – has the skills to perform a job function.
- Advanced – has exceptional skill and consistently performs in the top performance levels of expectation.
- Expert – has mastery level skill and has the technical and behavioural expertise to train others.

***HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued***

Skill Certification – System overview

HPT skill certification ensures a comprehensive understanding of the impact of Safety, Environmental, Quality, Process, and Maintenance within each skill. Skill certification is validated through the written and practical exams indicated above. A score of at least 80% is required for the written exam and 100% for the practical are required for certification. Additionally, the certifier will validate performance with the trainer/champion that conducted the training as well as the supervisor of the certifying employee. Employees are ideally required to maintain certification, which may be required on a recurring basis.

HPT Visual Standards

Visual Standards – Overview

The visual standards are put in place to define how HPT information and data is shared throughout the plant.

Meeting areas should be established so that teams have the ability to focus on the meeting agenda without interruption or distraction. Ideally, they should be located near the working area (provided noise-levels allow) so that the team feel the board is part of their operations, and that other staff can see the meeting and activity (modelling the right behaviours). Furthermore, this emphasizes the need for Guides to come to the team; which is also modelling the right behaviours.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

The HPT meeting area acts as a focal point for weekly meetings, information display, and problem-solving activity (with and without Guides) – the quality of the area is key to role modelling the right behaviours. Located within or adjacent to the working area (within the HPT boundary), the HPT must feel a sense of ownership and familiarity for the area (so preferably not to be located within a conference room in the administration areas of the plant). There is to be sufficient space for the meeting, and consideration to local noise levels; i.e., located away from areas where hearing protection would otherwise be required, or use a microphone/speaker for larger HPT meetings in areas of medium ambient noise. Provided each team's requirements can be accommodated, the meeting areas can be shared by more than one HPT; however, consideration should be given to meeting cadence should different HPTs need to run their meetings at the same time (for HPTs on the same shift).

Visual Standards – Shop-Floor (Gemba)

The Pilot Area is the HPT model for the rest of the plant to aspire to, and should be leading the plant visually. Additionally, the CI / Visual Factory Champion should be the team leader in adhering to the visual standards.

Adherence to the visual standards is not only for safety, but also for efficient knowledge exchange. While these policies should be in place already, it is best to verify that the Pilot Area is compliant with the following:

- Floor markings.
- Required PPE.
- Location labels for all parts.
- Minimum and maximum labels for all parts.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- Process procedures / standardized work posted.
- Andon system.⁵

The following image demonstrates how an HPT area can be integrated into an existing operations hub (Quick Reaction Quality Control - QRQC - actions and improvement) and represent good practice.



Figure 23 – Exemplar Indication of an HPT Area – Visual Standard

Visual Standards – Meeting Area

Following on from the above, the meeting area must contain the following data for each team (boundary) that uses the meeting area:

- A. Team Name (designation).
- B. Champion and Guide names (with pictures) using graphics as a centre point.
- C. Updated Balance Scorecard, with scores and radar graphic, plus a trend chart for each of the HPT high level metrics (scorecard categories).

⁵ Andon; a system for Gemba staff to notify local management of a problem or issue needing immediate attention.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- D. Data collection sheets/metrics for each KPI.
- E. Open actions display board (Action Plans) for CI (change the business) activities that includes the facility to track benefit/impact from CI Tracking tools.
- F. Latest Team Maturity Assessment.
- G. Latest set of HPT meeting minutes.
- H. An area for problem solving (table/board etc.); optionally, this area can include templates for routine problem solving/root-cause analysis (A3, 5-Why, Ishikawa, frameworks etc.). The area should either accommodate/display the results from the problem-solving templates within item E, or contain such to be accessible within the area.
- I. Escalation Procedure

Items B, C and D can be stored and displayed electronically if that helps optimise the use of space.

Visual Standards – Revision Process

Any changes to the visual display on the shop floor should be approved by the Visual Factory and/or Continuous Improvement Champions and Guides. New policies or revisions to the Visual Standards will be discussed at the HPT meeting so the team is completely aware, and the Champions can adjust their tasks if necessary.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

HPT Meetings

HPT Meetings – Overview

HPT Meetings provide a time and space for team members to evaluate performance gaps and action plan for gap closure. This is an essential function to promote team growth and maturity that results in improved performance on the shop floor.

HPT Meetings – Timing

Teams are provided a limited time to conduct team meetings. Those meetings are as followed:

- *Daily Meetings.* A 5-to-10-minute pre-shift/shift-start stand-up meetings with Champions and other HPT members within the boundary that review current conditions (i.e., were the goals met yesterday and what is to change today) and headlines for all HPT members (so best incorporated in daily shift meetings). Guides and senior managers are asked to attend on a routine basis (not every meeting) ensure support and behaviour role modelling.
- *Weekly Meetings.* A 30-minute weekly or 60-minute fortnightly meeting for Champions and Guides (where required) to deeply review KPIs, identify top issues, and problem solve using an array of tools (A3, Fishbone/Ishikawa, 5-Why, Is & Is-not, SIPOC etc.) Countermeasures are developed at this point for gap closure, and corrective action planning. A copy of the minutes format and evaluation is given at ANNEX F.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- *Steering Committee Meeting.* The HPT Steering Committee will need to meet in accord with the following rhythm:
 - Weekly during the HPT's Forming Stage
 - Every 2-weeks during the HPT's Storming Stage
 - Every 3-weeks during HPT's Norming Stage
 - Monthly once the teams reach the Performing Stage

The HPT Coordinator is to use the Team Maturity Assessment to trigger the meeting rhythm. The Steering Committee meeting must review the implementation status against the roadmap, track benefits and review team maturity reports / issues to identify areas for effort/improvement.

- *Monthly Meetings.* Plants can optionally consider a monthly HPT collaboration event, where HPTs come together to share experiences and problem-solving techniques, plus report headlines to each other and the management team. Guides will need to allocate time (minimum 30 minutes) to develop Champions and provide supports either within weekly meetings, or mutually convenient opportunities depending on working patterns and/or urgency.
- *Ad-hoc Meetings.* Ad-hoc meetings may be required as follows:
 - Regular meetings/interaction are needed between the Guides and the HPT Coordinator to discuss Guide support, team and Champion development.
 - Plant Leadership must recognise high performing teams by meeting with them to discuss projects and initiatives; providing time at quarterly meetings for high performing HPTs to present their findings/journey.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

HPT Meetings – Support and Escalation

Teams will have the support through each hierarchical level of the entire plant population. Managers and salaried staff will provide support on an as-needed basis to teams. As the teams encounter issues with root cause analysis or gap closure action planning, they have the ability to escalate the issue. The Facilitator, Team Lead, Supervisor, or HPT Coordinator may escalate a team issue to a support team or senior leader.

Plants will need to consider the establishment of a network of Guide support (Guides with Deputy Guides, or Lead-Guides with Guides) to ensure that HPTs can be supported in a timely manner. Certification will be required for all deputy roles akin to Guides, with leadership ensuring that they have the commensurate coaching skills and specialist expertise to appropriately support HPT maturity and Champion development.

In instances of deep/complex improvements that change the business, the support team will meet for 30 minutes to 1 hour to have time for completing root cause and gap closure action planning on behalf of the HPT. The support team will consist of the internal experts in the areas that are required to address the issue effectively. Once the support team decides upon an action, they have the responsibility to communicate their findings and decisions to the HPT. Any applicable actions are added to the HPT's action list for completion.

In the event of the HPT Coordinator experiencing difficulties beyond their sphere of influence or control within plant in order to obtain support and considered interventions, they are to escalate such matters to the researcher.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

Team Support

Team Support – Overview

Teams will require a great deal of support from everyone in the plant to ensure they continue to mature and improve. Support will include but is not limited to the following roles.

- *Plant Manager.* The Plant manager is the owner and leader of the HPT system in their facility, and provides resources to ensure a successful launch of the HPT system. He or she communicates the vision of the HPT system at all levels at their site, assists each HPT with overcoming obstacles, and promotes the high-performance approach. The Plant Manager has specific responsibilities as follow.
 - *Plant Manager - Scorecard.* Plant managers should ensure that team scorecards are reflective of true plant/area results. Team scorecard goals should be established so that they are challenging enough to create continual performance improvement if goals are achieved, but not so challenging that they are insurmountable. In a plant that has fully implemented HPT within all areas of the plant the average top-line of all team scorecards should be nearly identical to true overall plant performance.
 - *Plant Manager - Certifications.* Plant managers should ensure that team members diligently pursue and maintain both skill certification and Category-Champion Certification by holding their management team accountable toward training, coaching, mentoring, and certifying all plant team members.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- *Plant Manager - Meetings.* Plant managers must not only attend HPT meetings but also ensure all functional managers attend meetings. In the early months of a team's development, it is essential that the team has regular attendance by members of the management staff to ensure that the team is coached on behaviours, scorecard analysis, problem solving, and decision making. Lacking attendance by management may be perceived by the Gemba as an unwillingness to support or inability to lead a high-performance environment.
- *Organisation (Plant) Manager - Reporting.* Plant managers will be responsible for reporting progress toward implementation, scorecard performance, skill certification, and Champion / Guide certification to regional leadership and/or wider stakeholders.
- *Principle Manager/Category Guide.* Guides are responsible for leading the implementation of the HPT system in their area, coaching their supervisors to assume the expected leadership styles and behaviours, monitoring the completion of their teams' action plans, promoting collaboration between support staff and production areas, and providing resources as needed. The Guides have specific responsibilities as follow.
 - *Principle Manager - Scorecard.* Guides should ensure that team scorecards have accurate results on a daily, weekly, and monthly basis. Teams require timely KPIs to make decisions on performance improvement and it is the Guide's responsibility to consistently provide that information on-time.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- *Principle Manager - Certifications.* Guides are responsible for training, coaching, mentoring, and certifying Category Champions. Guides will develop training materials, exams, and audits for their Champions to ensure that they are educated and trained to take on the responsibility of being an advocate and representative of the Guide's principle (HSE, Quality, CI, Empowered People (human resources), etc.). They support team members by taking a pro-active role in coaching and mentoring Champions so that they improve in overall maturity and effectiveness within their teams.
- *Principle Manager - Meetings.* Guides must consistently attend HPT meetings. Especially so within the early months of a team's development, it is essential that the team meetings have regular attendance by members of the management staff to ensure that the team is coached on behaviours, scorecard analysis, problem solving, and decision making. Lacking attendance by management may be perceived as an unwillingness to support or inability to lead a high-performance environment.
- *Principle Manager - Reporting.* Guides will be responsible for reporting progress toward scorecard performance, Job certification, and Cat-Champ certification to the HPT Coordinator and Plant Manager. Teams may request additional information that will be integrated into plant-level communication and reporting as needed.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- *Non-Gemba Specialist Staff.* Specialist indirect staff (i.e., quality technicians, safety officers, human resource officers, manufacturing engineers etc.) may also deputise for the Category Guides. Beyond the responsibilities of being a Category Guide (if such is the case), specialist staff have specific responsibilities as follow.
 - *Non-Gemba Specialist Staff - Scorecard.* Specialist staff members will need to contribute as needed to ensure the data received for team scorecards is timely and accurate. It may be necessary to interact with teams during their HPT meetings to better understand their needs and challenges with scorecard comprehension.
 - *Non-Gemba Specialist Staff - Certifications.* Specialist staff may be called upon to validate or audit team member performance or achievements to help in the certification process. It is essential for team members to achieve and maintain both Champion and skill certification; salaried staff may be tasked in various ways to assist in this pursuit.
 - *Non-Gemba Specialist Staff - Meetings.* Specialist staff may be called upon to attend HPT meetings on an ad-hoc basis to help teams in root cause analysis or problem solving.
 - *Non-Gemba Specialist Staff - Reporting.* The HPT Coordinator will be preparing a weekly report of whether scorecard data was provided on time and accurately. This may require salaried staff to report information to the HPT Coordinator on a weekly basis. The management team may request additional reporting as needed.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- *Supervisor.* Supervisors may also deputise for the Category Guides. Beyond the responsibilities of being a Category Guide (if such is the case), supervisors have specific responsibilities as follow.
 - *Supervisor - Scorecard.* Supervisors can best support their teams' scorecards by ensuring team members have a thorough understanding of all KPIs and maintain visibility of those KPIs so that they strive for continual improvement on a daily basis. Furthermore, supervisors will best support their teams by ensuring team members draw the correlation between scorecard performance and actual work completed on the shop floor.
 - *Supervisor - Certifications.* Supervisors can best support their teams' certifications by ensuring they remain attentive and timely toward completion of those certifications. Making time for certifications ensures a thoroughly trained team member that can contribute more fully to the shop floor and company business targets.
 - *Supervisor - Meetings.* Supervisors will need to ensure that teams are provided with the time and location to meet for the most effective meetings. Ensuring team members arrive to meetings and return to their work areas after meetings is critical to ensuring the most efficient use of time during production campaigns.
 - *Supervisor - Reporting.* Supervisors are ultimately responsible for the performance of their teams and will be responsible for reporting on the progress of each team's scorecard, skill certification, and Champion

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

certification. The plant management team may require specific reports that apply to HPT performance as needed.

- *HPT Coordinator.* The HPT Coordinator is responsible for monitoring the successful implementation of the HPT system, ensuring compliance with the implementation instructions, mentoring and certifying the Champions and team facilitators in their role, and reporting on the performance of the key features. HPT Coordinators may also deputise for the Category Guides. Beyond the responsibilities of being a Category Guide (if such is the case), HPT Coordinators have specific responsibilities as follow.
 - *HPT Coordinator - Scorecard.* The HPT Coordinator can best support teams by ensuring scorecards are complete, contain updated data, and that data is available to teams on time each week (or in timely manner). Missing scorecard data should be addressed as soon as possible with the appropriate Guide. Additionally, HPT Coordinators can provide insight to team members on KPI definitions in the absence of Guides.
 - *HPT Coordinator - Certifications.* HPT Coordinators are responsible for ensuring the certification matrix for Champions and skill certification is current and updated. The HPT Coordinator will instruct Guides on how to create certification materials and conduct audits and exams for Champion Certification.
 - *HPT Coordinator - Meetings.* HPT Coordinators attend HPT meetings, especially so during the launch phase of HPTs, to provide guidance on meeting structure, team behaviour, and execution of deliverables. HPT

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

Coordinators conduct meetings to train Facilitators and administer exams for Cat-Champion Certification. Additionally, HPT Coordinators attend the Steering Committee meetings to provide such with an insight on HPT system progress and status.

- *HPT Coordinator - Reporting.* HPT Coordinators will provide a minimum monthly progress updates as a minimum to the plant management as well as any case study insights to the researcher. The HPT Coordinator is responsible for ensuring the Plant Manager is aware of the exact status of the HPT system in the plant and will report as needed to ensure the Plant Manager has all necessary information.
- *Facilitator/Team Lead.* Facilitators / Team-Leads have specific responsibilities as follow.
 - *Facilitator/Team Lead - Scorecard.* The Facilitator/Team Lead can best support teams by ensuring team members are engaged and responsible for their section of the team scorecard.
 - *Facilitator/Team Lead - Certifications.* Each team member should be responsible for their Cat-Champ and skill certifications and the Facilitator/Team Lead will help team members to understand their progress and responsibilities toward that certification.
 - *Facilitator/Team Lead - Meetings.* Facilitators/Team Leads will be responsible for conducting the team meetings and ensuring each team member contributes accordingly. Facilitators/Team Lead ensure the meetings remain on time, on topic, and constructive.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- *Facilitator/Team Lead - Reporting.* Facilitators/Team Leads will be responsible for ensuring all display boards have been updated in a timely manner by team members, month-end data is completed and available for supervisors and HPT Coordinator(s), and team members are able to communicate their performance to any management staff as requested.
- *HPTs Local Steering Committee.* The HPT Steering Committee is a site-specific council to review general performance and status of the HPTs, and includes participation from the Plant Manager, the HPT Coordinator, Guides and Area Managers. Depending on the organizational structure of the plant, multiple committees may be created to focus on certain aspects of the process such as the design of the HPT system or the implementation of the HPT system. The following are two examples of focused Steering Committees.
 - *HPT Design Steering Committee.* The main responsibilities of an HPT Design Steering Committee might be to:
 - Define objectives and scope for the plant's HPT system.
 - Ensure a close follow up for the HPT system implementation.
 - Provide required resources for both HPT system implementation and operation.
 - Review general performance of HPTs at the plant.
 - *HPT Implementation Steering Committee.* The main responsibilities of an HPT Implementation Steering Committee might be to:
 - Develop training materials for the Category Champions certification process.
 - Train and certify the Category Champions.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

- Define and evaluate HPT scorecard metrics.
- Define and audit Category Champion task.

Rewards and Recognition (R&R)

R&R – Overview

The HPT culture requires a system be in place for rewarding and recognizing the teams or individuals that have excelled and are performing better than any other team or individual. The Plant Steering Committee defines any KPIs required to achieve recognition. The following elements should be considered when defining a reward and recognition system:

- Consider the basic pay for Category Champions and how these fit with regional norms. Consider if HPT performance can be linked to an extant bonus scheme or ancillary duty payments if such an opportunity exists.
- Where appropriate, make the recognition public; however, consideration should be made for private recognition depending upon the disposition of the affected individuals.
- Involve the HR Manager to verify the recognition matches the Plant system.
- Deliver recognition to the right person.
- Ensure recognition is timely and given as close to the achievement as possible.
- Offer rewards and/or recognition on a monthly, quarterly, and annual basis.
- Consider gamification of the scheme, especially if rewards are of a lower fiscal value.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

HPT Norming Stage Process

HPT Norming – Overview

The HPT Norming Stage status is a status achieved when the plant has demonstrated the ability to successfully launch an HPT system, ensuring that the initial team is able to perform technically and behaviourally at a level that increasingly improves plant performance over time, and that the management team and specialist staff successfully support at least one team to a point of maturity through to the Norming Stage (Tuckman's Curve).

HPT Norming – Requirements

The Norming Stage status is achieved when the following criteria have been satisfied:

- *Scorecard Results.* Maintain a monthly scorecard of above 80% for at least 2 months within a fiscal year-quarter
- *Category Champions.* Over 90% of active team members are certified in at least one Cat-Champ role
- *Skill Certification.* Over 90% of team members are certified in at least one skill certification.
- *Team Maturity.* Team maturity assessment indicates the team is in the Norming Stage

The Empowered People Champion is to monitor the above performance indexes and then request Norming Stage status from the HPT Coordinator, who will record the achievement.

*HPT WORK DESIGN AND IMPLEMENTATION INSTRUCTIONS TO
PARTICIPATING PLANTS continued*

HPT Norming – Next Steps

Once the first HPT within a plant has achieved Norming Stage status the plant may implement HPT in successive areas at the plant's discretion. After Norming Stage, teams should be expected to achieve greater performance:

- *Scorecard Results.* Maintain a monthly scorecard of above 90%.
- *Category Champions.* 100% of active team members are certified in at least one Cat-Champ role.
- *Skill Certification.* 100% of team members are certified in at least one skill certification.
- *Team Maturity.* Team maturity assessment indicates the team is in the Performing stage.
- *Meeting effectiveness.* Team meeting effectiveness and attendance is greater than 90%.

CHAPTER 6 – RESEARCH METHODOLOGY AND REVIEWS OF A LEAN-CULTURE DESIGN

Research methodology and case study evaluation of a lean-culture socio-technical work design within 6 manufacturing plants, developing high-performance teams as a mechanism of rapid organisational cultural change to support lean implementation

Summary

This Chapter explains the research methodology that is to be used to test the work design at Chapter 5. The research approach will consist of case studies, wherein data will be obtained and analysed in order to test for cultural improvement and/or an improved suitability toward lean and continuous-improvement using an already-established 3-level framework for organisational culture. The 3-levels within the framework include the following: underlying assumptions; espoused values; and artefacts. Six (6) plants were reviewed as case studies for HPT implementation using the lean-culture socio-technical work design. An established cultural analysis framework was used to segregate 3 levels of evidence from each plant: underlying assumptions (the assessed quality of work-design implementation – the assessment of the implementation standards / standards-assessment); the espoused values through qualitative interviews with HPT Managers; and artefacts obtained as part of the standards-assessment. In order to ensure anonymity, the plants were assigned code-names, and all organisational branding was removed. Whilst a small measure of analysis is provided within this chapter as part of the collected data pertaining to underlying assumptions within the plant, the results are methodically collated and analysed in greater depth within Chapter 7.

Background

The socio-technical network (C Clegg, 2014) identifies the core components and relationships of an organisation that utilises both technology and people in order to develop value in terms of a service or a product. The research thus far in Chapters 1 to 4 have indicated the following:

- Cultural conditions represent a significant barrier to lean (and CI) implementation and sustainment (see Chapter 2).
- That socio-technical networks offer a solution to improve organizational culture (node #6) through improved work design in the remaining nodes (#1 to #5): people; goals; processes and procedures; infrastructure; and technology (see Chapter 1).
- When viewed as a socio-technical network, there are commonly occurring shortfalls in work design (see Chapter 3).
- Various theories and techniques exist to improve each socio-technical node, and these can be combined into a lean-culture socio-technical work design with a view to rapidly establishing the cultural conditions needed to support lean and CI (see Chapter 4).

Research Methodology

The following sections are contained within the methodology:

- Case study question.
- Case study proposition – the HPT (High-Performance Team) mechanism; the lean-culture work design.
- Researcher Entry Role.
- Case-study-plant selection.
- Assessment framework and data logic, including data collection methods for:

- Assessments for socio-technical implementation.
- Qualitative interviews for espoused values.
- Artifacts.
- Plant coding and descriptions.
- Plant interaction – including implementation, data collection for the interview and the survey and interview notes taking.
- Data Creation and Collection Overview.
- Criteria for interpreting findings.
- Ethics.

Case research approach and study question

The research design is comprised of a case study format with five components: questions, propositions, cases, logic linking data to propositions and criteria for interpretation (Yin, 2018).

The case studies seek to answer the following question: can a lean-culture socio-technical work design be developed and successfully used as a mechanism for rapid cultural change to support lean and CI?

Case study proposition – the HPT (High Performance Team) mechanism; the lean-culture work design

Using data from Chapters 2 and 3, the research developed a set of thorough instructions for the implementation of a lean-culture work design within a manufacturing plant. Within the test organisation (the company), this work design is referred to as High Performing Teams (HPT). These instructions represent the mechanisms for rapid organisational culture change for lean /

CI: the fundamental aim of the research. It is proposed that all cases implement the HPT work design so that later cultural analysis (case study assessment framework) can identify if the desired cultural change and subsequent improvement in lean / CI adoption can be realised within a 1-year implementation timeframe. The detailed lean-culture (HPT) work design and implementation instructions are contained within Chapter 5.

Researcher Entry Role

The researcher held two different working position throughout the research:

- *During HPT Implementation.* During HPT implementation the researcher was employed as the test company's Regional Leader for HPT implementation across the EMEA region (Europe, Middle East and Africa). The research was accordingly granted full access to the test-plants with the authority of the Manufacturing Excellence Director for the EMEA region. Physical resources were provided by host organizations, as well as funding for travel and subsistence where required. The HPT work design was agreed for implementation as part of the company's manufacturing excellence framework. The responsibility for framework implementation was with the Operations Directorate for each region. The researcher was not employed within this chain of command, and instead held an internal consultancy role that was independent of operational leadership.
- *Post HPT Implementation – At the Qualitative Interview.* At this point in time the researcher was no longer an employee, contractor or visiting-academic for/to the company. The benefit in this case was that participants could be assured of no corporate reporting linkage, and anonymity could be independently assured. By this point in time the company has HPT implementation instructions, framework and sufficient experience to no longer require the services of a regional HPT implementation leader.

Case Study – Plant Selection

Six (6) plants were selected for case study focus. The system (implementation instructions) will be implemented across all plants owned by the company; however, in order to keep the research to a practical level of effort within the available timeframe, 6 plants were specifically selected for case study, and commenced their implementation in advance of other plants. The plants were code-named for the research, and selected in view of the following:

- The HPT implementation was monitored at each plant to ensure progress was made.
- The plants undertake differing aspects of the manufacturing cycle (from raw material to finished goods supplied to the OEM) so each contains differing technical challenges.
- The plants are not all from one country within EMEA, so ethnic cultural factors can be de-emphasised along with regional pay differences.
- The data pertaining to % implementation against the design will be obtained through the HPT Standards Assessment, and this was used to ensure that there is deviation between implementations in order to validate aspects of the HPT work design, whilst also ensuring that sufficient implementation progress would have occurred to either validate or invalidate the work design's purpose: ultimately to improve lean / CI implementation.

Assessment framework and data logic

This research will utilise the 3 levels of cultural analysis (Schein, 2010) and be presented as a hierarchical pyramid as per Figure 20, indicating that each level is contingent upon the one beneath it.

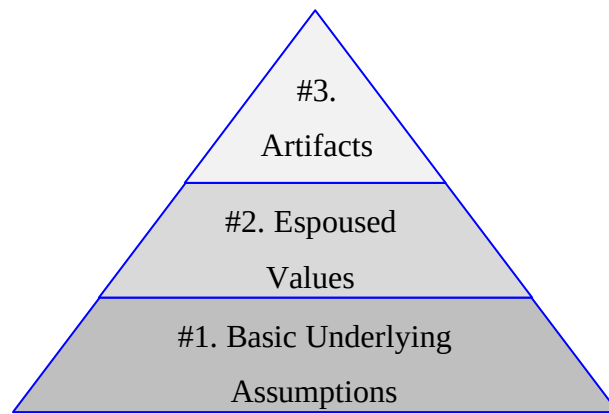


Figure 20 - 3-Level Framework to Identify Organisational Culture

The data logic for the study is thus:

- The basic underlying assumptions (level #1) will be that each plant will have implemented the lean-culture socio-technical work design, as specified in Chapter 5, for HPT implementation to a reasonable degree of completeness (at least to such a degree that meaningful data and conclusions can be drawn from the next two framework levels considerate of how much implementation is incomplete). In order to validate this assumption, the plant's HPT standards have been assessed by the HPT Standard Assessment (also featured within Chapter 5). The Standard Assessment results have been obtained, and the shortfalls (gaps) in completion identified against their socio-technical node with a small remark on the impacts that could be espoused.

If the HPT work design has established a set of underlying assumptions to improve the culture toward lean/CI then these will be identified as assumptions and identified as such within Chapter 7.

- The espoused values (level #2) can be gleaned from qualitative interviews with the HPT Coordinators / Managers of each case-study plant. These staffs do not have direct line management responsibility for the Gemba-based employees that constitute the majority of the workforce, and the largest (key) target for organizational culture change. The absence of direct line management responsibility within a collaborative work setting

better enables open and honest communication channels without repercussion. Furthermore, the data collection needed for team maturity and transformational leadership scores that are part of the work design will prompt the need for this type of frank dialogue between Coordinator and Gemba employee. If the espoused values support the notion that culture has been changed in the desired direction, then artifacts should be available to support the advocacy.

- The artifacts (level #3) are obtained from a mixture of sources including such as:
 - Photographs / images of infrastructure and events.
 - Scorecard data (team performance) and other (performance) documentation.
 - Direct observations from the HPT Coordinator and researcher.

The artefacts are obtained through standards assessment site visits and affixed to the standards assessment (and hence supplied to the research through this mechanism).

Plant Coding and Descriptions

Six (6) plants were selected as per Chapter 5 and assigned codenames. There codenames are Cleese, Chapman, Gilliam, Idle, Jones and Palin. The basic plant details are as follows:

- Cleese Plant. Cleese is in Romania. It is a seat-trim manufacturing plant comprising high volume material (fabric) cutting and sewing processes building products for supply to an assembly plant. The plant has been established for +6 years at time of implementation and retains +1000 employees working a 24-7 shift system.
- Chapman Plant. Chapman is also located in Romania. It is a metal component manufacturing plant comprising of high-volume press and welding machinery building products for supply to an assembly plant. The plant has been established for +5 years at time of implementation and retains +400 employees working a 24-7 shift system.

- Gilliam Plant. Gilliam is in Turkey. It is a metal component manufacturing plant comprising of high-volume press and welding machinery building products for supply to an assembly plant. The plant has been established for +8 years at time of implementation and retains +500 employees working a 24-7 shift system. The facility was built specifically for the organisation.
- Idle Plant. Idle is in Slovakia. It is a fabric manufacturing plant comprising of high-volume winding and weaving machinery building products for supply to a trim plant. The plant has been established for +15 years at time of implementation and retains +200 employees working a 24-7 shift system.
- Jones Plant. Jones is in the UK. It is a foam manufacturing plant comprising of high-volume injection foam moulding and trimming machinery building products for supply to an assembly plant. The plant has been established for +10 years at time of implementation and retains +400 employees working a 24-7 shift system.
- Palin Plant. Palin is in Serbia. It is an assembly plant, comprising of various flexible manufacturing lines for finished component assembly before delivery to the OEM (Original Equipment Manufacturer). The plant has been established for +4 years at time of implementation and retains +300 employees working a 24-7 shift system. The facility was built specifically for the organisation.

Plant Interaction

Implementation

The implementation started with initial training being provided for local implementers; these implementers represent the facilitators/coordinators/managers that are located at the plant with the specific responsibility of implementing the system and synthesising and requirements into

local infrastructure and language. These staffs were provided with the High-Performance Team design and instruction guide, including rationale behind the application. This required 2-days management-team training per plant with PowerPoint developed within the corporate style. This training was also provided to the plant management team. Additional days were allocated to the facilitator beyond the 2 days training, with a total of 1 week being spent with the facilitator to help develop plant-specific scorecard goals and implementation plans. A follow-up visit for 1-to-2 days was then had 3-to-6 months after the initial training to support implementation and attempt to address any local issues. The researcher facilitated all of the aforementioned training. The researcher is qualified to teach in the lifelong learning sector (QTLS certified) with a professional graduate certificate in education (PGCE). Schemes of work, lesson plans and teaching resources were created for each training session. Throughout the whole process, from initiation to review, this was supported ad-hoc remotely using Skype-for-Business communications. As the work design required plant management to undertake a shift toward transformational leadership, a specialist training course was provided lasting for 2.5 days based upon the Work of Leaders system by Wiley (Davis, et al., 2013). The researcher was trained by approved Wiley providers, and delivered the leadership training in person to the management teams within each plant. This also enabled the researcher to contextualise some of the learning in two ways:

- Forward looking; contextualising the establishment of a vision to support the new work-design implementation and explain how the learning could support new routines and behaviours that are measured as part of the work design.
- Rearward looking; using the researcher's considerable experience within manufacturing and operations management, the researcher was able to draw out experiences of good and poor practice in order to improve the learner's understanding.

The ability to contextualise the learning arguably improved the effectiveness of the training. Furthermore, the ability to use either forward or rearward looking contexts improved inclusion as not every learner, at the point of training, was necessarily highly motivated toward the future possible opportunities that the new work design may provide (i.e., they were not convinced of the new work design); however, the use of rearward looking experiences potentially enabled them to avoid the bias of their lack of conviction and view the learning from a perspective of improving their existing practices.

Training dates varied in accord with wider commitments; however, all plants received training before the assessment point. Furthermore, all plants received written and verbal guidance along with individual Work of Leaders assessments at the start of the implementation. The individual assessments provided data on their personal leadership style as per the DISC model (Dominant, Inspiring, Supportive, Conscientious). The assessment provides data on strengths and areas for development.

Data Collection – Interview and Survey

The review visit lasted for 1 day per plant, started at 0900(am) and finished circa 1600(pm).

The agenda/order was as follows:

- Review / complete the Implementation Standard Assessment with evidence to ensure the percentage Likert scale was used accurately. Evidence may include the following.
 - Training records.
 - Meeting minutes / coaching records for the following: plant-level steering group meetings, HPT meetings, champion and guide coaching meetings.
 - Continuous Improvement records.
 - Collected fiscal data.
 - Scorecards.

- Action plans.
- Completed team and leadership surveys.
- Project plans.
- A Gemba walk to review infrastructure and identify artefacts; obtain photo records of either previous use or actual use.
- Semi-structured interview using the questionnaire.

Interview note taking

Local notes were taken by the researcher from the verbal exchange and typed into the answer boxes (presented later in this chapter for each plant). Where language barriers presented an issue, the researcher had translations made using indigenous staff that possessed English as a second language. The translations were then agreed with the interviewee. Therefore, the responses are not a transcript as the interviews sometimes required extra conditioning to ensure that the correct meaning had been transferred. Given that some of the evidence for the Standard Assessment was presented in the local language, and that 5 of the 6 plants did not have English as a first language, the English plant took less time as no time for translation was needed. The same approach was adopted for consistency/simplicity, with the researcher taking notes that were then typed up into the response boxes.

Analysis

The notes were then thematically analysed using a template consisting of 2 rows divided by 6 node rows wherein assumptions, artefacts and Standards Assessment data were also grouped. The analysis was as per guidance from Dawson (Dawson, 2007).

The rows were:

- Barrier
- Interventions

The columns were the 6 Socio-Technical Nodes

- Goals
- People
- Infrastructure
- Technology
- Processes, Policies and Procedures
- Culture

The above template data was then transferred into tables pertaining to each node for each plant within Chapter 7. Any implied assumptions from the interview are presented with tables by the use of italics.

Data Collection Methods

Data for each framework level was to be collected accordingly. One interview/review was to be conducted per plant. The review was to last for circa 1 day per plant with the following aim/agenda:

- To test the validity of underlying assumptions (level #1) the HPT Standard Assessment will be used to identify the percentage completion to the HPT implementation plan (work design), and in doing so identify specific areas of shortage for later consideration when reviewing the data from levels #2 and #3. The Standard Assessment evidence should be reviewed in order to ensure the percentage Likert scale is used accurately. Evidence may include:
 - Training records

- Meeting minutes / coaching records
- Plant-level steering group
- Champion and Guide coaching meetings
- HPT meetings
- Continuous Improvement records
- Collected fiscal data
- Scorecards
- Action plans
- Completed team and leadership surveys
- Project plans

Given that some of the evidence for the Standard Assessment could be presented in the local language, and that 5 of the 6 plants do not have English as a first language, the English plant may take less time as no time for translation may be needed.

- The espoused values at level #2 will be collected through a series of qualitative interviews with plant HPT Coordinator / Managers. These interviews were held on a 1-1 basis, treated as confidential, and conducted after the researcher had left the employ of the company. The review was to take the following format.
 - A semi-structured interview using the questionnaire. Local notes taken and typed translations used where the language barrier presented issues.
 - A Gemba walk to review infrastructure, and identify artefacts; obtain photo records of either previous use or actual use. Precise number of photographs were to be dependent upon the availability of artefacts.
- As part of evidence for the Assessment, artefacts are shared by the plant, and will be collected and treated to ensure that all personal and company intellectual property / branding is removed from any image or document.

Ethics

The following pertains to research ethics in terms of data collection:

- *Qualitative Data.* The research was to be conducted in accord with the standard ethical guidance from the University of East Anglia, where the student had become subsequently registered due to a transfer of registration. Participants each received a full brief and were required to submit a signed Informed Consent Form as per APPENDIX 3.
- *Plant Standard Assessment Data.* A signed consent brief for access to plant-level socio-technical data, through the HPT Standard Assessments, was obtained in order to identify percentage completion of various aspects of the lean-culture socio-technical work design (as per APPENDIX 2)
- *Ethics Checklist.* The research ethics checklist was used.

Each plant had the luxury to negotiate the rate of manufacturing excellent framework implementation. This arrangement was established so that the relative starting position of each plant within the wider framework could be considered, and individual plans developed for each plant. This also ensured that no plant was compromised through corporate edicts.

Data Creation and Collection Overview

The following diagram in Figure 21 shows the timeline for key data creation, collection and implementation.

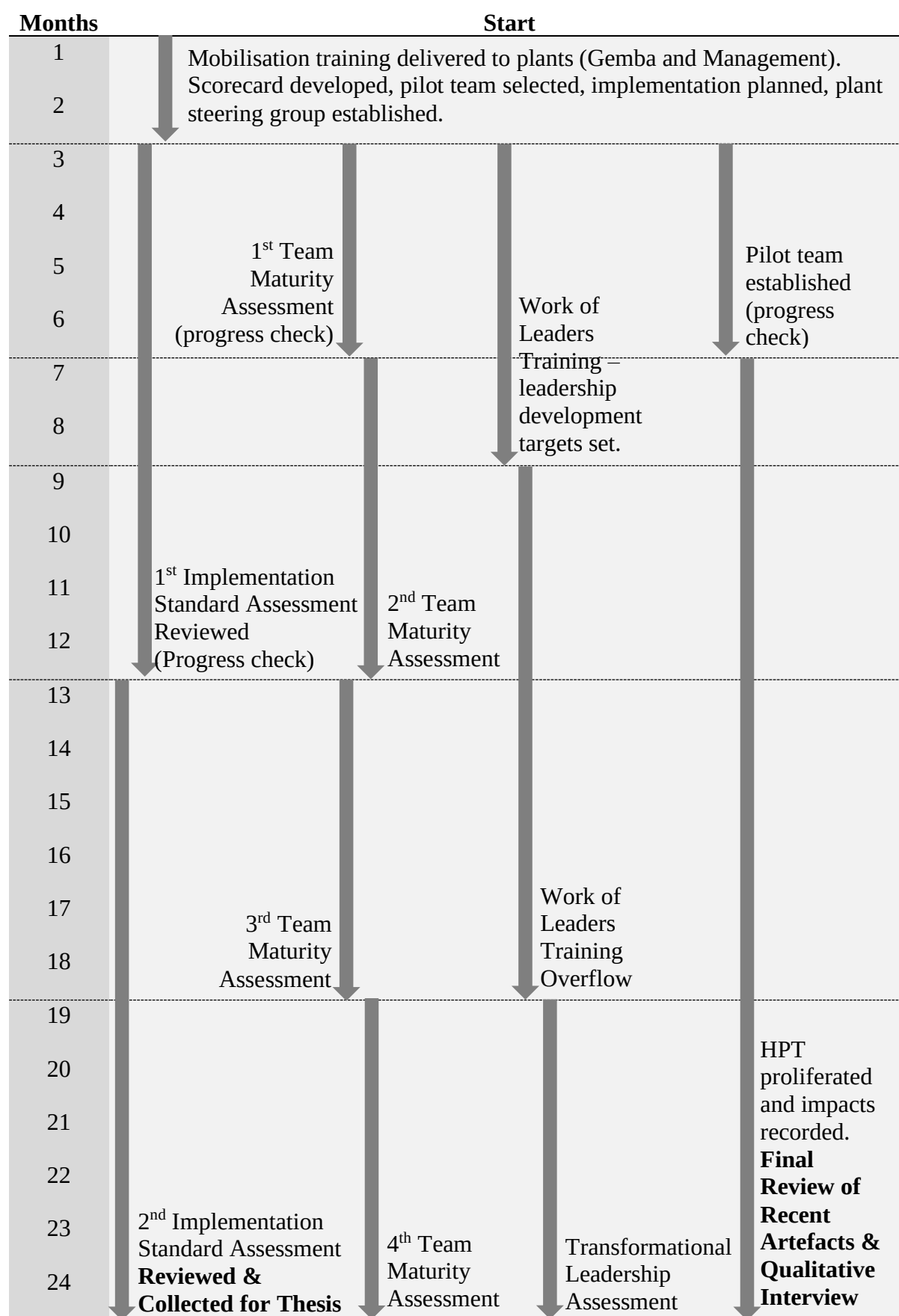


Figure 21. Data Creation and Collection Timeline

Case Study Data

The case study data for each of the six plants is presented in three parts per plant:

- Implementation (standard) assessment data as per the questionnaire and grading criteria within Chapter 5's Annex C.
- Qualitative remarks from an interview with the HPT manager and a survey of the facility.
- Artifacts collected throughout the implementation and up to the plant survey. Changes in business performance metrics that are considered attributable to the new work design are also collected and treated as an artefact.

For each case study the results of the survey and artifacts are cross-referenced against the standard assessment.

Case Study - CLEESE PLANT

Cleese - Culture Level #1 Underlying Assumptions

Table 47 - HPT Standard Assessment Data

HPT Metrics / Balanced Scorecard	PTS.
The Plant Manager & the Plant Management Team have completed Transformational Leadership Training.	100%
Leadership development action plans exist for all managers.	50%
Employee feedback interviews or leadership assessments indicate progression in leadership skills amongst the managers.	50%
All management and salaried staff have included a goal related to the HPT system in performance appraisals.	25%
The plant has identified the Cat-Champs to be developed, based on the HPT instructions.	75%
The Guides have trained and certified all of their respective Cat-Champs.	75%
All Cat-Guides have been trained in HPT.	75%

Cat-Guides meet with their Cat-Champs based upon the minimum requirements within the HPT implementation instructions.	50%
Boundaries have been established using the guidance in the HPT implementation instructions.	75%
Cat-Champ HPT certifications are recorded and tracked so that Guides can maintain their development & ensure functions are represented in all HPTs	100%
Cat-Champs are being utilized in the plant to communicate relevant information to the rest of the HPT members.	50%
There is a balanced Scorecard approved by the Plant Manager, for each boundary defined in the Plant. (Every scorecard is in compliance with criteria and requirements established in HPT implementation instructions)	75%
Weekly data is always available on time for scorecard KPIs	100%
There is a correlation between scorecard results and plant performance	75%
KPIs mandated by senior leadership are on the Scorecard	75%
KPIs are within the HPT's circle of influence	100%
HPT Scorecard results are part of all salaried staff performance evaluations (some specific metrics from the team Scorecard can be included, such as: % Skill Certification, Cat-Champs, meeting effectiveness, action plans completion). There is documentation of goals and KPIs related to HPT in the supervisor's performance evaluation.	50%
HPTs meeting area is established with space for problem solving, and visual standards in accord with the implementation instructions.	100%
There is an adhered-to schedule for HPT meetings.	100%
There is an established agenda that is followed by the teams.	100%
Teams use problem solving tools on regular basis in their HPT meetings.	50%
Actions plans close performance gaps.	100%
Employees outside of the team-space facilitate the closure of actions plans.	75%
Plant managers demonstrate HPT meeting attendance on at least a monthly basis.	50%
All meetings use standard template.	100%
Cat-Guides attend and support all meetings in response to support requests.	50%
Skill Certification is being conducted in accordance with the HPT implementation instructions.	100%
Skill Certification is being conducted with plans showing design and implementation of: Job descriptions; Skills assessments; Individual training plans; Performance reviews and feedback	100%

A Training Schedule (Plan) exists for all staff.	50%
Training is taking place in accordance with the Training Schedule (Plan).	50%
The teams have defined their name, mission, vision, values and objectives in accord with the organisation's business case.	100%
Team Maturity Assessment has been conducted in accord with the HPT implementation instructions.	100%
The results of maturity assessments have been analysed by the local steering committee. Action plans have been created for the HPTs to increase their maturity level.	100%
All plant personnel above the Team level are providing coaching and guidance to HPTs.	25%
Teams launched beyond the previous 9 months have advanced through and beyond the Storming Stage of the Tuckman Curve.	100%
Rewards and Recognition requirements include provision for HPT.	50%
Recognition and Rewards procedures have been declared to all teams and expedited as communicated.	50%
AVERAGE	74%

Most significant STS Gap(s)

The plant started the implementation journey in January 2018. The assessment was taken in August 2018; at the time of assessment, the plant was holding back on all available guides being allowed to support Champions until leadership training had been completed. This is observable within the assessment score and created a shortfall within the Processes and People nodes of the work design. At this point the guides had not had scorecard performance linked to their personal objectives. The guides had created training for champions in category specialisations, but the training and Gemba team management for each category was being managed by local supervisors and the HPT Coordinator. A lack of engagement by specialist management (Category Guides) can create issues as the workflow for elevation is not necessarily as responsive as the Gemba-based category champions need it to be. Furthermore, the guides provide a coaching mechanism separate to that of the champion's functional management, permitting a more conducive learning environment (impartial to their reporting

chain) and the champion's personal and social ability (integrated as part of the Technology, Infrastructure and Cultural aspects of the work design).

Cleese - Culture Level #2 Espoused Values

Qualitative interview with the plant HPT Manager / Coordinator, and likely derivation from Level #1.

Table 48 – Survey Response

Observable performance differential

Q1. What positive performance changes / improvements did you see as a result of HPT implementation?

A1. Increased labour force engagement. 75% more continuous improvement ideas and hence CI improvements enabled. Much better communication between management/coordination/execution levels. Creating an HPT Place on the shop floor encourages employees to be part of it. Seeing you there on the shop floor with them it is the best way to earn their trust, to encourage them to have trust in.

Q2. What was the feedback from the members of the organization (who and what)?

A2. The feedback from HPT members from the shopfloor was that the issues are solved immediately, whereas before HPT they were not.

Q3. Did the rate of improvement (Lean and/or Financial) change as a result of HPT?

A3. The number of CI ideas increase with 75% more than before HPT implementation. The financial impact was evaluated to cover all costs of carrying out HPT as well as bring further benefit.

Q4. Was there a business case and / or vision led by senior leadership (i.e., what commitment was observable or was this a directive that was tolerated)?

A4. We create our own local vision “*We build our future from today, with a new type of approach through communication, trust and performance!*”. This part relies on the Plant Manager driving a believing in and driving a vision that HPT will improve the overall performance of the plant. I believe that in some other plants HPT was a tolerated request from higher management, and their fiscal results reflected this.

Q5. Did the implementation meet the needs of the business case / vision set out by senior leadership (if so, then how)?

A5. HPT implementation improve our teamwork skills, we learn more about how linked we are in our work process. We learned to give us feedback and also to communicate transparently with each other. We improved our technical issues more quickly than before. We improve our daily KPI performance with their CI ideas. Unfortunately, now we risk a corporate decision to reduce the HPT resources *<the project is closing and new corporate leadership have taken over>*.

Omissions from the design

Q6. What parts were difficult / impossible to implement?

A6. The most difficult was to change the mentality of the people in the office area. We start from zero and went on to achieve 85 % involvement from them. After that Team Leaders needed convincing.

Initially the feedback on the idea of HPT was not so good. The primary reason was because there were preconceived ideas that such a system could not work in Romania. However, after starting and getting a systemic approach in place, the benefits were noted by all levels.

Q7. Where did you see a weakness in the implementation (what, who why)?

A7. From my point of view, it was difficult at the start because we did not have or understand a complete set of HPT instructions along with training *<the research supplied these, but the roll-out took time>* and it took too much time to receive special training for HTP Implementation (which was needed before the start of the implementation). It did not help that the HPT Coordinator role was also part time in the early days (when a full-time role is needed). This came late, and needed strong support from senior management.

Q8. What affect did these challenges or omissions have?

A8. The effect from the start was a lower involvement from the shop floor, because they see that the supervisors from office area had 0% involvement. The trust was initially smashed because of that. If sites do not see the benefit of HPT (business case) then this slows the implementation down.

Weaknesses in the design - recommendations

Q9. What would you do differently (different to or not within the instructions / guidance about implementation)?

A9. From my side I don't think I would like to change anything, because the implementation has been a success. However, I would make sure that implementation will not be done on all plants at once and make the rollout out slower to help with training. I would also ensure formal and informal support of senior management before starting; if this cannot be achieved, I would not go further.

Free commentary

Q10. Any other comments

A10. Appreciated the trainers and leaders of the subject; these are a key success factor to have.

Cleese - Culture Level #3 Artifacts

Observable artefacts and likely derivation from Level #2 as follow. A dedicated HPT area has been established. The area looks smart and is branded with corporate colours. The area is at the Gemba, signifying Gemba ownership and a space / commitment for the problem-solving process.



Figure 25 - HPT Area at the Gemba within Cleese Plant

Within the HPT area can be seen a white board and access to local IT (plant data) so that simple-problem solving can be undertaken. There is also information pertaining to the team personnel (the champions), current scorecard performance, which indicates activity / progress is underway. Visible within the area are the HPT scorecards. The scorecards here have a comparative paucity of KPIs compared to other plants and the implementation instructions.



Figure 26 - HPT Information: Scorecards, nominated Champions and performance data

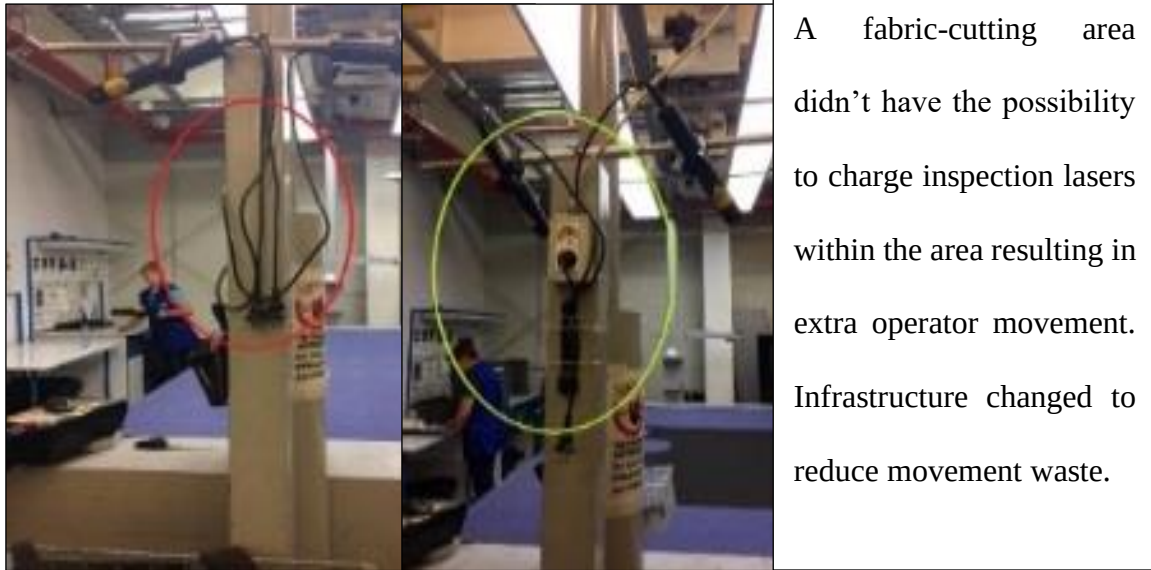
The plant take pride in recognising achievement and the accreditation of new Guides and Champions is recognised with plant management, and it is locally celebrated. Since the standards assessment was completed, a further 34 Guides have been accredited with a view to support HPT.



Figure 27 - A Champion and Guide HPT Certification Event and Celebration

The Team Maturity assessments indicate that the Gemba HPT is within the performing phase of the Tuckman curve; however, it is yet to assess the quality of its leadership as beyond transactional (at time of survey); the survey, however, is being undertaken and it currently indicates that a transactional leadership mode exists.

Figure 29 continued - Examples of Improvements that were created and implementation-managed by the HPT(s) at Cleese Plant



21 quadrilateral cutting blades are used, blunted and replaced per month.

The HPT team learned how to polish them with equipment and techniques supported by maintenance team members. After the costs of re-sharpening and cost reductions of not purchasing at such a high frequency are both taken into account, the annual cost saving is Euro2,720.

Results Summary for Cleese Plant

The lean-culture HPT work design was well implemented in accord with the instruction guide and implementation-standard assessment. The new work design has already yielded tangible business impact through lean kaizen with significantly increased (75% more) continuous improvement ideas enabled. The plant was reluctant to neither provide any further data on the fiscal savings from this increase, nor the reason behind their reluctance to share the larger fiscal data. However, the work design has been established as the new routine and an increase in kaizen is being experienced. The implementation remains less reliant upon senior management support as all middle managers have adopted work design targets as part of their annual appraisal targets. To this end, the lean-culture work design is proven to be successful. New, incoming, corporate leadership may not understand that the routine investment in time for HPT is yielding more savings than it costs; the fiscal data would need to be presented to new leadership. As a result of this lack of awareness the new leadership may see an opportunity to cut costs and remove the HPT routines as a cost saving measure without first realising the lost opportunities in future savings.

Case Study - CHAPMAN PLANT

Chapman - Culture Level #1 Underlying Assumptions

Table 48 - HPT Standard Assessment Data

HPT Metrics / Balanced Scorecard	PTS.
The Plant Manager & the Plant Management Team have completed Transformational Leadership Training.	100%
Leadership development action plans exist for all managers.	0%
Employee feedback interviews or leadership assessments indicate progression in leadership skills amongst the managers.	0%
All management and salaried staff have included a goal related to the HPT system in performance appraisals.	0%

The plant has identified the Cat-Champs to be developed, based on the HPT instructions.	100%
The Guides have trained and certified all of their respective Cat-Champs.	50%
All Cat-Guides have been trained in HPT.	25%
Cat-Guides meet with their Cat-Champs based upon the minimum requirements within the HPT implementation instructions.	25%
Boundaries have been established using the guidance in the HPT implementation instructions.	0%
Cat-Champ HPT certifications are recorded and tracked so that Guides can maintain their development & ensure functions are represented in all HPTs	25%
Cat-Champs are being utilized in the plant to communicate relevant information to the rest of the HPT members.	0%
There is a balanced Scorecard approved by the Plant Manager, for each boundary defined in the Plant. (Every scorecard is in compliance with criteria and requirements established in HPT implementation instructions)	25%
Weekly data is always available on time for scorecard KPIs	0%
There is a correlation between scorecard results and plant performance	50%
KPIs mandated by senior leadership are on the Scorecard	100%
KPIs are within the HPT's circle of influence	100%
HPT Scorecard results are part of all salaried staff performance evaluations (some specific metrics from the team Scorecard can be included, such as: % Skill Certification, Cat-Champs, meeting effectiveness, action plans completion). There is documentation of goals and KPIs related to HPT in the supervisor's performance evaluation.	25%
HPTs meeting area is established with space for problem solving, and visual standards in accord with the implementation instructions.	100%
There is an adhered-to schedule for HPT meetings.	100%
There is an established agenda that is followed by the teams.	100%
Teams use problem solving tools on regular basis in their HPT meetings.	25%
Actions plans close performance gaps.	75%
Employees outside of the team-space facilitate the closure of actions plans.	75%
Plant managers demonstrate HPT meeting attendance on at least a monthly basis.	75%
All meetings use standard template.	100%

Cat-Guides attend and support all meetings in response to support requests.	100%
Skill Certification is being conducted in accordance with the HPT implementation instructions.	75%
Skill Certification is being conducted with plans showing design and implementation of: Job descriptions; Skills assessments; Individual training plans; Performance reviews and feedback	75%
A Training Schedule (Plan) exists for all staff.	75%
Training is taking place in accordance with the Training Schedule (Plan).	75%
The teams have defined their name, mission, vision, values and objectives in accord with the organisation's business case.	100%
Team Maturity Assessment has been conducted in accord with the HPT implementation instructions.	100%
The results of maturity assessments have been analysed by the local steering committee. Action plans have been created for the HPTs to increase their maturity level.	25%
All plant personnel above the Team level are providing coaching and guidance to HPTs.	25%
Teams launched beyond the previous 9 months have advanced through and beyond the Storming Stage of the Tuckman Curve.	100%
Rewards and Recognition requirements include provision for HPT.	100%
Recognition and Rewards procedures have been declared to all teams and expedited as communicated.	100%
AVERAGE	60%

Most significant STS Gaps

The plant started HPT implementation in November 2017. The standards assessment was taken in June 2018. The gaps pertaining to category guide support are very significant. Scorecard oversight was low, as was business case development; this can lead to issues with Goals and People contexts within the work design. Whilst guides were responding to team requirements on an ad-hoc basis, the guide attendance at routine meetings was not monitored or enforced. The guides did not have HPT performance linked to their annual job performance review. So, HPT is running but the Goals are ill-defined, and the work design implementation discipline is poor.

Chapman - Culture Level #2 Espoused Values

Qualitative interview with the plant HPT Manager / Coordinator and likely derivation from Level #1.

Table 49 – Survey Response

Observable performance differential

Q1. What positive performance changes / improvements did you see as a result of HPT implementation?

A1. First KPI was staff turnover – originally had a very large staff turnover of circa 30% and this reduced to circa sub 5%. This is because the direct relationship between employer and employee improved – team leaders and managers started to better serve the team members. Machine utilisation and scrap were also improved; the machines were very old and had plenty of issues, so these were addressed along with 5S and safety. Eventually the easy wins were completed, and the issue became completing the more complex improvement ideas.

Q2. What was the feedback from the members of the organization (who and what)?

A2. Employees felt that issues that were personal to them (things that annoyed them) were being addressed through HPT because the management were listening. The personal relationships were improved; there was respect.

Q3. Did the rate of improvement (Lean and/or Financial) change as a result of HPT?

A3. There were plenty more ideas on the plant level for CI – for example 1 team contributed 20 ideas in 1 month for CI (Lean), which is considerable improvement from the 1 or 2 ideas (normally experienced) in the same time period. The average going forward from each team was 1.5 per week.

Q4. Was there a business case and / or vision led by senior leadership (i.e., what commitment was observable or was this a directive that was tolerated)?

A4. The financial reporting systems were very poor so it was very hard to identify the true costs of waste (cost of poor quality) – this makes it very hard to develop a business case.

Q5. Did the implementation meet the needs of the business case / vision set out by senior leadership (if so, then how)?

A5. HPT made improvements, but the poor financial controls hid a lot of benefits, and also made the initial plant assessment problematic as certain items of data were missing or less-than-robust.

Omissions from the design

Q6. What parts were difficult / impossible to implement?

A6. Engagement in this plant was always difficult as the rewards and recognition system did not include facility for HPT performance, so there was always the question of “why operators should ‘do more’ without any financial reward. So, this relied on the HPT Manager having a close relationship with the operators to give it a chance.

Q7. Where did you see a weakness in the implementation (what, who why)?

A7. One of the barriers was getting the idea on paper and robustly using the problem-solving processes and hence resolution – team leaders would write ideas down on a flip-chart. The problem was that whilst recognition existed for the idea but there was no remuneration for completing it. The poor financial controls drove some excellent people (CI staff – Guides) out of the business, which also frustrated HPT support and implementation.

There was insufficient attention paid to selection of team leaders and follow-on leadership training.

Q8. What affect did these challenges or omissions have?

A8. The R&R policy was rewarding the wrong behaviours – the instructions did not explicitly provide a policy for each plant to follow. This would have been an HR problem too, but they pushed HPT into the Operations leadership.

Weaknesses in the design - recommendations

Q9. What would you do differently (different to or not within the instructions / guidance about implementation)?

A9. The system relies on reliable financial and performance data; these are fundamental systems (that were assumed to be there before implementation). For a definitive rewards and recognition policy to work it needs a robust business case, that needs reliable data. We did not have this.

Team leaders need training in soft skills and leadership. The company used to have a corporate programme but withdrew it before HPT was implemented. This affected HPT as Gemba supervisors were ill-prepared for the soft-skill requirements of HPT.

The HPT area benefits from being enclosed for more private coaching and feedback with IT supporting the obtaining the data.

Free commentary

Q10. Any other comments

A10. It works better when HPT performance is linked to a bonus system that rewards completion of improvement activities as opposed to the generation of improvement ideas.

Chapman - Culture Level #3 Artefacts

The following artefacts were observed. Firstly, the HPT meeting area, whilst at the Gemba, do not offer any protection from the noisy environment, or facilities to write ideas (i.e., a table / board or bench). Infrastructure was generally poor. The HPT display board is rudimentary and looks as though the plant did not have funds available (or the desire) to invest in the area. Scorecard was also observed to be basic with circa 8 KPIs included, which makes for an easy scorecard upon which to achieve (under-whelming challenge).

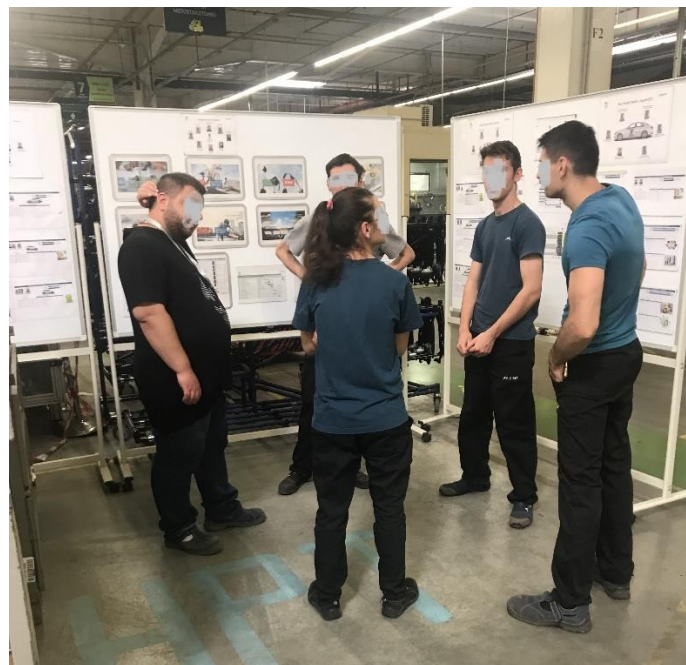


Figure 30 - HPT Meeting area at the Gemba within Chapman Plant

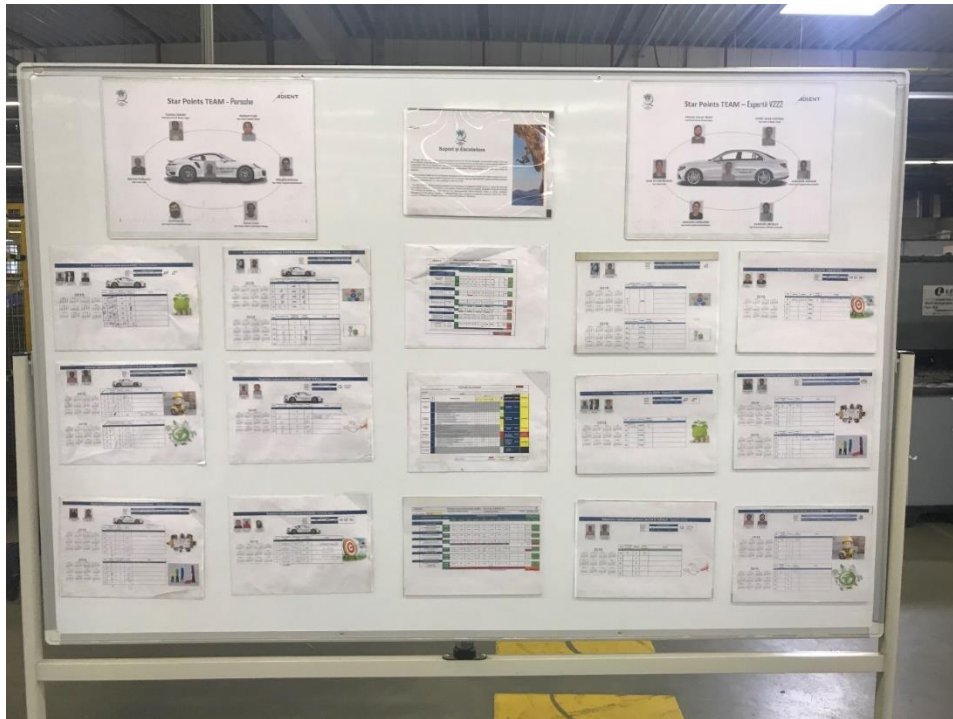


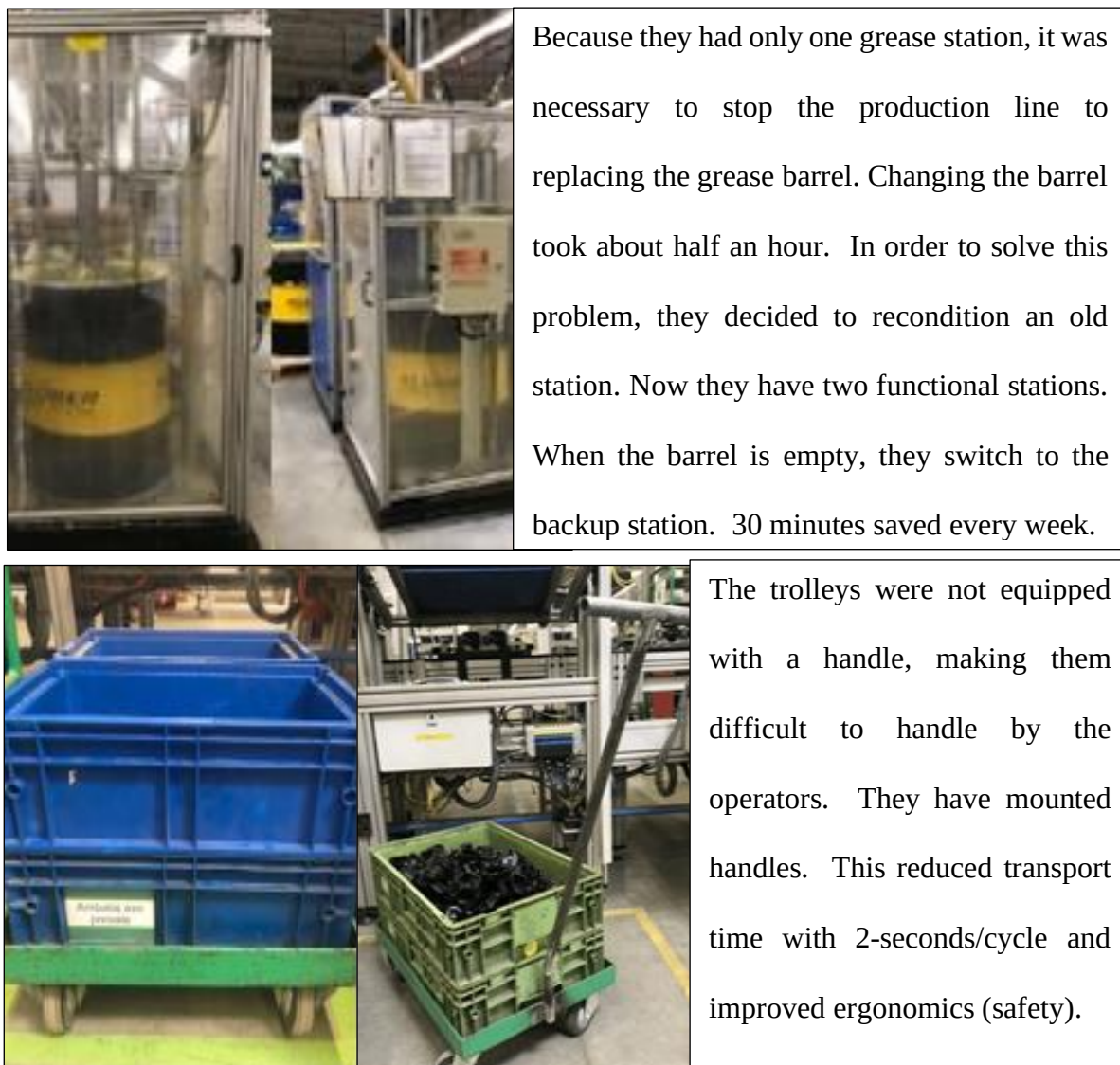
Figure 31 - HPT Display board

The image shows a detailed template for Quick Reaction Quality Control (Problem Solving). It is a large, structured form with multiple sections. The top section is titled 'QRQC/R24-8D' and includes fields for 'Date', 'Time', and 'Location'. Below this, there are several sections for data entry and analysis, including '8D Problem Solving' and '8D Problem Solving - 8D'. The form is designed to guide the user through the problem-solving process, from identifying the problem to implementing the solution. It includes various tables, charts, and text boxes for detailed information.

Figure 32 - Quick Reaction Quality Control (Problem Solving) Template

The area does contain paper copies of problem-solving templates with a generic Quick Reaction Quality Control (QRQC) sheet using a cork-board, but there is no table to be able to easily use it. There is evidence of problem solving and improvements being conducted within the plant by the HPTs as follows.

Figure 33 - Examples of Improvements that were created and implementation-managed by the HPT(s) at Chapman Plant



Results Summary for Chapman Plant

In comparison with other plants, the lean-culture HPT work design has been poorly implemented in accord with the instruction guide and implementation-standard assessment. The new work design has yielded minor business impact through lean kaizen. The work design has not been robustly established as the new routine. The implementation is completely reliant upon a single facilitator. To this end, the lean-culture work design is proven to be unsuccessful; however, it has not been fully implemented.

Case Study - GILLIAM PLANT

Gilliam - Culture Level #1 Underlying Assumptions

Table 50 - HPT Standard Assessment Data

HPT Metrics / Balanced Scorecard	PTS.
The Plant Manager & the Plant Management Team have completed Transformational Leadership Training.	100%
Leadership development action plans exist for all managers.	0%
Employee feedback interviews or leadership assessments indicate progression in leadership skills amongst the managers.	0%
All management and salaried staff have included a goal related to the HPT system in performance appraisals.	50%
The plant has identified the Cat-Champs to be developed, based on the HPT instructions.	100%
The Guides have trained and certified all of their respective Cat-Champs.	100%
All Cat-Guides have been trained in HPT.	100%
Cat-Guides meet with their Cat-Champs based upon the minimum requirements within the HPT implementation instructions.	100%
Boundaries have been established using the guidance in the HPT implementation instructions.	100%
Cat-Champ HPT certifications are recorded and tracked so that Guides can maintain their development & ensure functions are represented in all HPTs	100%
Cat-Champs are being utilized in the plant to communicate relevant information to the rest of the HPT members.	75%

There is a balanced Scorecard approved by the Plant Manager, for each boundary defined in the Plant. (Every scorecard is in compliance with criteria and requirements established in HPT implementation instructions)	75%
Weekly data is always available on time for scorecard KPIs	100%
There is a correlation between scorecard results and plant performance	75%
KPIs mandated by senior leadership are on the Scorecard	75%
KPIs are within the HPT's circle of influence	100%
HPT Scorecard results are part of all salaried staff performance evaluations (some specific metrics from the team Scorecard can be included, such as: % Skill Certification, Cat-Champs, meeting effectiveness, action plans completion). There is documentation of goals and KPIs related to HPT in the supervisor's performance evaluation.	50%
HPT's meeting area is established with space for problem solving, and visual standards in accord with the implementation instructions.	100%
There is an adhered-to schedule for HPT meetings.	100%
There is an established agenda that is followed by the teams.	100%
Teams use problem solving tools on regular basis in their HPT meetings.	75%
Actions plans close performance gaps.	100%
Employees outside of the team-space facilitate the closure of actions plans.	75%
Plant managers demonstrate HPT meeting attendance on at least a monthly basis.	100%
All meetings use standard template.	100%
Cat-Guides attend and support all meetings in response to support requests.	100%
Skill Certification is being conducted in accordance with the HPT implementation instructions.	100%
Skill Certification is being conducted with plans showing design and implementation of: Job descriptions; Skills assessments; Individual training plans; Performance reviews and feedback	100%
A Training Schedule (Plan) exists for all staff.	75%
Training is taking place in accordance with the Training Schedule (Plan).	75%
The teams have defined their name, mission, vision, values and objectives in accord with the organisation's business case.	100%
Team Maturity Assessment has been conducted in accord with the HPT implementation instructions.	100%

The results of maturity assessments have been analysed by the local steering committee. Action plans have been created for the HPTs to increase their maturity level.	100%
All plant personnel above the Team level are providing coaching and guidance to HPTs.	25%
Teams launched beyond the previous 9 months have advanced through and beyond the Storming Stage of the Tuckman Curve.	100%
Rewards and Recognition requirements include provision for HPT.	75%
Recognition and Rewards procedures have been declared to all teams and expedited as communicated.	50%
AVERAGE	82%

Most Significant STS Gap(s)

The assessments present a reasonably complete implementation, with leadership training lacking due to the availability of appropriately skill (native-speaking) training resources within the region. Furthermore, the plant has yet to spread and share the category guide function to other salaried staff, so there is a shortfall of linkage of HPT to performance evaluations. Whilst the plant has also focused on the team maturity assessment, it has not conducted the leadership assessment and hence has no feedback on leadership quality.

Gilliam - Culture Level #2 Espoused Values

Qualitative interview with the plant HPT Manager / Coordinator and likely derivation from Level #1.

Table 51 – Survey Response

Observable performance differential

Q1. What positive performance changes / improvements did you see as a result of HPT implementation?

A1. Unplanned downtime rate reduced by letting the team discuss the reasons of low machine utilisation (MU) scores. MU now above 80% due to HPT (circa 10% increase). After reaching 5S⁶ score at 75% as plant, target has been moved to 80%.

Engineers, supervisors and managers are able to better discuss some KPIs such as scrap cost, absenteeism, machine utilisation etc. with Gemba operators. In all levels, these KPIs are meaningful. Operators are presenting their monthly results to managers / engineers, so they feel responsible and adopt the company KPIs as their personal KPIs. As a result, operators have started to generate KPI related ideas.

Q2. What was the feedback from the members of the organization (who and what)?

A2. Gemba Team Leaders have indicated that they are now able to highlight the problems directly to engineers and managers on a monthly basis. If they are waiting for something from somebody (i.e., to help solve a problem) then it is accelerated before the monthly presentation session.

Q3. Did the rate of improvement (Lean and/or Financial) change as a result of HPT?

A3. CI Projects are much easier to implement with HPT. For example, *'Overstock in the quantity of raw material boxes in the welding cells'* was written as an action in an HPT 5S audit. Guides from CI, logistics and production have completed theoretical calculations of min-max levelling of shelves. HPT teams are supporting Guides in the implementation phase of the new CI project because they are aware of advantages of min-max levelling.

We note that tracking scrap cost adds more value instead of tracking scrap quantity. Also, machine stoppage is reviewed in minutes instead of a % rate as team members feel they can understand the results and make some meaningful changes (which they have).

⁶ 5S is a technique to reduce waste by following 5 'S' behaviours to the plant's equipment and working area. The 5 'S' are: Sort, Set-in-Order, Shine, Standardise and Sustain.

Q4. Was there a business case and / or vision led by senior leadership (i.e., what commitment was observable or was this a directive that was tolerated)?

A4. The plant has just finished a transformation project taking it from worst performing in group into good profit. Its biggest problem was in finding people with the right attitude. The change involved recruiting local women; a demographic in this part of the world that had a lot of tradition associated with it – the type of work in the plant had previously only targeted local men. Now fully staffed with cognitive diversity, the plant had improved but reached a plateau. So, the senior leadership vision was to make operators more pro-active, because they lost their passion for the daily routine. They had become used to the same problems on their daily routine, until the problem is accepted and it becomes normal. Senior leadership wanted to change this mindset.

Q5. Did the implementation meet the needs of the business case / vision set out by senior leadership (if so, then how)?

A5. In my opinion, 75% – 80% of leadership vision has been met. Team members are forcing engineers to solve their problems, to make the current-state better. If the operators don't get a satisfactory response, then they raise the topic to higher managers. They then share the same dissatisfaction as the senior leadership do.

Omissions from the design

Q6. What parts were difficult / impossible to implement?

A6. To persuade the first team was the most difficult part of HPT because the first team felt it was an additional workload. While implementing the first team, there was several unanswered questions such as;

- “When does HPT meeting run exactly; during production period (production manager is unhappy) or during breaks (team members are unhappy)?”
- “What do team members talk about?”
- “Which kind of action can team members take?”
- “What are engineers, managers, senior leadership role?”

It took a lot of energy to convince team members that they were able to use the HPT as a communication tool with senior management, and also senior management team needed to be open for communication. Tracked metrics needed data and the flow of data to HPT team members is the most challenging part.

Q7. Where did you see a weakness in the implementation (what, who why)?

A7. In our HPT implementation, our weakness was setting KPIs. According to my experience, KPIs must be;

- The simplest version to understand, easy to explain and easy to calculate the result.
- Meaningful for senior management, and effect their tracked KPIs.
- Team members are able to be observe the changes themself in their KPIs according to their actions.
- To track all KPIs, team members need user-friendly tools.

There was nobody experienced with KPI generation, so we had to learn by experience that means lots of failure before a successful HPT.

Q8. What affect did these challenges or omissions have?

A8. We were close to lost the belief in the senior leadership vision after failing (or close to failing) on persuading the first team.

Weaknesses in the design - recommendations

Q9. What would you do differently (different to or not within the instructions / guidance about implementation)?

A9. Before I explain HPT to Gemba I would think about how to explain it with the simplest way. I would make the team feel that this is nothing new, same we did before, but with new vision, make feel them comfortable. In the first day of HPT, I would show them how they could in communication with senior management instead of promising them.

Free commentary

Q10. Any other comments

A10. CI projects are much more easily implemented within the plant when the HPT is involved in the change. To summarize:

- Design the most user-friendly HPT KPI tracking tool (I would recommend something digital, some program etc.) because using some smart tool taking attraction of people, and easy to analyse data.
- Upload the easiest to understand KPIs, call them as target instead of KPIs
- Show them how to communicate with engineers and senior management.
- Prove how changes happen after communication.
- Persuade supervisors, engineers, senior management before team members.

After team members see how much they could affect targets, they will force you to enlarge the HPT. We intend to keep this change now.

Gilliam - Culture Level #3 Artifacts

The plant was one of the worst in group and could not recruit sufficient local talent. The plant has since shifted its recruitment practices to the female population (this was previously considered to be a culturally questionable activity within this region) and linked the implementation of HPT with this initiative. The implementation time period is April 2017 to July 2018, and the observable artefacts are as follow.



Figure 53a - HPT Area Integrated within Visual Factory Area within Gilliam Plant

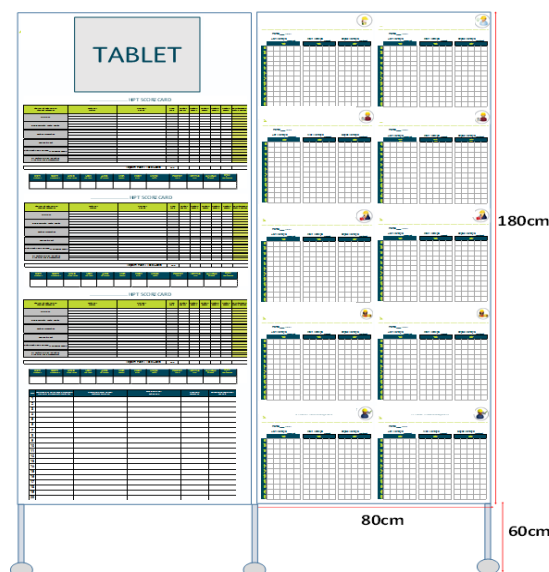


Figure 53b – New HPT Boards for Gemba placement with integral data tablet



Figure 54 - HPT Meeting in Progress

The plant has an outstanding meeting area with plenty of space for multi-team meetings and all data to be displayed. Across the corridor from the area are high tables for teams to stand around and draw up ideas and use simple problem-solving templates. The plant has had a strong focus on Gemba-level HPT team selection; there were too many volunteers to be a category champion so the plant used a test on the 8 lean wastes in order to select the best candidates. They had a strong focus on team maturity, and presented the following graphic at a regional HPT sharing event. The graphic attempts to explain that through sharing experiences between Gemba employees newly established HPTs almost skipped through the forming stage (NOTE: it is more likely that the forming stage lasted for less time rather than being skipped).

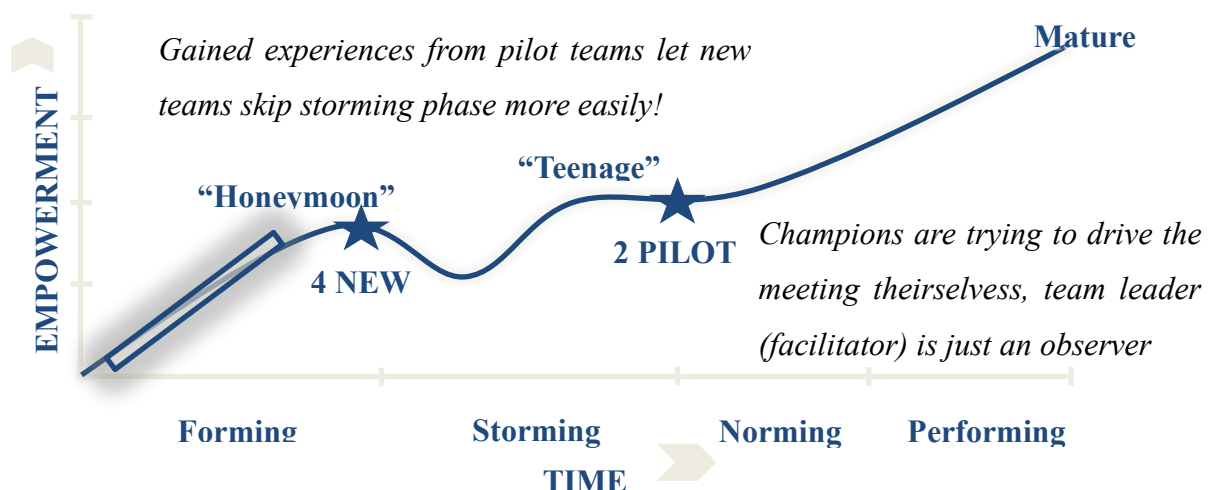


Figure 55 - Graphic Indicating that 3rd and 4th Teams reached Norming more Quickly

There is solid evidence of improvement beings identified and implemented by and through the HPT as the following examples indicate.

Figure 56 - Examples of Improvements that were created and implementation-managed by the HPT(s) at Gilliam Plant



Wire barrels were waiting on pallets behind the welding cells; operators needed transport pallets to change wire barrels, which took approximately 20 min every time to source, operate and re-position. Instead, pallets have been replaced with wheeled base plates. Operators put full wire barrels on this base plates. With this implementation, full wire barrels will be ready for changing which takes only 5min. Saves 15 minutes every 3 hours; 14 hours per week.



There was no cover for sensors at the backrest welding cells. Sensor damage was found to be a consistent cause of welding burr defects. Sensors have since been covered to prevent welding burrs. Saved \$2,780 per year after this implementation.



There are 6 bends used for the backrest tubes, so machine's P axis has 6 forward and 6 back motions. There was waste motion due to the pattern's intermediate distance of 90mm. Pattern intermediate distance had been reduced by 25mm and calibrated to 65mm from a macro program from an HPT team member. After this improvement machine utilisation increased 3%.

Results Summary for Gilliam Plant

The lean-culture HPT work design was very well implemented in accord with the instruction guide and implementation-standard assessment. The new work design has already yielded tangible business impact through lean kaizen. The work design has been established as the new routine. The implementation is less reliant upon a single senior manager to support the design as all middle managers have bought in to the process with 50% of managers having goals formally assigned as part of appraisal targets. The plant is also innovating new information technology tools and information boards that ultimately build upon the lean-culture design further. To this end, the lean-culture work design is proven to be successful.

Case Study - IDLE PLANT

Idle - Culture Level #1 Underlying Assumptions

Table 52 - HPT Standard Assessment Data

HPT Metrics / Balanced Scorecard	PTS.
The Plant Manager & the Plant Management Team have completed Transformational Leadership Training.	100%
Leadership development action plans exist for all managers.	0%
Employee feedback interviews or leadership assessments indicate progression in leadership skills amongst the managers.	0%
All management and salaried staff have included a goal related to the HPT system in performance appraisals.	0%
The plant has identified the Cat-Champs to be developed, based on the HPT instructions.	100%
The Guides have trained and certified all of their respective Cat-Champs.	100%
All Cat-Guides have been trained in HPT.	100%
Cat-Guides meet with their Cat-Champs based upon the minimum requirements within the HPT implementation instructions.	100%
Boundaries have been established using the guidance in the HPT implementation instructions.	100%

Cat-Champ HPT certifications are recorded and tracked so that Guides can maintain their development & ensure functions are represented in all HPTs	75%
Cat-Champs are being utilized in the plant to communicate relevant information to the rest of the HPT members.	100%
There is a balanced Scorecard approved by the Plant Manager, for each boundary defined in the Plant. (Every scorecard is in compliance with criteria and requirements established in HPT implementation instructions)	100%
Weekly data is always available on time for scorecard KPIs	75%
There is a correlation between scorecard results and plant performance	75%
KPIs mandated by senior leadership are on the Scorecard	100%
KPIs are within the HPT's circle of influence	100%
HPT Scorecard results are part of all salaried staff performance evaluations (some specific metrics from the team Scorecard can be included, such as: % Skill Certification, Cat-Champs, meeting effectiveness, action plans completion). There is documentation of goals and KPIs related to HPT in the supervisor's performance evaluation.	50%
HPTs meeting area is established with space for problem solving, and visual standards in accord with the implementation instructions.	100%
There is an adhered-to schedule for HPT meetings.	100%
There is an established agenda that is followed by the teams.	100%
Teams use problem solving tools on regular basis in their HPT meetings.	50%
Actions plans close performance gaps.	50%
Employees outside of the team-space facilitate the closure of actions plans.	100%
Plant managers demonstrate HPT meeting attendance on at least a monthly basis.	75%
All meetings use standard template.	100%
Cat-Guides attend and support all meetings in response to support requests.	50%
Skill Certification is being conducted in accordance with the HPT implementation instructions.	100%
Skill Certification is being conducted with plans showing design and implementation of: Job descriptions; Skills assessments; Individual training plans; Performance reviews and feedback	100%
A Training Schedule (Plan) exists for all staff.	100%
Training is taking place in accordance with the Training Schedule (Plan).	50%

The teams have defined their name, mission, vision, values and objectives in accord with the organisation's business case.	100%
Team Maturity Assessment has been conducted in accord with the HPT implementation instructions.	75%
The results of maturity assessments have been analysed by the local steering committee. Action plans have been created for the HPTs to increase their maturity level.	50%
All plant personnel above the Team level are providing coaching and guidance to HPTs.	0%
Teams launched beyond the previous 9 months have advanced through and beyond the Storming Stage of the Tuckman Curve.	100%
Rewards and Recognition requirements include provision for HPT.	100%
Recognition and Rewards procedures have been declared to all teams and expedited as communicated.	100%
AVERAGE	78%

Most Significant STS Gap(s)

This plant has a deficit in arrangements pertaining to leadership engagement, suggesting that category champions are not engaging with the HPT design. This will not only reduce the level of category training and specialist insights needed for problem-solving, but also dilute the sources influence that the HPT infrastructure and techniques provide. This will also reduce the fiscal impact, which is manifested within the assessment as low performance-gap closure through the actions plans consequently being weak. Subsequently, successes are also not being shared / broadcast in view of their relative paucity as well as the absence of the specialist staff supporting across multiple HPTs and sharing success stories.

Idle - Culture Level #2 Espoused Values

Qualitative interview with the plant HPT Manager / Coordinator and likely derivation from Level #1.

Table 53 – Survey Response

Observable performance differential

Q1. What positive performance changes / improvements did you see as a result of HPT implementation?

A1. Through developing and improving the KPIs, especially from quality point of view, the scrap rates improved. Long-standing failure causes were addressed. Scrap improvements circa 2 to 3% per annum were experienced and given the low scrap rates that already existed, there would have been very challenging to achieve without HPT.

Also, there was improvement of communication within the team; as well as management understanding of shop floor. The General Director was on the cusp of retiring, and was reluctant to undertake the new ways of working; however, managers from specialist functions (Quality, H&S and Maintenance) improved their communication with the Gemba people; before HPT they previously did not communicate with them as much or as well.

Q2. What was the feedback from the members of the organization (who and what)?

A2. Supervisors could see a new type of involvement in the daily routines, and members of the team had all relevant information. Previously plant performance information of this detail was not shared and supervisors less involved in decisions. The Gemba were very experienced and so there was previously beliefs (held by the management) that they did not need much feedback; however, the increased feedback was greatly appreciated by these Gemba professionals. The operators took ownership (became the leader of their machine / area).

Teambuilding exercises brought humour and joy – the mature employees were ‘playing’ and a sudden difference was observable in their behaviour.

Q3. Did the rate of improvement (Lean and/or Financial) change as a result of HPT?

A3. Quality has improved with scrap bring reduced from using simple-problem solving. The plant was already operationally stable, so the improvement was made through small but frequent marginal gains.

Q4. Was there a business case and / or vision led by senior leadership (i.e., what commitment was observable or was this a directive that was tolerated)?

A4. The plant discussed what it could achieved, and what it needed to achieve. Henceforth the plant focused on cutting down the scrap levels; they had tried before to lower the scrap levels with only limited success. They also wanted better involvement of shop floor people/operators as it was considered that the improvements needed would be many but each small (operationally stable plant); hence this would need a whole team effort. HPT also developed a competitive environment among teams, with them playing on who is better, who will be a winner with best results.

Q5. Did the implementation meet the needs of the business case / vision set out by senior leadership (if so, then how)?

A5. Yes, it did – the leadership wanted a very specific type of manageable incremental change (small) that could be sustained.

Omissions from the design

Q6. What parts were difficult / impossible to implement?

A6. The absence of senior leadership, and the initial reluctance of subject specialists, made the intent of HPT difficult to understand until the researcher provided direct support. It was a slow start. Training the people to be involved was challenging before regional training resources were made available. It took time for the regional culture (former communistic) to develop the trust for the Gemba to open up to supervision and management

about problems or solutions, which made changing from storming to norming a bit more challenging.

Q7. Where did you see a weakness in the implementation (what, who why)?

A7. The Gemba team needed specialists within management to be involved in order to workflow problems or solutions so that they could generate the next step changes. The irony was that as the Gemba improved at problem-solving then certain managers (Guides) stopped attending meetings; however, the Gemba staff wanted to go further and needed the Guides (who did not then consistently attend, thinking they were less needed). To make meetings work involved managers for certain areas to be at the meeting, and they started to not attend. This started to break the new connection between shop floor and the management.

Q8. What affect did these challenges or omissions have?

A8. There was the appearance of no further interest from management leading to less interest from members of team; there was hence less role models. This badly affected the stability of teams, which became a challenge.

Weaknesses in the design - recommendations

Q9. What would you do differently (different to or not within the instructions / guidance about implementation)?

A9. Management needs to be trained first, and management has to be connected with HPT before HPT implementation is allowed to proceed / progress. Knowledge of HPT was really limited in the earlier days of implementation. Role models are needed to be visible within the management as well as shop floor.

Free commentary

Q10. Any other comments

A10. This was a very established plant that has seen many political changes within the region since its creation. The local area has recently seen a lot more stability and industry arrive; reducing the appeal of the plant and its old technologies to new recruits. The plant is also very financially stable, and senior leadership do not share a vision for improvement; the focus is more about sustainment, with the biggest risk being the availability and desire of local people to want to work at the plant.

Idle - Culture Level #3 Artefacts

The following observable artefacts that were likely derivation from Level #2 have been obtained. The diagram below indicates that the plant has done an exemplary job of establishing HPT inn terms of covering the plant's operations.



Figure 34 - Plant Map with HPT Coverage (Teams 1 to 5) within Idle Plant

Furthermore, the Gemba employees have imprinted some personal identity upon the process with team names and logos, that have also been supported with branded t-shirts. This can be seen from both the print of a local key to team names, and logos, and the picture of the team within the following images (the matching black t-shirts) have the logo and team name printed on the front.



Figure 35 - HPT Team Names and Logos



**Figure 36 - An HPT Shift Briefing on the Shop Floor
(Plant Manager is in the Light Short Sleeved Shirt)**

The attention to facilities and the HPT optics continues as the following images demonstrate the before and after conversion of a former Gemba-based store facility into a dedicated HPT meeting area. The plant seemingly put a lot of effort into looking like HPT is implemented.



Figure 37a - Former Spare Store Room



Figure 37b - Former Spare Store Room Converted for HPT Meeting

This particular plant uses machinery with high noise hazard; the plant has accommodated HPT through identifying and providing rooms and converting them accordingly. There is also evidence that simple problem solving is being utilised by Gemba staff (Champions) in the form of tools such as fishbone and 5-why templates.

Riešenie problémov: 5x Prečo?

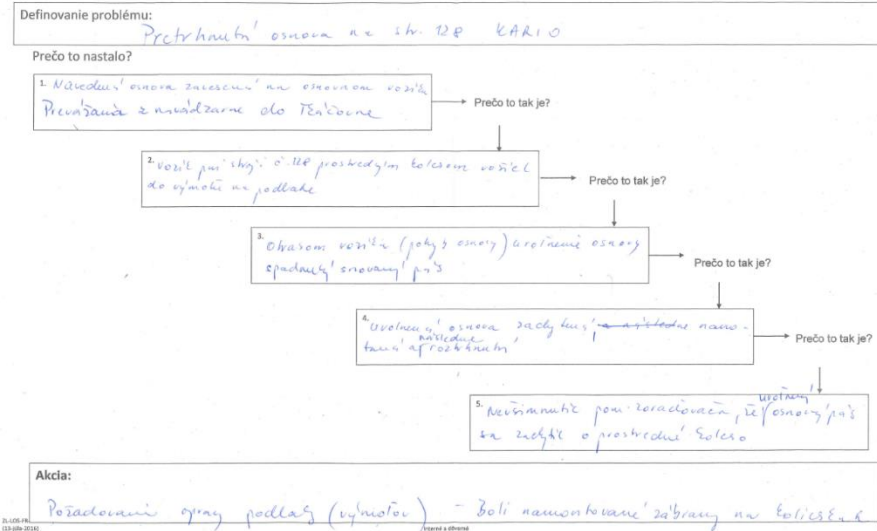


Figure 38 - 5-Why Simple Problem Solving

The following leadership and team maturity assessments also indicate the team maturity is seemingly robust, whilst the quality of leadership has considerable room for improvement.

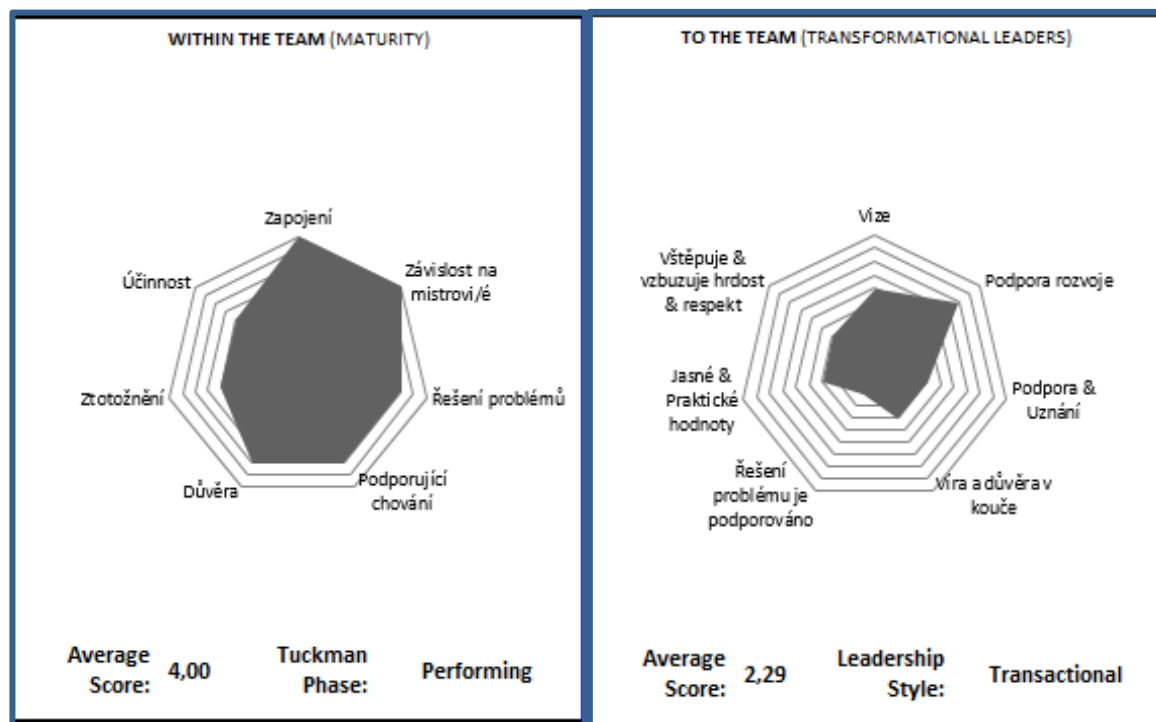


Figure 39 - Team Maturity and Leadership Assessments

The plant leadership achieved a scrap reduction through the HPT and seemingly reduced the energy thereafter once this very specific target was achieved. However, the HPT has the potential to go further and improve other aspects such as reducing operational costs by saving time and improving safety arrangements (as can be seen by the following examples).

Figure 40 - Examples of Improvements that were created and implementation-managed by the HPT(s) at Idle Plant

 Under floor fastening holders for A-frame	HPT safety audit found weakness in A-Frame anchors and a subsequent trip hazard. New bracket installed. Less tools contaminated with debris, leading to less rework and a higher RFT (Right First Time), plus a safety improvement.
	Rewinding bobbins at the end of each run was difficult as residual material needed to be removed before rewind. Moving the rotator slowly could help remove material, but the machine had no way of doing this. A new regulator was installed to help control rotator speed, reducing time to rewind overall and saving time after each production run and allowing more time for set-up.

Results Summary for Idle Plant

The lean-culture HPT work design was reasonably well implemented and in general accord with the instruction guide and implementation-standard assessment. Middle manager support was variable and the senior manager has not driven training and targets into the middle management level. The senior manager wanted the HPT design to specifically target the

reduction of scrap levels that had thus far been unobtainable. The new work design has achieved the scrap reduction targets through lean kaizen. The work design has been established as the new routine but remains reliant on few supportive middle managers. To this end, the lean-culture work design is proven to be successful yet fragile given the shortfalls of implementation as per instructions.

Case Study - JONES PLANT

Jones - Culture Level #1 Underlying Assumptions

Table 54 - HPT Standard Assessment Data

HPT Metrics / Balanced Scorecard	PTS.
The Plant Manager & the Plant Management Team have completed Transformational Leadership Training.	100%
Leadership development action plans exist for all managers.	50%
Employee feedback interviews or leadership assessments indicate progression in leadership skills amongst the managers.	75%
All management and salaried staff have included a goal related to the HPT system in performance appraisals.	75%
The plant has identified the Cat-Champs to be developed, based on the HPT instructions.	100%
The Guides have trained and certified all of their respective Cat-Champs.	75%
All Cat-Guides have been trained in HPT.	100%
Cat-Guides meet with their Cat-Champs based upon the minimum requirements within the HPT implementation instructions.	75%
Boundaries have been established using the guidance in the HPT implementation instructions.	100%
Cat-Champ HPT certifications are recorded and tracked so that Guides can maintain their development & ensure functions are represented in all HPTs	100%
Cat-Champs are being utilized in the plant to communicate relevant information to the rest of the HPT members.	75%
There is a balanced Scorecard approved by the Plant Manager, for each boundary defined in the Plant. (Every scorecard is in compliance with criteria and requirements established in HPT implementation instructions)	100%
Weekly data is always available on time for scorecard KPIs	100%

There is a correlation between scorecard results and plant performance	100%
KPIs mandated by senior leadership are on the Scorecard	75%
KPIs are within the HPT's circle of influence	100%
HPT Scorecard results are part of all salaried staff performance evaluations (some specific metrics from the team Scorecard can be included, such as: % Skill Certification, Cat-Champs, meeting effectiveness, action plans completion). There is documentation of goals and KPIs related to HPT in the supervisor's performance evaluation.	100%
HPTs meeting area is established with space for problem solving, and visual standards in accord with the implementation instructions.	100%
There is an adhered-to schedule for HPT meetings.	100%
There is an established agenda that is followed by the teams.	75%
Teams use problem solving tools on regular basis in their HPT meetings.	100%
Actions plans close performance gaps.	100%
Employees outside of the team-space facilitate the closure of actions plans.	75%
Plant managers demonstrate HPT meeting attendance on at least a monthly basis.	100%
All meetings use standard template.	100%
Cat-Guides attend and support all meetings in response to support requests.	75%
Skill Certification is being conducted in accordance with the HPT implementation instructions.	100%
Skill Certification is being conducted with plans showing design and implementation of: Job descriptions; Skills assessments; Individual training plans; Performance reviews and feedback	100%
A Training Schedule (Plan) exists for all staff.	100%
Training is taking place in accordance with the Training Schedule (Plan).	75%
The teams have defined their name, mission, vision, values and objectives in accord with the organisation's business case.	75%
Team Maturity Assessment has been conducted in accord with the HPT implementation instructions.	100%

The results of maturity assessments have been analysed by the local steering committee. Action plans have been created for the HPTs to increase their maturity level.	75%
All plant personnel above the Team level are providing coaching and guidance to HPTs.	100%
Teams launched beyond the previous 9 months have advanced through and beyond the Storming Stage of the Tuckman Curve.	100%
Rewards and Recognition requirements include provision for HPT.	100%
Recognition and Rewards procedures have been declared to all teams and expedited as communicated.	75%
AVERAGE	90%

Most significant STS Gap(s) & Notes

The plant started implementation in early 2018. This data is current as of mid-2019. It is the most complete implementation within the set with high levels of adherence and progress against the lean-culture work design. Most scores at 75% are linked to a longer-term requirement that often makes 100% implementation challenging due to staff turnover or expansion (i.e., training plan adherence). This is a plant that more frequently adjusts their scorecard baseline, which is due to higher performance levels being met and maintained (hence the need for scorecard review). This plant invested considerable energy in developing a vision for the future along with new ways of working that were branded to the plant; the ‘Jones Way’. In effect the policy changes were considerable for this plant, with HPT now firmly integrated into their daily routine.

Jones - Culture Level #2 Espoused Values

Qualitative interview with the plant HPT Manager / Coordinator and likely derivation from Level #1.

Table 55 – Survey Response

Observable performance differential

Q1. What positive performance changes / improvements did you see as a result of HPT implementation?

A1. The management team have seen some excellent improvements with regard to key KPI's. Equipment efficiency was markedly improved (16% improvement in equipment utilization), achieved through process improvements in the production methods as well as less downtime (improved reliability) and less scrap.

Q2. What was the feedback from the members of the organization (who and what)?

A2. I've had positive and negative feedback.

There were more engaged cross functional teams, which was something the plant had not had before. Teams were being involved in various projects and feeling more important and part of a team, which in turn led to better morale and improved performance in general.

This was positive feedback in the sense that individuals feel involved, part of a team, and that they are recognized for good performance and improvements.

The manager also saw the negative remarks as an opportunity to improve. Comments such as: *actions take too long or not getting the support on this issue*, give the management team a reason to find the root cause of why champions feel this way - and then create an action plan to fix the issue. As the plant implemented new teams, the successive teams became stronger more quickly as the plant learnt lessons from existing teams.

Q3. Did the rate of improvement (Lean and/or Financial) change as a result of HPT?

A3. The plant has seen improvements, especially in having more lean-implementations per year, which makes the direct financial impact of HPT difficult to see as the saving is

claimed under internal CI budgets codes and not against HPT; however, HPT supports its successful implementation.

Q4. Was there a business case and / or vision led by senior leadership (i.e., what commitment was observable or was this a directive that was tolerated)?

A4. As the HPT Manager, I've had tremendous support from internal and external resources. There was a business case, and resources to use to support the HPTs. The plant developed a vision that is now embedded into their culture. Top management within the plant support HPT and this is proven in the bi-weekly steering committee meetings they have, as well as through consistent daily and weekly communications.

Q5. Did the implementation meet the needs of the business case / vision set out by senior leadership (if so, then how)?

A5. Overall, yes. The plant now has a well-defined structure. Everyone in the plant is involved in HPT; this includes teams on the production lines, office staff and management. HPT is being led from the top, and why I feel that we have succeeded as a plant. The plant has also gone on to share best practise along the way with other plants in EMEA. HPT is now part of our new <Jones>-Way of doing business every day.

Omissions from the design

Q6. What parts were difficult / impossible to implement?

A6. The difficult part of HPT was trying to gain buy-in from the 'lagers'. I would hear comments such as: *"It's a waste of time, I don't want to do it and just another project that will fail"*. This is difficult to manage, so how I tried to overcome this was by using quick wins, and successes within other teams to show how HPT will benefit those directly involved.

Q7. Where did you see a weakness in the implementation (what, who why)?

A7. As mentioned previously, the instructions and standards were excellent supporting tools. However, in my experience I believe that a lot of plants have different cultures where different approaches would have to be made. In my opinion, the instructions needed to discuss more roadblocks that may be commonly faced.

Q8. What affect did these challenges or omissions have?

A8. The challenges sometimes forced to us to have to find new approaches to gain support and buy-in. This sometimes demoralised me, thinking I was failing, but I never gave up and managed with support in our plant becoming seen as one of the best in class. I also had to turn to external resources and mentors for their fantastic leadership advice and support.

Weaknesses in the design - recommendations

Q9. What would you do differently (different to or not within the instructions / guidance about implementation)?

A9. The company had HPT instructions to use as a guide, and a standard to follow. Although it's all very good and professional, it was difficult to follow with some cultural roadblocks that I came across during implementation. It is suggested to include within the guide suggestions on how to deal with some 'classic' roadblocks that the person implementing can encounter.

Free commentary

Q10. Any other comments

A10. Overall, HPT is a great tool for teams to use. What the plant learned as they implemented new teams, and why they have become stronger with each team, is to show

the quick wins and benefits from the outset – this turns the ‘Laggers’ into the ones that ‘Just get it’.

Jones - Culture Level #3 Artefacts

The following are observable artefacts that are likely derivations from Level #2. The plant has developed a large and prominent communal HPT meeting area with high quality facilities and templates for simple problem-solving and action tracking. Integrated within the facility is a bespoke HPT software system developed within the plant to enable the tracking data for each team to be brought up via a large touch screen (scorecards, action trackers and maturity assessments are all electronic). Furthermore, the touch screen allows access to live plant performance data for the HPTs to access, as well as messaging between team/shift.



Figure 41 - HPT Area prominently located within the centre of the Shop Floor within Jones Plant



Figure 42 - Digital technologies used to record data and track performance

The plant holds quarterly category guide meetings. These meetings are mandated by the plant manager and have the following rules/requirements: each cat-guide has a maximum of 3 minutes to present actions thus far, impact and planned actions for the next quarter.

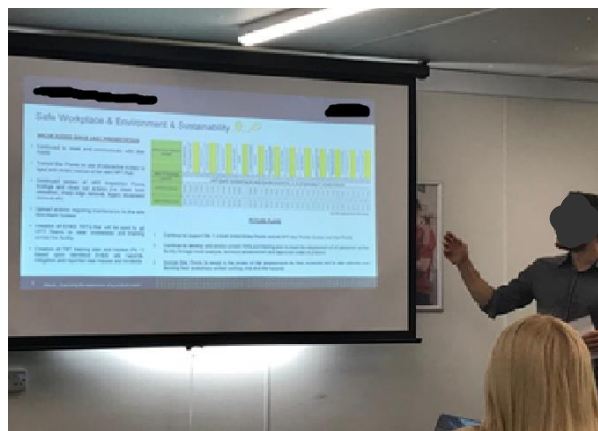


Figure 43 - A Category Champion presenting at the quarterly Category Guide meeting

The quarterly cat-guide presentations are aimed at driving accountability, and sharing / role-modelling better guide practice.

		3 Teams of Guides (Active)												All Guides active	
		Week	13	14	15	16	17	18	19	20	21	22	23	24	
		Cat-Guide Name													
Safe workplace	XXXXXXXX														Guide Active
	XXXXXXXX														Guide NOT Active
	XXXXXXXX														Champion on nights
	XXXXXXXX														Guide Inactive
Total Quality	XXXXXXXX														
	XXXXXXXX														
	XXXXXXXX														
	XXXXXXXX														
Service and Production	XXXXXXXX														
	XXXXXXXX														
	XXXXXXXX														
	XXXXXXXX														
Cost	XXXXXXXX														
	XXXXXXXX														
	XXXXXXXX														
	XXXXXXXX														
Empowered People	XXXXXXXX														
	XXXXXXXX														
	XXXXXXXX														
	XXXXXXXX														
CI and Visual Factory	XXXXXXXX														
	XXXXXXXX														
	XXXXXXXX														
	XXXXXXXX														
TOTAL			8	7	7	7	7	5	4	6	5	0	9	4	
% Of Engagement			67%	58%	58%	58%	58%	42%	33%	50%	42%	0%	75%	67%	

Figure 44 - A roster of Category Guide HPT support

The responsibilities of category guides are a high priority to this plant; the HPT Coordinator is required to track Guide activity against each category in order to ensure that coverage is in place for Champions, and that HPT meetings are appropriately supported.



Figure 45 - Cat Champion Certification

Newly qualified Cat Champions are broadcast on the notice board and the achievement is celebrated.

Figure 46 - Examples of Improvements that were created and implementation-managed by the HPT(s) at Jones Plant



Defects on the manufacturing line were above the acceptable limit at the start of the month. The stand for operators placing insert only had one board in the middle that did not lock, so it was difficult to reach and the board kept twisting causing an obstruction. HPT carried out basic problem solving to improve consistency, bringing defects well under limits. They installed a double rotating board that brought it closer to the inserters, which made it easier to reach for inserts. This improved ergonomics, utilisation and reduced mis-placed inserts



Right First Time levels (RFT) too low at month start (just under target). One debris blower was not clearing all foam debris in mould tools.

HPT carried out basic problem solving to address root causes, RFT significantly improved meaning monthly target will be met. Added second blower to cover what the first blower did not manage to clear. This was funded and justified based on the accounting work of the HPT to track and measure the problem, cost and propose a solution and then implement and sustain such.

Less tools with debris contamination, which causes less rework, meaning higher RFT (Right First Time) and less scrap costs.

Results Summary for Jones Plant

The lean-culture HPT work design was very well implemented in accord with the instruction guide and implementation-standard assessment. The new work design has already yielded tangible business impact through lean kaizen (a 16% annual improvement in efficiency). The work design has been established as the new routine. The implementation is not reliant upon a single senior manager to support the design as all middle managers have bought in to the process. The plant is also innovating new information technology tools that ultimately build upon the lean-culture design further. To this end, the lean-culture work design is proven to be successful.

Case Study - PALIN PLANT

Palin - Culture Level #1 Underlying Assumptions

Table 56 - HPT Standard Assessment Data

HPT Metrics / Balanced Scorecard	PTS.
The Plant Manager & the Plant Management Team have completed Transformational Leadership Training.	0%
Leadership development action plans exist for all managers.	0%
Employee feedback interviews or leadership assessments indicate progression in leadership skills amongst the managers.	0%
All management and salaried staff have included a goal related to the HPT system in performance appraisals.	75%
The plant has identified the Cat-Champs to be developed, based on the HPT instructions.	100%
The Guides have trained and certified all of their respective Cat-Champs.	75%
All Cat-Guides have been trained in HPT.	100%
Cat-Guides meet with their Cat-Champs based upon the minimum requirements within the HPT implementation instructions.	100%

Boundaries have been established using the guidance in the HPT implementation instructions.	100%
Cat-Champ HPT certifications are recorded and tracked so that Guides can maintain their development & ensure functions are represented in all HPTs	100%
Cat-Champs are being utilized in the plant to communicate relevant information to the rest of the HPT members.	50%
There is a balanced Scorecard approved by the Plant Manager, for each boundary defined in the Plant. (Every scorecard is in compliance with criteria and requirements established in HPT implementation instructions)	100%
Weekly data is always available on time for scorecard KPIs	100%
There is a correlation between scorecard results and plant performance	100%
KPIs mandated by senior leadership are on the Scorecard	75%
KPIs are within the HPT's circle of influence	100%
HPT Scorecard results are part of all salaried staff performance evaluations (some specific metrics from the team Scorecard can be included, such as: % Skill Certification, Cat-Champs, meeting effectiveness, action plans completion). There is documentation of goals and KPIs related to HPT in the supervisor's performance evaluation.	75%
HPTs meeting area is established with space for problem solving, and visual standards in accord with the implementation instructions.	100%
There is an adhered-to schedule for HPT meetings.	100%
There is an established agenda that is followed by the teams.	100%
Teams use problem solving tools on regular basis in their HPT meetings.	100%
Actions plans close performance gaps.	100%
Employees outside of the team-space facilitate the closure of actions plans.	100%
Plant managers demonstrate HPT meeting attendance on at least a monthly basis.	100%
All meetings use standard template.	100%
Cat-Guides attend and support all meetings in response to support requests.	100%
Skill Certification is being conducted in accordance with the HPT implementation instructions.	100%
Skill Certification is being conducted with plans showing design and implementation of: Job descriptions; Skills assessments; Individual training plans; Performance reviews and feedback	100%

A Training Schedule (Plan) exists for all staff.	100%
Training is taking place in accordance with the Training Schedule (Plan).	100%
The teams have defined their name, mission, vision, values and objectives in accord with the organisation's business case.	100%
Team Maturity Assessment has been conducted in accord with the HPT implementation instructions.	75%
The results of maturity assessments have been analysed by the local steering committee. Action plans have been created for the HPTs to increase their maturity level.	100%
All plant personnel above the Team level are providing coaching and guidance to HPTs.	100%
Teams launched beyond the previous 9 months have advanced through and beyond the Storming Stage of the Tuckman Curve.	100%
Rewards and Recognition requirements include provision for HPT.	100%
Recognition and Rewards procedures have been declared to all teams and expedited as communicated.	100%
AVERAGE	87%

Most significant STS Gap(s) & Notes

The plant started implementation in early 2018. This data is current as of mid-2019. It is the almost a complete implementation within the exception of transformational leadership. The remote location of the plant obstructed opportunities for their staff attending a local transformational leadership training event. To this end, the quality of leadership was reliant on the natural disposition of plant management. Fortunately, in this case the plant leadership had a natural inclination for HPT implementation and independently researched vision development. They created a vision without the need for training to support such. Unfortunately, despite this initiative, the metric has remained as unfulfilled on the assessment as no formal training was provided.

Of further interest is the way in which the plant linked HPT performance to the plant's extant bonus payment scheme. This has polarised the Gemba toward supporting HPT and pulls support from guides in view of the hygiene requirements to maintain as high an earning opportunity as possible. This does make scorecard renegotiation slightly sensitive, but the plant manager has been chairing that strategy (as per the implementation instructions). Recently, the manager left to take a larger role in another company, and the HPT Coordinator is concerned if the new manager will be as supportive.

Palin - Culture Level #2 Espoused Values

Qualitative interview with the plant HPT Manager / Coordinator and likely derivations from Level #1.

Table 57 – Survey Response

Observable performance differential

Q1. What positive performance changes / improvements did you see as a result of HPT implementation?

A1. A shift in performance has been achieved at all levels due to HPT. There has been no HSE incidents for more than 2 years since implementation. Scrap reduction has been observed; scrap cost has reduced by over 50%; and rates from 58 000 parts per million to 34 000 parts per million per month. This has reduced customer complaints by 87%. Absenteeism has also reduced from 10 % to below 4% at the Gemba level.

Q2. What was the feedback from the members of the organization (who and what)?

A2. At the very beginning, there was resistance to change, at all levels. Members of the organization viewed the HPT system as another additional commitment. What has reversed the perception of HPT from frustration to a positive attitude is a high level of transparency,

openness and willingness to help and support from higher organizational members and structures, giving feedback (both positive and negative), active communication and cooperation both cross-sectoral and hierarchical. As a final result, HPT becomes our culture of work and behaviour, everyday life and a generally accepted model of the functioning of the organization.

Q3. Did the rate of improvement (Lean and/or Financial) change as a result of HPT?

A3. The number of continuous improvement ideas are at a much higher level than before the HPT. Kaizen proposals before the introduction of the HPT system ranged from 15 to 20 proposals per month, while after the introduction of the HPT system, the number of Kaizen proposals per month ranged from 80 to 110 proposals per month (400% increase). The number of CI workshops before the HPT system was 4-5 workshops per year (without the participation of employees in Shop Flora), after the implementation of HPT we now have over 12 workshops per year with the active participation of HPT members from shop floor in each workshop. The result of CI workshops with HPT members is that the CI savings target is fulfilled every year without exceptions. Annual financial savings resulted in the realization of the CI task in the range of € 180,000 to € 450,000 (depending on the projects).

Q4. Was there a business case and / or vision led by senior leadership (i.e., what commitment was observable or was this a directive that was tolerated)?

A4. Management recognized the HPT system had the potential to help the organization to climb a few steps above expectations on its path to operational excellence, both in terms of performance, employee engagement and employee learning and development. As a strategy for successful implementation, the management decided to spend a significant part of its time on the shop floor in spreading HPT culture, talking to people, empowering them,

encouraging engagement and showing readiness to change at all levels. The essence of our change is to implement it through personal example and engagement.

Q5. Did the implementation meet the needs of the business case / vision set out by senior leadership (if so, then how)?

A5. The implementation process itself required a lot of time and patience, so accordingly the targeted results were slow to achieve. It took time for all teams to launch, reach a certain stage of maturity to achieve the desired result, but also meet certain management expectations. The realisation was achieved for HPT when a causal link was made between company KPIs and the HPT scorecard. Also the realisation was improved when an escalation and feedback system was established, and when cooperation between HPTs became a necessity (i.e., when engineers, coordinators, freight forwarders, managers, came to operating HPTs themselves, to see what was bothering them, what the problem was, and how to solve it). HPT has connected and networked all employees to strive for the same goal, achieving operational excellence through joint work and cooperation and all-round engagement of all members.

Omissions from the design

Q6. What parts were difficult / impossible to implement?

A6. One of the things to single out as a resistor to implementation was that the HPT instruction requires that the entire management staff in the organization, starting from team leaders, through shift managers to top managers have a high level of knowledge, awareness and engagement about HPT. There was a local assumption that they already understood their role in the HPT system, and that it was the Gemba that would need a lot of training. In fact, the difference in awareness between them and the Gemba operative was very small.

We needed to work with them more, and in more detail than with Gemba operators. In this regard, I note that it is crucial that the implementation of HPT is carried out from top to bottom, so that after the adoption of what has been learned, higher employee levels (*hierarchy*) transfer their knowledge and HPT culture to lower levels.

Q7. Where did you see a weakness in the implementation (what, who why)?

A7. Barriers in the way of implementation were primarily related to eliminating the fear of transparency without the consequences that freely talking about omissions and problems might bring blame or embarrassment. Also, one of the barriers was that managers found it difficult to leave the comfort and micro-management zone, without the ability to influence and control people from their sectors who are members of various HPTs. Another basic challenge was how to motivate members to engage and be active participants in the HPT system; the problem was that there was no money in the budget intended for rewards and recognitions for HPT members.

In the beginning, greater resistance to the implementation of the HPT system came from levels above the operational level, so there were often situations that required the involvement of managers in order to resolve a resource constraint or how much data we should share with the Gemba e.g., using business in scorecard planning and holding training with or without overtime.

Q8. What affect did these challenges or omissions have?

A8. Through joint work within HPT team members from different sections, they started to get acquainted with what their colleagues from the teams experienced and learned from each other; ultimately, they helped each other jointly achieve targeted performance. The most important thing is to provide maximum support to the teams in the storming phase, at which point the involvement of all organizational and hierarchical levels is necessary.

Although money is not the main motivating factor, it was necessary to do marketing for the implementation of the HPT system (printing T-shirts with HPT insignia, gift vouchers for newly formed team members that have performed well).

Also, one of the problems was that the HPT culture was first established at the Gemba level and only after that then at a higher level, which required additional engagement to spread awareness of the importance of HPT in parallel on several fronts.

Weaknesses in the design - recommendations

Q9. What would you do differently (different to or not within the instructions / guidance about implementation)?

A9. There is a list:

- Implement the HPT system from top to bottom. First establish HPT at the top - management team, then start with implementation at lower levels, because, although a higher level of awareness and knowledge is expected at higher levels of the organization, this is often not the case in practice.
- Allocated a special organisation-wide budget for HPT system rather than leave it to plants to find funds.
- Define the development path of the HPT coordinator (next step).
- Define a specific reward and recognition system for HPT members at all levels (from top to bottom).
- HPT Lean administration (digitization, develop applications that will simplify the functioning and operation of HPT, enable fast flow of information, data, results through digital form)

- Develop a unified / digital KPI cascading system (from top to bottom)

Free commentary

Q10. Any other comments?

A10. Due to HPT underpinning manufacturing excellence, HPT was accepted as an obligation imposed by the global corporation as a necessity. I have seen plants share an HPT coordinator but this led to failure. Implementing cultural change, such as HPT, requires serious commitment and engagement from everyone in the plant and especially HPT coordinators and plant managers as key figures. Promoting people who do not have credibility or experience working with operations as HPT Coordinator, leads to failure.

Palin - Culture Level #3 Artefacts

The plant was a reasonably new addition to the company but has grasped HPT incredibly quickly with minimal physical support from the researcher (most early support was provided remotely). The plant quickly established a business case and vision for HPT, linking the HPT performance with the bonus payments for Gemba staff; the better the HPT would do, the better the payment. Whilst this seemed at face value to push the pressure to perform on to the Gemba, the HPT model required the support from specialist / management guides. The feedback mechanisms were very quick and specialist staff were expected to respond to HPT needs. This was such a crucial plan that the plant manager personally briefed every employee within the plant.

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Figure 47 - HPT Meetings in Progress within the HPT Area within Palin Plant

The HPT also developed detailed action tracking notes; no IT systems were developed (although the plant did eventually borrow the software from Jones plant but had not implemented it at time of survey) so basic paper systems were maintained within the HPT area and were reviewed at each meeting. Display screens with plant metrics and selectable displays were installed within the area to gather essential plant performance data.

Employee voluntary turnover as a % of employees remained the same both pre- and post-HPT implementation.

HPT List escalation of nonconformity							HPT name
Form							
No	Workstation	The initiator of escalation	Category escalation	Problem Description	Action to remove the non-conformities	Responsible person	Date of escalation
1	FA01 L	PE V. Tomić	Quality	In the zone of the workstation are scrap foam	Remove or build space for scrap foam	PE A. Mekinović	2/12/2018
2							2/13/2018
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Figure 48 - Simple Action Tracking Tool Maintained by Champions

The champions were prioritised in the plant. Multiple HPT areas had tables and seating for all HPT champions. During a full / busy meeting guides and visitors were required to sit at the chairs on the perimeter of the HPT meeting area, or stand to discuss / present their business / support. For guide-to-champion 1-1 coaching, the area could be used, and each may sit at the table.



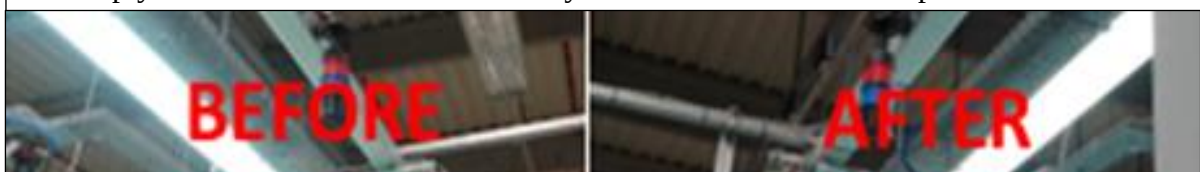
Figure 49 - HPT Area with Main Table Reserved only for Champions

The plant was making excellent gains with improvements being implemented by and through the HPT. The improvements would ultimately affect (and improve) the plant efficient (equipment utilisation) through reduce non-value time. The following are examples that were provided as part of the Standard Assessment.

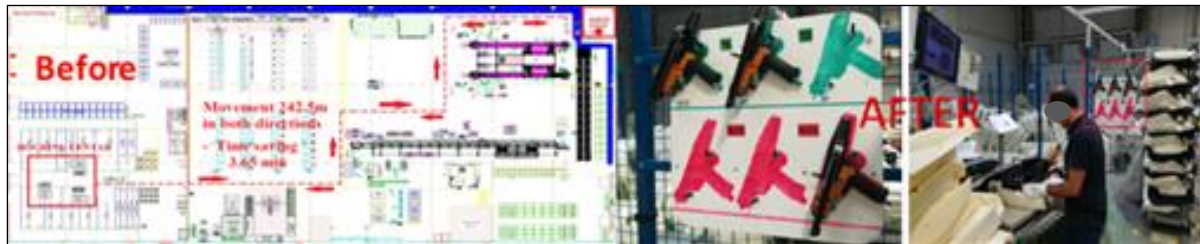
Figure 50 - Examples of Improvements that were created and implementation-managed by the HPT(s) at Palin Plant



Trolleys with kitting boxes for supplying material lines were on two levels, with 5 kitting boxes on each level (BEFORE picture). Full and empty boxes were manually delivered from the trolley to the operator on the line by the logistics operator. Reducing the kitting boxes down by 10cm made it possible to modify the trolleys so that all kitting boxes could go to one level, with the gravity drop of the boxes to the line supported by shock absorbers. The manual operation was removed (AFTER picture). The same system was used to return the empty boxes from the line to the trolleys. Time saved 16.8 hours per week.



Some defects that were detected at the final inspection station are not visible completely in earlier rework check station because of poor lighting, and they can't be reworked at final inspection. The seat has to return to the rework station and back again to final inspection; after the re-identification of the same defect, it returns to the rework again. Implementation of additional lamp (neon tube) in rework station (Picture- After). The same degree of capability for identifying visual defects in rework area as well as at the final station (visual inspection station). This reduces the wasted movement and repeated inspection operations.



The hog ring zone is physically separated from the maintenance sector by 121.7m. In the case of a failure on the hog ring tool, the operator passes the path of 242.5m in both directions (3.65 min) in order to enable the operator from the maintenance to provide the work tool or replacement if the repair is impossible or requires time (Picture Before – Layout and walking routes). Placed a board in the hog ring zone, which contains 3 spare tools (Hog ring guns) (Picture- After). In case of tool failure, they go to the red marked place, a good tool is taken from the green field. With the specified frequency of sightings during the shift, the operator from maintenance checks the board with the guns and reacts if necessary. This saves circa 3.65minutes every 3 hours (3.5 hours per week).

Results Summary for Palin Plant

The lean-culture HPT work design was very well implemented in accord with the instruction guide and implementation-standard assessment. The new work design has already yielded tangible business impact through lean kaizen. The work design has been established as the new routine. The implementation remains reliant upon senior management support for its adoption as whilst the costs associated with adopting the work design (time from shop floor staff) are outweighed by cost savings generated, new management that are unfamiliar with the system may view the reduction of shop floor meetings as an immediate cost saving without considering the wider losses of removing the routines. This is exacerbated by the middle management training and annual targets not be completed as specified by the instruction and

work design. To this end, the lean-culture work design is proven to be successful provided the incumbent senior manager remains supportive.

Results Summary – All Plants Combined

The lean-culture HPT work design was successful in that when implemented at a completion of circa 80% or above in accord with the instruction guide then tangible business improvements were delivered through lean kaizen. Furthermore, at that level of implementation the organisations have adopted the design as the new way of working, and start to show signs of innovation beyond the lean-culture work design as initially designed and presented by the researcher. Plants below that level of implementation show signs of shortfall at the middle management buy-in and adoption level, and not at the shopfloor/Gemba level. It seems that this part of the design may be the weakest component as the cases all emphasize the need for senior and middle leadership buy-in / support. The implementation of the work design requires an investment of time using shopfloor/Gemba staff. The fiscal benefits of the lean kaizen outweigh the fiscal investment in the work design; however, this is not always apparent despite the work design calling for performances to be displayed within a public area. It is considered that new senior management unfamiliar to the implementation may see the investment in Gemba resources as a potential cost saving measure and cease the activity unless there is overwhelming support or argument from the middle management level to maintain the work design.

CHAPTER 7 – CONCLUSIONS AND RECOMMENDATIONS

Research Conclusions and Recommendations

Summary

The thesis began by explaining the key definitions and origins of lean, as well as explaining the high failure rate associated with its implementation and sustainment. The anecdotal cause of these failures was implied to be that lean requires the right organisational culture within which to sustain. The thesis then reviewed the field of socio-technical work design, and analysed its relevance to indirectly affect organisational culture by directly reviewing and improving the socio-technical features that feed into organisational culture. An appropriate framework was selected and used to analyse over 1000 cases of lean implementation for barriers and interventions to lean implementation. The knowledge gained from the literature survey and systematic case study review was then cross-checked using field-work research that included the development-and-application of a rudimentary data collection exercise that reviewed the inherent socio-technical arrangements within three manufacturing plants. The data collected from the fieldwork was used to validate and improve upon the knowledge from the literature survey and systematic review. This enabled the development of a definitive list of socio-technical barriers and possible interventions to lean sustainment. The barriers and interventions were then structured into a list of research search terms in order to explore the relevance of wider practices and scientific theories. These theories and practices were surveyed and selected based upon their relevance to either addressing a barrier, or supporting an intervention. The selected theories and models were then incorporated into a new lean-culture work design. Implementation instructions for the work design were developed. The work design was branded as a High-Performance Team (HPT) implementation, and applied at six

(6) selected manufacturing plants within the automotive manufacturing sector. The work design included an implementation-standard assessment that not only assisted the plants in measuring their progress as part of implementing the design, but also supported the researcher in evaluating the quality of each plant's implementation. Any notable changes in plant performance were obtained along with the quantitative data developed as part of the standard-assessment within the work design. Evidence was observed as part of the standard assessment. Evidence included features such as training records, annual appraisal targets, HPT plant coverage and meeting records. Some of the aforementioned evidence was potentially considered to be confidential information by the organisation, and hence copies of such were generally not requested. Where examples were not considered to be confidential, then a small sample of such was collected and used within the thesis to represent a sample of such artefacts that supported the standard assessment results. Meanwhile, the wider evidence was observed by the researcher in order to ensure that the standard assessment scores had integrity against a set of percentage-level definitions for 0%, 25%, 50%, 75% and 100% completion against each assessment question. Qualitative data was then also collected via semi-structured interviews. The standard assessment score, artefacts (including changes in plant performance) and interview data was combined and analysed in order to identify if the plants had experienced a change in organisational culture that better suited the sustainment of lean.

This chapter will undertake a cross-plant review against each socio-technical context. The purpose is to evaluate the efficacy of the interventions within the work design for each socio-technical context. The quality of implementation will also be considered so that the interventions can be assessed objectively. Given that lean is a philosophy for business growth, the fiscal changes in performance for each plant will be compared to the quality of their HPT implementation in order to identify any trends and thresholds for implementation whereupon the impact of the lean-culture work design (HPT implementation) is reasonably assured.

The research concludes that the lean-culture work design was successful in that it has demonstrated that it can stand as a mechanism for rapid organisational culture change to support lean implementation. However, the design has not been completely successful across all 6 case study implementations; there is room for the work design to be improved through the addition of further features such as:

- a systematic approach to lean or business opportunity development and business case development;
- a prescriptive approach to employee rewards and recognition within an HPT work setting.

Recommendations for further research include the development and testing of further leadership training, as well as the synthesis of this work in developing a tool for rapidly assessing an organisation's socio-technical arrangements with a view to identifying where opportunity exists and energy may be needed. Wider recommendations are also included that propose the integration of STS learning within manufacturing and lean training. Finally, it is recommended that this research be synthesised using wider organisations where a lean culture is not the primary focus or requirement (i.e., where the removal of operational waste is either equal or secondary to a different business focus such as technological research-and-development, palliative care or the entertainment industry).

Analytical Approach

The cross-plant review draws information to form the 3 levels of Schein's Model of Organisational Culture (Schein, 2010) as presented within Chapter 6. The data from each plant will be reviewed against the barriers and interventions developed for each socio-technical node within Table 1 of Chapter 3. These formed the minimum requirements of the lean-culture

socio-technical work design within Chapter 4 and 5. Following each table will be a commentary of any cross-plant correlations, and a review of what impact the interventions have had to organisational culture and other socio-technical nodes. Once this is completed for each node, the Chapter will present final conclusions and recommendations for future research. A consistently applied template that reviews the success-indicator/interventions and barriers across all 6 plants has been developed for each of the 6 socio-technical nodes (Goals, People, Infrastructure, Technology, Plans/Processes/Procedures and Culture). As per Chapter 6, assumptions with the templates are indicated by italics.

Cross Plant Review – Policy & Procedure - Barriers & Interventions

The cross-plant analysis for this node is as follows in Table 58. For reference purposes, the barriers and interventions identified up to Chapter 4 against this node are given below.

- *Barriers:* B1. Change Approach to Philosophy; B2. Low rewards and recognition; B3. A lack of commitment to structured problem solving.
- *Interventions:* I1. Policy change driven by a local business case for improvement; I2. Local Rewards and Recognition policy to be established; I3. Fixed meetings (time resource) with Gemba & management commitment.

Table 58 - Cross-Plant Review For Barriers & Interventions - Policy & Procedure Node

	Success indicator / Intervention	Barrier
Cleese Plant	It was only after an unexpected mindset change occurred in senior leadership that support was obtained for the implementation. The work design was then implemented, rewards and recognition provided, and a vision established and Gemba routines initiated.	It took time to gain support from salaried staff and team leaders for HPT meetings. <i>Whilst effort has been made toward such, HPT routines have not been completely formalised as part of the organisation's business model going forward.</i>
Chapman Plant	<i>The HPT implementation does not infer success in terms of developing and sustaining a new culture to support lean.</i>	Fiscal business case not established due to poor financial controls. No budget was allocated for fiscal rewards and recognition; new policy not established. Policies not implemented/enforced to drive Guides to support HPT. HPT is not formalised within the plant's routines, <i>and could be subject to removal in the future.</i>
Gilliam Plant	<i>It saw HPT as the next step to remove more waste and continue with improvement. HPT has been included into new ways of working (new norms).</i>	No specific business case targets developed, but the plant had just completed a transformation from a failing position into profit, and had since reached a plateau.
Idle Plant	<i>Plant identified what it wanted to achieve from HPT, a specific (narrow) business case for scrap reduction (small scope) with increased job interest for new employees.</i>	A business case for scrap reduction represents a small scope. Once achieved, the HPT is at risk of being marginalised by the management, whose buy-in is essential if it is to be supported in the future.
Jones Plant	<i>A vision for a new way of working developed and branded to the plant. New policies for management support and employee rewards established. Plant has evolved the work design; enhancing it with new routines and facilities that work even better for them.</i>	No perceived barriers to further sustainment in terms of policy or procedures.
Palin Plant	<i>Rewards policy established and linked to bonus payment. Business case established in terms of growth targets.</i>	No perceived barriers to further sustainment in terms of policy or procedures.

Conclusions on the Efficacy of the Interventions for the Policy and Procedure Node

The lack of rewards and recognition policy design hampered progress once the improvements that directly supported the immediate frustrations of Gemba staff were achieved. This is in direct correlation with Herzberg's 2-factor theorem (Herzberg, 1959) as the once the hygiene factors of working conditions and relationships were improved, other hygiene factors concerning remuneration hindered further motivation.

Fixed meeting routines were successful in providing resourced problem-solving and demonstrating commitment to the process. Not investing in meetings degraded the work design. The meetings were an investment that had to be offset by the benefits (business case), which demanded a level of belief that didn't always come naturally to the guides within the plant leadership staffs.

The policy changes, and subsequent changes in approach, were embraced more quickly at the Gemba level than at the management level. This is dichotomous as the responsibility for improvement for each scorecard category rests at the management level, who normally hold a small team to support them (i.e., a quality team or health and safety team), yet the managers sometimes failed to quickly appreciate the advantages of artificially expanding their team via specially training and engaged Gemba staff.

Cross Plant Review – Goals - Barriers & Interventions

The cross-plant analysis for this node is as follows in Table 59. For reference purposes, the barriers and interventions identified up to Chapter 4 against this node are given below.

- *Barriers:* B1. B4. Lack of Leadership Skills / Direction; B5. Company goals must be cascaded with KPIs specific area influence.
- *Interventions:* I4. Training to establish a vision; I5. Goals fractally cascaded and measured / monitored on a scorecard.

Table 59 - Cross-Plant Review Against Barriers & Interventions for the Goals Node

	Success indicator / Intervention	Barrier
Cleese Plant	From the artefacts and standards assessment, only 6 items were included on their scorecard utilising only 5 categories, and not the 6 categories as per the implementation plan. Scorecard KPIs represent cascaded plant-level KPIs.	<i>The scorecard was slightly cautious (representing a lack of ambition). This may have hampered improvement.</i>
Chapman Plant	<i>The goals did not represent any real challenge beyond maintaining routine operations.</i>	Some KPIs are too easily achieved (i.e., 5S walk carried out) and seem almost to exist in order to fill space on the scorecard.
Gilliam Plant	Scorecard highly focused on lean wastes and CI opportunity development (for taking into Kaizens). These are the plant priorities and they have been fractally cascaded. HPT scorecard performance is in 50% of salaried staff performance objectives.	<i>The arrangements do not represent a barrier to lean improvement or work design efficacy.</i>
Idle Plant	A very focused scorecard that specifically aims to reduce scrap and the causes of scrap. Wider plant KPIs are not provided as much priority.	<i>The scorecard reflects the plant's vision for HPT; scrap reduction. This is a small scope and limits HPT effectiveness.</i>
Jones Plant	Plant goals fractally cascaded and HPT vision set. A high-quality scorecard created with multiple KPIs to drive action, including a KPI to track late HPT actions / decisions.	<i>The arrangements do not represent a barrier to lean improvement or work design efficacy.</i>
Palin Plant	Scorecard akin to the implementation instructions with plant priorities fractally cascaded together with KPIs that drive the correct behaviours.	<i>The arrangements do not represent a barrier to lean improvement or work design efficacy.</i>

Conclusions on the Efficacy of the Interventions for the Goals Node

Leaders could not always develop a business case or vision for HPT without external (specialist) support; the skill to see beyond the maintenance of current state was less present in the leadership than the ability to envisage and fiscally justify new ways of working. In some case the leadership had become so entrenched in ‘the way things are’ that they lost the ability to dream a better dream unless it fitted in with much of the current state. Through establishing a relevant scorecard that had fractally established ambitious goals, the leaders could start to see a benefit that, in turn, drove higher engagement from themselves.

Cross Plant Review – People - Barriers & Interventions

The cross-plant analysis for this node is as follows in Table 60. For reference purposes, the barriers and interventions identified up to Chapter 4 against this node are given below.

- *Barriers:* B1. B6. Leadership not supporting Gemba-based problem-solving; B7. Job rotation and diversity wanted.
- *Interventions:* I6. Management roles explicitly defined and monitored; I7. Inc. job certification and rotation.

Table 60 - Cross-Plant Review Against Barriers & Interventions for the People Node

	Success indicator / Intervention	Barrier
Cleese Plant	Skills certification is not on the scorecard, but present in the HPT implementation plan that is published in the HPT area and maintained at a high level. Pertinent data from Guides needed for problem solving was fed into the HPT via the HPT coordinator and supervisors. Guides have recently started engaging with HPT and with scorecard development; HPT performance is just starting to be integrated into annual appraisals, and 34 Guides have recently been accredited with the job skill.	Guide support was held back pending leadership training. <i>This again represented an overly cautious approach and lack of belief by the senior leader (plant manager) in his specialist and management staff to adequately adapt to the new work design without having any leadership training (dichotomous given the fact they already hold extant leadership positions). This overly cautious approach has likely impacted on the work design efficacy within the timescale of the research / implementation.</i>
Chapman Plant	Gemba actors have adopted the system. Skills certification is not on the scorecard. HPT performance is separate to any annual appraisal for any Guide or supervisor.	<i>HPT roles for guides and management is not enforced and support is meagre as a result, resulting in poor implementation and low efficacy of the work design.</i>
Gilliam Plant	Gemba adoption complete, especially at the Gemba supervision level. Guides are also engaged but coming late to the implementation. Skills certification is on the scorecard and maintained at a high level.	<i>HPT Coordinator has had to occasionally enforce the support as not all of the required specialist / management staff have engaged with the process (but the majority have).</i>
Idle Plant	Guides pertaining to scrap reduction fully engaged. The Gemba has fully adopted the system. Skills certification is on the scorecard and maintained at a high level.	<i>Support is ad-hoc from other guides beyond those involved in scrap reduction. This limits the life span of the work design beyond the achievement of the scrap reduction target.</i>

Jones Plant	The highest performing plant in this regard; HPT roles are linked to annual appraisals for all actors, and guides recruit deputies with a quarterly management team report. HPT Coordinator monitors Guide availability and checks efficacy with the champions. Guides subsequently fully bought in to the work design and appreciate its value. Skills certification on the scorecard and maintained at a high level.	<i>No barriers pertaining to the people node are present within this implementation.</i>
Palin Plant	Senior leadership supports HPT, but Guide roles were not enforced from the start. Gemba staff demanded Guide support, and this was eventually enforced by senior leadership, and the plant has since obtained high involvement from the Guides. Skills certification on the scorecard and maintained at a high level.	<i>Guide roles were not enforced from the start. This delayed the efficacy of the work design as Gemba teams did not initially obtain the support needed for deeper problem analysis and resolution.</i>

Conclusions on the Efficacy of the Interventions for the People Node

Gemba staff adopted and embraced the HPT work design more quickly than management, who in some cases seemingly failed to adopt the design unless directed within a transactional or coercive leadership manner by their leadership. All plants identified that the support from the guides was essential for HPT success, hence there is an association between management participation-and-support and work-design success. The most successful plants achieved this, whilst the less successfully still experienced issues in either launching or maintaining the work-design capabilities.

Cross Plant Review – Culture - Barriers & Interventions

The cross-plant analysis for this node is as follows in Table 61. For reference purposes, the barriers and interventions identified up to Chapter 4 against this node are given below.

- **Barriers:** B1. B8. No leadership vision with coercive or transactional leadership; B9. No feedback for Gemba staff to raise leadership issues.
- **Interventions:** I8. Training in appropriate leadership styles and Kata coaching; I9. Team maturity and transformational leadership measured and reviewed.

Table 61 - Cross-Plant Review Against Barriers & Interventions for the Culture Node

	Success indicator / Intervention	Barrier
Cleese Plant	Leadership training recently completed at the time of the standards assessment. Team maturity and leadership surveys in place. Surveys are reviewed by the plant steering committee with apposite actions planned.	Leadership survey results are not impressive. <i>Leadership is still transactional.</i>
Chapman Plant	Team and leadership assessments have been taken.	Leadership assessments are not being analysed robustly at the steering committee level for apposite action development.
Gilliam Plant	All training completed but no leadership follow-on actions identified. Team maturity and leadership surveys in place and reviewed by the plant steering committee with apposite actions planned. Leadership training recently completed at the time of the standards assessment.	Leadership is still transactional, and has been seemingly unambitious. However, a vision has recently been developed for the plant and the HPT system, so this might be case of over-caution slowing what could become a reasonable implementation.
Idle Plant	All training completed but no leadership follow-on actions identified. Team maturity and leadership surveys in place; leadership survey results are not impressive, and not showing signs of improvement.	Leadership is still transactional. Evidence of mature, long-standing, Gemba employees ‘having fun’ with HPT and enjoying their work more.
Jones Plant	Exemplar implementation; training fully completed at all levels, with maturity and leadership assessments fully deployed and regularly reviewed with apposite actions at a plant steering committee level.	A palpable change can be experienced within the plant, with formerly-dissonant and aggressive employees now engaging with plant strategy. This plant was actually the worst performing plant reviewed in Chapter 3 as part of the fieldwork.
Palin Plant	Leadership training not completed due to there being no regional trainer available. However, plant leadership have independently researched vision-development and made efforts to engage Gemba staff accordingly, and regional trainer has remotely coached plant leadership. All remaining training completed with maturity and leadership assessments fully deployed.	Despite this, the plant has not been able to demonstrate progression toward a transformational leadership mode, but has progressed beyond transactional. Leadership appears passive in terms of leadership assessment scoring; this could be due to the plant self-managing their lean improvement in light of it being linked to their bonus scheme payment (leadership may have removed themselves from the equation – almost an abdication).

Conclusions on the Efficacy of the Interventions for the Culture Node

All plants utilised the team maturity and leadership assessments, and the standards assessments indicated improvements within the team maturity aspect of the assessments. Leadership maturity improvement seemed dependent upon the level of HPT analysis and responsiveness from each management team. Plants that had improvements toward transformational leadership experienced high levels of lean improvement. The application of coaching, and linking the HPT performance to management appraisal objectives, contributed to improved leadership experiences and transactions at the Gemba. HPT seemingly provided a common routine (at least an opportunity) for guides to support and coach the Gemba employees. When guides were remiss in this duty, (i.e., *lagers* (Sinek, 2011)) then the HPT surveys and workflow processes enabled Gemba staff to spotlight poor support to senior leadership. As well as this mechanism, the HPT work design would have also reinforced the identification (and redress) of this behaviour by the *lagers*, as the design specified that HPT activities required of the guides (and most specialist management staff) were to form part of their annual performance objectives. It could be argued that these mechanisms, when combined, should have prevented a lack of HPT engagement at this employee -level; however, if the senior chose to collude with the *lagers* (or address the capacity within the level) then this would represent a rather blatant rejection of a key part of the work design by the senior leadership (who, also had ultimate responsibility for the business case improvements that HPT was seeking to develop).

Cross Plant Review – Infrastructure - Barriers & Interventions

The cross-plant analysis for this node is as follows in Table 62. For reference purposes, the barriers and interventions identified up to Chapter 4 against this node are given below.

- **Barriers:** B1. B10. Lack of equipment to access data; B11. Insufficient space for problem solving.
- **Interventions:** I10, HPT area to include data access; I11. HPT area to provide the environment for problem solving.

Table 62 - Cross-Plant Review Against Barriers & Interventions - Infrastructure Node

	Success indicator / Intervention	Barrier
Cleese Plant	A low cost but professional looking central area located within the Gemba. Plenty of space of visual controls and progress reporting / advertising.	Limited desk space available for collaborative problem solving.
Chapman Plant	<i>It's difficult to envisage the infrastructure being successful – it looks and feels like an afterthought project with minimal investment.</i>	A very low cost and scruffy looking Gemba area with no space for desk-based collaborative problem-solving or high-profile advertising of achievement / progress.
Gilliam Plant	<i>Visually stunning area with great advertising space.</i>	Not a lot of resources for desk-based problem solving.
Idle Plant	<i>Good HPT areas sourced near the Gemba but away from high-noise areas, with excellent desk space for problem solving. Local boards within high noise areas advertise progress.</i>	The arrangements do not appear to present a barrier to implementation.
Jones Plant	<i>Outstanding centralised Gemba area with outstanding visual standards and meeting facilities for desk-based simple problem-solving. Located at the Gemba; with enhanced IT facilities specifically designed for HPT.</i>	The arrangements do not appear to present a barrier to implementation.
Palin Plant	<i>Multiple meeting areas created with excellent resources for collaborative desk-based problem solving, and space for publishing progress (visual control).</i>	The arrangements do not appear to present a barrier to implementation.

Conclusions on the Efficacy of the Interventions for the Infrastructure Node

The infrastructure provided a neutral environment for all actors to come together and carry out the routines that the work design requested. All plants provided infrastructure as part of the implementation to HPT; some areas were clearly better than others. The weakest example of such was from Chapman Plant, which also had the weakest implementation and overall success

across the case study plants. Whilst not the only direct cause of the comparative lack of success, the poor infrastructure would have indicated the plant management's lack of commitment, which in turn would have inspired the same behaviours and beliefs in its inhabitants (James Q Wilson, 1982). The infrastructure provided a readily accessible access point to facilitate HPT, as well as an area to demonstrate progress (or not) for the purposes of visual management (Bateman, 2016). Furthermore, the good or bad infrastructure provides a source of influence (J Grenny, 2013) that, in turn, can manipulate the beliefs and assumptions as part of organisational culture (Schein, 2010).

Cross Plant Review – Technology - Barriers & Interventions

The cross-plant analysis for this node is as follows in Table 63. For reference purposes, the barriers and interventions identified up to Chapter 4 against this node are given below.

- *Barriers:* B12. Lack of Lean/CI Knowledge; B13. A lack of problem-solving tools.
- *Interventions:* I12. Provide PDCA tools with training; I.13. CI tool templates to be provided.

Table 63 - Cross-Plant Review Against Barriers & Interventions - Technology Node

	Success indicator / Intervention	Barrier
Cleese Plant	Basic paper-based tools installed but fully coached through the coordinator and supervisors. Real time electronic data available on display screens.	<i>Whilst not particularly outstanding, the arrangements do not represent a barrier.</i>
Chapman Plant	Basic tools implemented.	Low tech basic tools that are not well-maintained.
Gilliam Plant	Initially paper-based professionally formatted and coached tools within an outstanding facility that are easily seen and accessed. Specialist boards created to hold electronic computer tablets for local data input and acquisition.	No barrier observed.

Idle Plant	Basic paper-based tools installed but fully coached through the coordinator and supervisors. Tools are maintained in orderly folders within each meeting area.	No barrier observed.
Jones Plant	The plant developed its own application and installed touch screen technologies within the HPT area for champions to access and upload data. Specialist PDCA tools and templates branded to the plant's HPT were also created and coached.	No barrier observed.
Palin Plant	Basic paper-based tools installed but fully coached through the coordinator and supervisors. Real time electronic data available on display screens.	No barrier observed.

Conclusions on the Efficacy of the Interventions for the Technology Node

The approach to problem solving across all plants has been through the use of very basic tools despite more complex tools being previously available (but not necessarily used) before the HPT implementation. It seems that very simple problem-solving techniques appear to be more effective in that they are more likely to be used by Gemba employees than the more capable but complex six-sigma tools (which are probably more suitable to specialist employees). This de-emphasises the need for sophisticated lean technique training, and instead the recommendation would be to employ training on the fundamentals of waste, value, opportunity/issue identification and root-cause analysis.

The quick and accessible problem solving needs an environment and, in some cases, the specialists (guides) to facilitate the deeper understanding needed for root cause analysis; all the aforementioned draws upon the infrastructure and people nodes. Culture is improved through the provision of ability toward achieving (and being worthy of) a vision, whilst also reducing feelings of powerlessness (Senge, 2006).

Performance and Implementation Quality

Cross Plant Comparison

A common theme to successful implementation is the adoption of new management behaviours and organisational systems that are included as part of the lean-culture design. Whilst training in new behaviours and ideas supports the work-design, the measured percentage of the work-design against the standards assessment is the essential measurement in order to compare the efficacy of the design across each implementation. Beer et al (2016) suggest that training in new systems of working will not improve organisational performance unless the routines and behaviours are changed, and these activities are then formalised as measured-and-tracked requirements (M Beer, 2016). The work-design specifies these requirements, and so the percentage implementation is the first reference point against which performance changes shall be reviewed for the purposes of cross-plant comparison. The following table demonstrates the scale of performance improvement against the standards assessment for each plant. The performance is considered in 2 ways:

- output KPIs (improvements that directly improve plant efficiency by reducing waste);
- internal improvements such as reduced absenteeism and voluntary turnover.

Where such were made available to the researcher, the output KPIs were provided from plant management. These were tracked by internal resources such as operations and/or human resource management at the plant-level. Increases in staff turnover rates can be positive as well as negative i.e., culture improvement may drive away employees that would resist it (a positive aspect); or otherwise-high-performing employees reject the organisational current-state conditions, and leave (a negative aspect). In the case of HPT implementation, the research attempts to define a reduction in staff turnover as a positive through the following thought process. Participation as a champion within the lean-culture work design is not compulsory.

So, for those employees seeking greater involvement and challenge, the work becomes more diverse and may have greater appeal. Meanwhile; for other members that do not want significant change to their routine, they can experience minimal disruption beyond method changes resulting from lean kaizen. However, these may be unwanted outcomes from their own personal perspective. With that in view, a reduction in voluntary turnover was arguably considered to be a more of a positive indicator than a negative one.

Table 64 – Implementation Quality and Fiscal Performance

	HPT % Implementation	Fiscal Improvement regarding output KPIs	Voluntary Turnover and/or Absenteeism
Jones Plant	90%	16% improvement per EQU (circa £400,000 per annum saving)	No metrics provided
Palin Plant	87%	Scrap cost has reduced by over 50%. (Circa £350,000 per annum)	Voluntary Turnover up from 2.3% to 3.2% per annum. Absenteeism down from 10 % to sub 4%.
Gilliam Plant	82%	10 % improvement in utilisation (circa £200,000 saving per annum).	No metrics provided
Idle Plant	78%	2.5 % improvement in utilisation (circa £62,000 saving per annum).	No change in voluntary turnover rate at 9.7% per annum
Cleese Plant	74%	75% increase in CI improvement ideas but no fiscal metrics provided	Voluntary Turnover up from 9.1% to 10.2% per annum.
Chapman Plant	60%	No metrics provided	Voluntary turnover reduced from 83.3% to 43% per annum

The data suggests that the better implementations do not experience a considerable difference in voluntary turnover. This suggests that the implementation does not drive employees away from the plant, and key personnel changes can be discounted from the implementation. The data also suggests that fiscal impact improves with implementation quality. Jones, Palin and Gilliam are likely to maintain HPT despite changes in corporate leadership and a relaxing of corporate policy regarding centralised monitoring of operational excellence standards. Idle and Cleese plants have met specific targets and not gone as far as Jones, Palin and Gilliam. This is reflected in their standards assessment scores, as well as the ability to fiscally demonstrate success, with the former plants being unable to. With the exception of Chapman, the plants all experienced a noticeable improvement in improvement ideas and implementation.

Overall Percentage Thresholds for Work Design Success

The data suggests that an implementation above 70% average-score on the standards-assessment will positively affect organisational performance within the context of lean. Higher levels of continuous improvement (CI) suggestions are observed, and HPT routines are self-funding (i.e., the extra costs associated with the work design are potentially recovered). However, only Jones, Palin and Gilliam have indicated a commitment to sustain the work design as part of their organisational routines and beliefs. This suggests that a score above 80% of the standards assessment (percentage implementation of the work design) changes the nature of the organisation, and hence has rapidly affected organisational culture to support lean.

Management Commitment

The interviews suggested that management involvement was a key success factor in implementation. The work-design explicitly demands this involvement, and the standards

assessment tracks the level of explicit management commitment via changes to annual appraisal and performance evaluation arrangements. The following table demonstrates the differing levels of commitment that each plant demonstrated to 3 specific entries (questions) that were part of the standards assessment checks. These entries were pertaining to management commitment.

Table 65 – Implementation Quality and Fiscal Performance

		Standards Assessment Checks pertaining to management commitment			AVERAGE SCORE
		Management and salaried staff have included a goal related to the HPT system in performance appraisals.	HPT Scorecard results are part of all salaried staff and supervisor's performance evaluations.	All plant personnel above the Team level are providing coaching and guidance to HPTs.	
PLANTS	Jones	75%	100%	100%	92%
	Palin	75%	75%	100%	83%
	Gilliam	50%	50%	25%	42%
	Cleese	25%	50%	25%	33%
	Idle	0%	50%	0%	17%
	Chapman	0%	25%	25%	17%

The table shows that both Jones and Palin plants have invested energy with high levels of completion to the HPT implementation standard, Gilliam have less so, but demonstrated performance against each specific assessment-check. In contrast, Cleese, Idle and Chapman have fared poorly with areas of no progress made at all within some areas. This suggests a strong correlation with the ability to sustain HPT as the new normal, and hence change the

organisational culture. Only Gilliam, Palin and Jones are indicating that the work design is there to stay.

Discounting Wider Initiatives

Running in the background to the HPT implementations was a long-term implementation of a manufacturing excellence system. The system comprised of 5 levels of maturity across 9 excellence principles as follows:

- Safe Workplace
- Environmental Management
- Empowered People
- Design for Manufacture
- Material Control
- Visual Factory
- Total Quality
- CI Culture
- Value Stream Flow

HPT was embedded as a large part of the Empowered People Principle, with a remit to directly support KPIs needed for achieving Level 3 and Level 4 maturity levels within the remaining principles. Against each principle, plants are measured for maturity, ranging from Level 1 (not meeting the principle) to Level 5 (most capable at meeting the principles). Each principle states the practices and governing behaviours expected at each level. The excellence system was launched in 2014. After 18 months, in 2016, it had been identified that maturity was generally low with inconsistent performance rates between plants and principles. Cultural Principles (CI Culture and Empowered People) represented the most common challenges (lowest maturity),

and hence the most likely cause of low manufacturing excellence maturity when all the principle were combined into a single plant-score. The following data was provided from a typical sample of 30 plants - principle-performance results in 2016 (MEBP, 2018):

- i. A total of 85% of all the principle-maturity levels were at-or-under Level 2, which represented an overall maturity of only 40%-or-less after 18 months of system deployment, following years of pre-deployment plant-operation. CI Culture and Empowered People are the principles with the lowest average maturity levels (only 23% toward full maturity).
- ii. Maturity levels for individual principles between plants varied from Level-0 (0% mature) and Level 4 (80% mature).
- iii. Maturity levels varied considerably between principles with the exception of CI-Culture and Empowered People; which had up to a 62% reduction in statistical variance compared to the average variance of all remaining excellence principles. This demonstrated that the plants' responses to the principles of CI Culture and Empowered People had the most correlation (commonality) to each other than any other principle (i.e., they were all consistently low).
- iv. Level 1 represents the lowest Principle-maturity level; 41% of Level 1 scores were within only two excellence principles: CI Culture and Empowered People.

The HPT work-design was not launched until the plants had reach level 1 on their excellence maturity journey across all principles, and were working toward level 2. Hence the case study plants did not commence their HPT implementation (or preparations) until the either the end of 2016 or the start of 2017. At level 2, the HPT requirements were preparatory in nature, robust implementation started within Level 3, as part of the journey toward level 4. All plants were expected to obtain level 3 excellence maturity by 2017, and did so. Plants at level 3 were

considered to be a sound operating level with world class elements, and as such plants were provided time to consolidate their achievements and learning before any corporate push toward level 4. With that in view, no such timeline target was set or enforced for Level 4 achievement at the time of implementation. The data above demonstrates that the change in maturity between levels 1 and 2 is challenging, with lean / CI improvement being one of the most challenging principles within which to achieve. Furthermore, the maturity rate did not change in accord with any high-level edicts to demonstrate compliance as part-of or meeting level 4 on the excellence maturity scale; the case study plants did not artificially have to demonstrate compliance toward a level 4 accreditation. With this in view, the excellence framework can be discounted as an influencing factor at the specific time of HPT implementation.

Final Conclusions – Reducing Barriers, Implementation Weakness and Time Efficacy

Reducing the Cultural Barrier to Lean

The research's ultimate purpose became the establishment of new working arrangements (mechanisms) that were specified by a lean-culture socio-technical work design, which would improve organisational culture to benefit the implementation and sustainment of lean (CI). The results indicate that provided the implementation meets or exceeds 80% completion, then the purpose has been achieved. Furthermore, the results indicate that the better the quality of work-design implementation, the better the lean (CI) performance output. The systematic review at Chapter 2 robustly linked the suitability of organisational culture as a barrier to lean implementation, hence the higher lean performances experienced from within the HPT implementations would indicate that this barrier has been reduced.

The plant with the lowest level of HPT implementation was Chapman Plant at circa 60% implementation. Despite the low implementation rate, Chapman experienced a measure of

improvement toward the rate of lean and CI undertakings beyond that which it had experienced up to that point. Whether Chapman Plant has a renewed organisational culture that would be able to sustain these behaviours is unknown, and the plant could arguably fall into its old ways without much in the way of complaint from all of the actors; some would arguably have felt the HPT initiative did not deliver a sufficiently remarkable enhancement in performance or culture to warrant continuation. However, even in its weakest state of implementation, the design did facilitate and improvement in the plant's CI culture. In contrast to Chapman Plant, Jones, Gilliam and Palin all had high levels of implementation and in turn experienced high levels of CI improvement driven by all employee levels; a de-facto improvement in CI culture with new routines now affixed as part of the new normal. Furthermore, the removal of the system now would be problematic as the work design is now embedded within business as normal operations (how they do their business). In summary, the work design reaches its full effect when 80% completion or above against standards assessment is achieved.

Weakness in Implementation

From the cross-case study analysis, there are two areas of weakness within the work design. These are as follow:

- a) A lack-of or slow engagement from plant mid-level management that constitutes the majority of the category guides within the work design. This may be due, at least in part, to a lack of direction/vision and/or priorities from their chain of command. Such direction would possibly have been more forthcoming if a robust business case for implementation had been developed (see item b).
- b) A reliance on senior plant leadership to independently develop a fiscal business case to support implementation, and from this a robust but balanced scorecard to realise business case benefits as part of the balanced internal and external key performance indicators.

- c) Rewards and recognition policies and approaches were inconsistent between case study plants, and in weaker implementations adversely affected progress.

It is worthy to note that the aforementioned weakness in the work design all manifest at the specialist staff / management level and not at the Gemba where resistance was thought to be an issue within the barriers identified at Chapter 2. It appears to be once the mechanisms or Gemba actor involvement are in place, then it is the shortfalls in wider leadership and entrepreneurial talent (transformational thinking) that represent the next barriers to overcome.

Timeline Efficacy

The research is seeking ‘rapid’ mechanisms for organisational culture change. Rapid can be a subjective term; however, given that Toyota have been building their organisational culture for decades (J Womack, 2007), and represented the benchmark organisation within the automotive sector for lean or CI cultural attainment, it can be argued that any implementation taking below 2 years would constitute rapid by comparison. The 6 case study plants implemented the work design over an 18-month period (to a sufficient point where above 50% of the plant in terms of physical or chronological geography was enjoying HPT coverage). By Toyota standards, the shift in organisational culture to facilitate lean and CI would be considered as ‘rapid’.

Final Conclusions – Has the Research Met the Aim?

The aim of this research is:

to develop a lean-culture work design that enables organisations to develop an organisational culture that supports lean implementation within an 18-month period.

From reviewing the above paragraphs, a de-facto improvement in CI culture with new routines being affixed as part of the new normal are achieved when 80% or above completion against standards assessment is achieved, and that these can be achieved within an 18-month implementation period. To this end, the research suggests that this research has met the aim.

Final Conclusions – STS in Manufacturing, Lean and Other Theoretical Perspectives

STS as a Taught Manufacturing Concept

It is this researcher's opinion that manufacturing must first be taught as a socio-technical model. Between 2010 and 2017 the researcher was employed as a lecturer, teaching across various UK engineering degree and diploma programmes within the further and higher education sector. The researcher was tasked with researching and selecting materials for academic modules within degree programmes, as well as developing teaching plans and resources to meet the learning criteria within the established (national) curriculum of diploma-level programmes. Manufacturing organisations and their components are seemingly not presented formally as a socio-technical mechanism. Instead, the literature previously used within operations management teaching texts refers to job design, and not work design; examples include *Operations Management* by Slack et al (2004) and *Managing Production and Operations* and *Production and Operations Management* both by Martin Starr (1989) (2008). Job design is often presented with 6 features akin to the 6 nodes that the STS network uses in this research. However, job design considers the lower-level (specific) ergonomics of the task, and not the wider socio-technical interplay of the organisation as a whole. From 2018 to 2021 the researcher has been informally supporting work-based colleagues with their masters-degree studies in technology management and business. Their curriculum is currently reviewing the context of operational excellence within manufacturing; both the concept and principles of lean have been part of a taught module. Given the researcher's experience and

research subject, he has been recommended as a useful source of peer-guidance and review by other colleagues. This has provided the researcher with an insight into what is currently being taught. The curriculum has seemingly brought the learner directly to the concepts of lean and, specifically, its tools; one assignment calls for a value stream map to support the establishment of a new hypothetical manufacturing design as part of a 1500-word assignment. These students are asking how they can apply a lean tool during the establishment and set-up phase of a theoretical design; they are not being asked to consider the wider socio-technical work design as a basis for the lean tools to be integrated at a later point in time. This draws attention immediately to the concept of efficiency and waste reduction at set-up rather than the establishment of a learning organisation that will use the learnt principles more effectively and adapt them beyond the initial system design whatever the efficiency or inefficiency that the design may have. Whilst other core concepts of manufacturing may also be taught (such as quality assurance, safety etc.), the practical implementation and continuous adaptation of these core concepts are better explained within a socio-technical framework so that learners can identify with the interrelatedness of each node: Goals, People, Infrastructure, Technology, Procedures/Policy and Culture.

The point is organisations that are equipped to self-reflect and learn are arguably better equipped to continuously and successfully adapt and apply lean tools. In order to improve our understanding of how socio-technical systems must be considered as part of such continuous adaptations (for a learning-organisation,) curriculum needs to be changed in order to inform new generations of engineers and managers of the nature of socio-technical work design, and how such a concept is inescapable when considering improvement. It needs to be considered as essential learning if successful improvement philosophies (such as lean) are to be used. Lean can only grow if it falls on fertile ground.

Contribution to Lean Knowledge

STS needs to be understood and mapped before lean integration is commenced or attempted, and a learning-organisation work design needs to be established. Lean knowledge needs to be revised in order to inform the lean-student on the importance of understanding STS principles before a deeper understanding of lean can be obtained. For an organisation to become lean, or sustain lean, requires a learning-organisation. Lean principles and tools alone do not necessarily guide or inform organisational leaders in how to develop a learning organisation. The principles of a learning organisation are arguably more easily and consistently (between different sectors) described/prescribed in general terms using a generic socio-technical work design. In starting with a socio-technical work design, any return on the investment in lean tools and training will be more secured as the organisation will be more suited to its adaptation. Lean consultancy currently focuses on the delivery of training and guidance within the use of the lean tools; these tools often provide value or opportunity-for-value within a relatively short timescale, and are hence viewed as attractive. For example, Go-Beyond Partners (formerly OEE consulting) promotes stories of multi-million-pound fiscal impact within 1 year (GoBeyond, 2021). The Construction Industry Research Information Association generated a sector wide brief extolling what appears to be an array of very simple approaches to implementation of a variety of lean tools along with business benefits within the construction sector (O'Connor & Swain, 2013). The brief was funded by the UK Government department for Business Innovation and Skills, and both the authors are established independent consults. The book titled '2-Second Lean' not only extolls the benefits of implementing specific lean tools and routines, but also how easy they are to implement (Akers, 2016); the author, Akers, also offers training and public speaking services. These publications offer appealing opportunities to the business owner and/or lean-sponsor. However, the earlier systematic review at Chapter 2 identified that there was identical investment in such training or

consultancy services between successful and unsuccessful implementations. The understanding of lean implementation needs to be changed to inform all practitioners of the importance of mapping and identifying their current-state and ideal-state (learning organisation desired-state) socio-technical networks before improvement techniques such as value stream mapping or 5S are applied.

The Application of STS to Lean

Lean tool training within a business environment does not necessarily inform the learner of what socio-technical changes are needed to support the lean tools. The learners in such cases are often employees who are being introduced to new lean tools (such as 5S, or Value Stream Mapping) using the working environment as a context (i.e., on-the-job-training). Lean manufacturing practices are arguably socio-technical systems, but they are not presented, explained or trained in that form; it demands a lot from the lean-student by asking them to consider how to successfully synthesise lean tools and principles into their organisation. To be more explicit, and to view such in their most simple form, the tools are processes that require trained people (with capacity) to utilise such processes with infrastructure and technology to achieve a specific goal. Within that explanation was a list of socio-technical nodes: people, goals, infrastructure, technology and processes. The only STS node not mentioned in that list was 'culture'. That's not to say that culture was irrelevant, but instead that it will be developed from the level of consideration that is applied to the other nodes. A culture regarding the lean tool will be developed by the stakeholders whether or not the training-sponsor wants it or not; the culture will affect the efficacy of the tool. The following represents some basic examples of shortfalls in work design that could contribute to the creation of an adverse or unhelpful culture:

- the goals have been poorly selected or considered to be irrelevant;

- the right people are not involved or do not have capacity;
- time is not allocated for lean tool (process) to be applied (probably due to other processes)
 - there is a shortfall in policy or planning to prioritise activities;
- or the infrastructure and or technology that hosts or supports the lean tool (process) is insufficient or represents a barrier to progress.

The adverse culture will at first be an output created by the shortfall in design, before it proliferates to new or wider team members (current or future stakeholders). As a result, the lean tool will be doomed to wither and fail as its host environment becomes toxic rather than nurturing. A more specific example follows next.

The value stream mapping tool may be a very effective way of identifying waste; however, to do so and then exploit the new knowledge requires Gemba involvement and the fluent application of simple problem solving. The prudence to involve the Gemba in the value stream mapping, as well as the insight to go-and-see the real conditions at the Gemba rather than assume policy has been implemented, arguably require either an extant and collaborative organisational learning-culture or an extraordinary leader. Furthermore, the changes that the value stream mapping tool may identify will need management and Gemba effort in order to ensure that they are sustained if the organisation is to avoid degenerating back to the previous conditions.

These are all socio-technical work design challenges that lean learners need to be coached within in order to appropriately consider such and adapt the work design as part of lean changes / improvements.

Adapting STS by Integrating Other Theoretical Perspectives

STS work design should be applied within other sectors that have a focus beyond lean. This research has been focused upon improving organisational culture to support lean

implementation and sustainment. It is recognised that not every organisation has the same focus. For example, a research and technology organisation (RTO) may have a focus beyond operational efficiency. Whilst such lean efficiencies are not without importance for an RTO, greater emphasis may instead be placed upon scientific development, or improved provision of scientific advice and non-standard services. This would require a different focus, with a very different Gemba split between scientific-laboratories (technicians) and world-leading scientists each delivering value to clients in very different ways. However, the principles of fractal goals, Gemba-tracked performance, teamwork, empowered and Gemba-directed change-management that form part of the lean-change work design all remain relevant. With this in consideration, the machinations of this research should be attempted within such sectors that require an alternate primary focus to lean. Other sectors that may also have priorities that are equal to or beyond efficiency may include the entertainment industry or palliative care sector. STS could be used to generate employee-driven behaviour-based performance management. Within a traditional (inherent) socio-technical work design, the requirement for Gemba-level change is often identified and driven by leadership. In response to this requirement, the organisational leadership design the change they consider is needed; as part of this design is the specification and delivery of training to support the change. This could be akin to a lean implementation, wherein leadership may identify the benefits that lean extols and commences the delivery of training such as six-sigma yellow/green belt training. The aspiration / aim of the training is ultimately to change Gemba behaviour, which is hoped will lead to a consequence (benefit to the organisation). Moustaghfir et al (2016) propose that Gemba members may not adopt the behaviours immediately, and hence the consequences (benefits) may not be realised. The Gemba may see the consequences as negative or uncertain, and hence the behaviour is not adopted (Moustaghfir, et al., 2016). With the adoption of a lean-culture socio-technical work design (or a similar design that enables Gemba-driven learning / change)

the empowered and influential Gemba will identify opportunities for benefits (consequences) that then hence require new behaviours, which will then develop from them a pull for training in order to model the behaviours (and then ultimately received the benefit). This approach represents the reverse to the traditional leadership-driven approach, and is likely to be more successful than forcing training and driving behaviours, which would consume considerable management resource. If STS and Gemba-driven performance management were linked and improved, then there may be considerable benefit from not only lean efficiency improvements but also improved training efficacy.

Recommendations for Lean-culture Work Design Development

Wider Theories and Continued Surveillance

The implementation was not 100% successful in all cases, with the biggest weakness being that leadership was sometimes slow to adopt the work design. This presents an argument for further refinement of the work-design with potential exclusion or inclusion of different wider theories to increase the implementation quality, consistency and speed. Given the time to develop the new work design (mechanisms), the research only had sufficient time and resources for a limited number of full implementations and evaluations. Whilst this could be sufficient to draw conclusion as to the efficacy of the mechanisms, the next steps would be the further refinement and test of the HPT design in order to ensure that the mechanisms are fine-tuned (avoiding unnecessary activities) and scalable for industrial sectors beyond manufacturing. The research could hence benefit from continued surveillance in order to identify if the culture sustains, and if not then which of the following questions would apply:

- What intervention or event re-directs the culture to less optimal conditions or returns it to the condition before HPT implementation?

- What omission from the work design eventually degrades the culture to less optimal condition?

Business Case Development

It is proposed that a systematic approach to opportunity identification and subsequent business case (vision) development be considered downstream. Such an approach would also lend itself to improved scorecard development; the work design does allow flexibility but is also quite explicit how the balanced scorecard should look. A systematic approach to business case and subsequent KPI development would enable the work-design's approach to scorecard development a measure of greater flexibility.

Benefits Tracking

The lean-culture design does not include a template for fiscal benefit tracking. This was initially kept out of the design upon the assumption that pre-existing systems would accommodate these requirements. It is now apparent that pre-existing systems are either not suitable, or do not adequately separate improvements from HPT efforts from other pre-existing arrangements. Furthermore, there was resistance from the participating organisation to share cost improvement data with Gemba employees. The data from Chapman and Cleese plants indicates that this position has proven to be counterproductive. Furthermore, the more successful implementation at Jones, Gilliam and Palin took the local initiative to share this data with the employees as part of the Cost category within the scorecard. It is suggested that a local benefit tracking system would support the HPT implementation through identifying the actual performance against business case requirements, and reduce the issue arising from structural conflict (Senge, 2006). This is similar to the principles of tracking earned-value-management (EVM) within project management, where the project benefits are tracked

throughout project execution. Whilst this could be incorporated within the scorecard, a separate system would press the need to track benefits as part of any new implementation. To this end, any further iterations of the design should include a basic approach to fiscal benefit tracking.

Rewards and Recognition Policy Development

It is also proposed that a lean-culture system be developed for differing approaches to rewarding and recognising contribution. Whilst identified as a requirement within the work design, this was not finitely specified and left to plants to develop in accord with their own constraints. This flexibility may have also inadvertently given permission for senior leadership to be apathetic to this requirement. Whilst a case for more pay can always be argued and countered by the various actors within the scope of HPT, further research into optimal levels of reward (or alternative types of reward using gamification) could be advantageous.

Leadership and Entrepreneurial Skill Development

The case studies identified a shortfall within the abilities of the plant leadership to quickly adopt the system in view of not being able to draw out benefits vs implementation costs. Due to the setting being a manufacturing environment, the costs associated with Gemba resources being assigned to HPT meetings, as well as HPT infrastructure were identified but not cross checked against the fiscal opportunities of efficiency savings associated with operational waste reduction. Such opportunities were not easily apparent. The Chartered Management Institute makes a claim that many managers are being promoted due to their functional abilities and not in view of any leadership or entrepreneurial skill or talent (Chartered Management Institute, 2017) and label these managers as accidental managers. It claims that these managers are draining productivity due to lack of appropriate development. Further research into the type

of development that would enable such leaders to become more adept at transformational thinking could benefit the work design as an integrated item. These transformational thinkers could arguably be more adept at developing a vision (a function of leadership).

Change Readiness Assessment Development

In order to better define the barriers to lean implementation from Chapter 2, Chapter 3 included a general survey that included change formulae in order to ascertain if remarks represented drivers or resistors to change. Further development of this work, with enquiries set against the work design and results in Chapter 5 onward, could improve the measurement of cultural change/improvement for this type of research. Furthermore, a rapid survey for socio-technical arrangements improves change tempo through identifying a need for change. A former exemplar manager at Goodyear, Billy Taylor, has spoken of the benefits of “*holding a mirror up to the plant management*” (Taylor, 2017), and that such an approach can inspire leaders to take action in view of seeing the plant and leadership effect from an employee perspective. Similarly, such a survey could also be used for different applications such as mergers and acquisitions as part of due diligence activities for gaining better understanding in the following:

- what effort may be required to align a newly acquired organisation to differing corporate values; or,
- what opportunity may exist for improvement.

More data collection and development into a robust survey would be required in order to develop a scale with which to assess overall change readiness, and develop numerical boundaries for negative, moderate and positive change readiness. More organisations contributing data, together with an overall assessment of their current KPI performance would enable a scale to be developed that could indicate 3 zones within which organisations could be assessed as either positively, moderately, or negatively ready for change. As this research

progresses then common themes might be identified that are associated with low contextual scores; countermeasures could then be drafted and cumulated for each socio technical contexts. Work designs such as HPT could then be improved.

This tool could benefit from further development to avoid the effects of test and gamma change (R Milshap, 1988). Gamma change refers to the reconceptualization or redefinition of a referent variable. It occurs when subjects (people affected by the change) change the basic understanding, from one testing period to another, of the criterion being measured. Thus "teamworking ability" may mean something quite different at one point in time as compared to much later time, especially if a planned treatment or intervention was directed at enhancing the subjects' understanding of this or other related concepts. Test change occurs when the standard of measurement used by a subject(s) (people affect by the change) to assess an item changes from one testing period to another; a subject (person) may rate a certain teamworking behaviour as a 2 (on Likert-type scale) at one point in time, and the identical behaviour as a 3 at much later point in time as they have gotten used to certain standards of behaviours and re-baseline what is average, low and high performance. Ideally, alpha change is preferred by way of increasing confidence that true change has taken place. Alpha change is defined as a rating change for which both gamma and test change have been ruled out. That is to say, neither the subjects' understanding of the criterion being measured nor the measurement scale has changed. As an example, assume that a group of managers is exposed to a planned intervention and that as a result their behaviour is changed. Then further assume that the ratings of their behaviour by subordinates have been collected according to a standard pre-test/post-test research design. If, after determining that neither gamma change nor test-change has occurred, the researcher observes a difference in subject responses from the first survey point to the second survey point (much later), alpha, or real change, can be argued to have occurred. Another example may be to ask a subject to rate his/her knowledge of lean at the start of a long-

term (i.e., 5-year) lean improvement journey with consultancy support – their rating would change at year 1 to year 5, as their understanding/awareness of how big it is and what they did not previously understand increases. A rapid cultural assessment tool, with intrinsic indicators of what to improve, would likely be useful to organisational leadership that either:

- have an interest in evaluating and improving their own organisation's culture; or,
- are interested in expansion / procurement of existing facilities and would like to measure the socio-technical and cultural issue that may otherwise not be apparent upon a balance sheet.

Integrating two time points and survey plots for identifying test and gamma change could support improvements in evaluation-accuracy and more robustly justify the selection of specific interventions that have been tried and successfully produced alpha change.

As a bi-product of its creation, the fieldwork data capture tool in chapter 3 also acted as a basic means of investigating and grading an organization's readiness for change. Such a tool could have the potential to assist leaders to not only select countermeasures to address weakness, but also consider the influence of arrangements at less visible socio-technical contexts in terms of whether or not those arrangements act as a significant enabler or preventer to change and improvement. However, it may also be used to generate knowledge at the plant-leadership level where the negative effects of a fixed mind-set to growth can have the most detrimental effect. By requesting plant management forecast the result in advance of the data collection and analysis, the results could be used to alarm leaders into action that may otherwise have not been apparent.

Implications for Future Research

With Respect to Relevant Literature

Soliman et al indicate that lean production is a means for influencing the complexity of socio-technical systems (Soliman, et al., 2018), and in doing so infer that lean is arguably socio-technical in nature. Whilst they do not offer a framework for practical application, their paper compiles case studies that explains how lean impacts the socio-technical nature of lean-adopting organisations. Whilst this is arguably useful for most business leaders considering lean implementation and potential failure, it can also be argued that most lean journeys will instead start with business leaders taking a measure of insight gleaned from a management/business-book or a conference as opposed to an academic journal paper. This is argued as more likely due to the possibility that most business leaders would have more access to that type of publication. Furthermore, the text is likely to be more accessible to that particular audience. Of the literature of this ilk, reviewed as part of this research, none had an explicit socio-technical network linked to its content. Most discussed the instances where common lean tools and techniques were synthesised and applied, along with contextual data, stories and guidance for their implementation. This links to Miller's comments (Miller, 2020) wherein she implies that organisations tend to seek pragmatic and accessible tools for copying within their organisations, but often lack the background wisdom to fully exploit and sustain such tools. The inclusion of mapping the organisation's socio-technical arrangements may improve such wisdom and hence the likelihood of sustaining lean methods; however, such guidance is not predominantly included within most business-book literature pertaining to lean implementation. This concludes that more research is required that integrates socio-technical work design thinking into mainstream business literature, and preferably with a focus on

organisational performance against specific sectors (i.e., manufacturing, KIBS⁷, healthcare and research / technology organisations).

With Respect to the Application of Lean in Other Sectors

Lean is being observed and implemented within wider sectors beyond manufacturing (Zimina & Pasquire, 2011) (Rodriguez, 2020) (George, 2003), with some publications suggesting how specific lean tools could be provided into service sectors. Lean is considered to transcend the boundaries of the manufacturing sector. Similarly, socio-technical systems analysis also transcends such boundaries, as can be seen by the example of using such for crowd control analysis (Challenger & Clegg, 2011). Furthermore, socio-technical systems analysis is also starting to be linked to change and project management (Norton, 2006) (Alexander, 2013). Joan Knutson of The Project Management Institute indicates that project management is a socio-technical process, and extolls the virtues of using a 6-node network to break the project management discipline down into six subsets so that the project management discipline may be analysed to see how each node affects the success or failure of other node(s) and hence the organisation of a project as a whole (Knutson, 1996). This could have implications on the design of project management frameworks. Considering the relative paucity of literature on the subjects, both the applications of lean in wider sectors and the application of socio-technical systems analysis within change and/or project management seem immature compared to the applications of lean within the manufacturing sector. It could be perhaps more appropriate for socio-technical work design to be more formally integrated as an organising framework as part evolving change or project management theory/practice.

⁷ KIBS – Knowledge and Information Business Services.

STS as an Organising Framework

The plants that implemented the lean-culture work design well started to innovate new features (technological and procedural features) that improved the work design to better suit their organisation. The features of the new work design promoted further innovation; the organisation became a learning organisation. It can be argued that this ‘learning organisation’ feature will have a greater benefit and value in the longer term, especially if applied beyond the operations management aspects of the plant, and instead into the wider environment within which the plant exists i.e., the political, economic, social, technological and legislative contexts that make the wider environment within and beyond the plant’s physical boundaries.

A lot of literature regarding socio-technical systems design often pertains to new information technology systems and their integration with users. Whilst this may be relevant to that field, it may possibly mis-represent socio-technical thinking as being limited to (information) technology design. The paper ‘A Call for Bravery’ by Challenger et al (Challenger, et al., 2014) calls for socio-technical systems to be more widely used within applications such as those within this research. The plant-level instructions, however, did not explicitly demonstrate the 6-node socio-technical network used for the lean-culture design, which has been the purview of the researcher (the work designer). This was because the plants needed a practical and comprehensive guide for implementing new ways of working instead of having the responsibility of developing the HPT system from a 6-node work design model. The plants do not own the funded capacity or skill for that level of research and development. The lean-culture design has created a method to empower all employees at all levels to focus on value improvement by creating a structure within which organisational learning is systematic to routine operations. Challenger’s paper attempts to provide a generic framework to create opportunities for development, however, it can be argued that a more structured information-guide and coaching methodology (and capability) may need to be established in order to

generate this type of framework thinking within organisations. The STSRT (Socio-Technical Systems Round Table) is a voluntary group/blog that seeks to incorporate socio-technical systems thinking within Change Management (STSRT, 2014); however, their electronic publications are currently limited to explaining the history of socio-technical systems development and its relevance to change management. Given the paucity of practical guidance at this point, and building upon the work by Challenger et al, further work is required to better explain pragmatic models for using a socio-technical model specifically toward sustaining lean initiatives or developing project management frameworks or project designs.

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ANNEXES

CHAPTER 3 - ANNEX 1 – BARRIER SURVEY DATA FROM PLANT A

ANNEX Table A-1 - Remarks Received Within the ‘Goals’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
Departments only concentrate on their own goals; (they have) no time for the plant (goals). Sometimes you need to sacrifice something to be able to achieve more.						y			Driver for change but no current agreed system to reinforce the solution or shared vision.
(There are) conflicts between departments; mixed goals.						y			Goals are mixed and diluted.
What's the point to set unachievable goals e.g., 'no accidents'?						y			Goals are unachievable.
Team do not understand that we need to improve even when we are in (a) good situation.						y			There is a lack of vision and goal development.
(There is) not one clear strategy for all plants.						y			Unclear whether or not the issues of goal miss-alignment rests at plant or corporate level.
Different departments focused on personal goals (and) not on important plant metrics.						y			Lack of goal alignment.
The Plant has a belief that it should expand the processing facilities with a second processing line, and that it is one of the best, if not the best, in class.		y							A goal is defined.
By creating savings, (is there a) possibility of potential job loss?						y			This is a story that could provide a resistor to change, even if such is unfounded.
We try/want to standardise plants/procedures for old/new plants, which is impossible. We should take into consideration what resource we have.						y			Goals need to be developed that reflect and direct resources; this infers that it has not been done.

ANNEX Table A-1 - Comments Received Within the ‘People’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
(There is a) lack of time for training.								y	Lack of training / skills

Good cooperation (amongst teams and plants)				y					Good teamwork
Lack of proportions between work and breaks.								y	Moderated by the Lean Task Force: the organisation appears to have a "café-culture" with a high amount of high-quality coffee and opportunity to imbibe.
People are over-loaded with basic jobs.								y	Lack of capacity
(There is a) lack of money for training.								y	Lack of funding
(There is a) lack of / small (amount of) knowledge about Lean tools and culture.								y	Lack of training / skills
People want to improve but don't know/don't want to use proper tools.								y	Lack of training / skills
Wide inter-plant cooperation and support = development of plant and leaders.				y					Good teamwork
(There are) too many tasks for (the) plant in comparison to (the) resources.								y	Lack of capacity
(The staff levels in) central teams are not balanced. (There is a) number of people in some areas missing staff which means no support for the plant.								y	Lack of capacity
A minority of people in key positions have an unjustifiably strong opinion of their Transition-to-Lean skill.								y	Lack of training / skills
(From) Kaizen events (there are) many ideas not implemented (due to) lack of time (and) lack of money.								y	Lack of capacity
Internal training (is) not always available in local language.								y	Lack of training / skills

ANNEX Table A-1 - Comments Received Within the ‘Processes and Procedures’

Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
EPIC (<i>planning system</i>) not updated on time.							y		Software and procedural unsuitability
Global suppliers only for strategic goods. For non-strategic (we) should be local and not limited to SAP suppliers.							y		Unsuitable policy
Cooperative value (sharing good practice between plants) should sustain value for the customer.			y						An excellent example of good practice, with a policy that reinforced good practice
Good implementation recently of the Ops Hub and Info Centre.			y						New procedures implemented sustaining positive behaviours.
(<i>There are</i>) too many procedures. (<i>Some</i>) procedures (<i>are</i>) not applicable to all divisions (<i>within the wider organisation</i>).							y		Unsuitable policies - too many
(<i>The key</i>) process (<i>is</i>) not stable.							y		Indicates a lack of process control and policy to pursue the development of such.
(<i>There are</i>) too many global procedures (<i>that are</i>) not flexible.							y		Unsuitable policies - too many
(<i>There is a</i>) lack of local suppliers (<i>used</i>) - only central (<i>suppliers used</i>).							y		Unsuitable policy
(<i>There are</i>) too many procedures (<i>and</i>) documents to fill in (<i>and</i>) audits (<i>leading to</i>) no time to do the actual task. (<i>There is</i>) no time to think about improvements.							y		Unsuitable policies - too many
(<i>The</i>) information (<i>flow is</i>) inadequate to normalise the culture.							y		Unsuitable policy
All modification requests are waiting too long for approval.							y		Inadequate procedure

ANNEX Table A-1 - Comments Received Within the ‘Building and Infrastructure’

Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
(There are) not enough conference rooms.								y	At face value a minor issue, but the room in the organisation are also used for training and value stream mapping, hence it has been included as a shortage in internal capability.
The plant is clean; showing good 5S implementation.				y					The organisation demonstrates excellent implementation of high-level husbandry and cleanliness standards, inferring a positive story, shared values and systems as well as skill/capability.
The plans is (a) clean, neat place to work. Equipment is quite modern.				y					Once again, the organisation demonstrates excellent implementation of high-level husbandry and cleanliness standards, inferring a positive story, shared values and systems as well as skill/capability.
(A) low-cost focus (on) planning for new investments (that) closes future expansion = cost is doubled.								y	A polar opposite to the above and what is being observed, this is likely to be a frustrated individual who considers that the organisation doesn't go far enough on investment planning and commitment.

ANNEX Table A-1 - Comments Received Within the ‘Technology’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
Isn't it better to see the process first and then map it?								y	Indicates a miss-use of the Lean tools.
All modification requests are waiting too long for approval.								y	Tools need modifying.
(There is) weak IT support.								y	Lack of capability in terms of IT and its support

(We need) one standard tool for production planning across all plants (<i>production planning is manual at this organisation, but an organisation-wide system is available for use</i>).								y	An observation that the organisation is not standardising its use of production planning processes across all sister-plants. This infers a desire to standardise and exploit apparent benefits, whilst also inferring a lack of skill or capability as this has not yet occurred despite opportunity.
The plant has successfully implemented more advanced core processing techniques than a number of its peers.				y					A number of processing techniques together with associated technology was observed that are absent in some sister-organisations. Good practice was clearly identified with a clear capability benefit.

ANNEX Table A-1 - Comments Received Within the ‘Culture’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
(There is) weak teamwork between central and plant (<i>teams</i>).					y				Story of weak cooperation
(The) people from the shop-floor should be more involved.					y				Story of weak cooperation
(The plant has an) adoption and sustainment culture; it can synthesize techniques but has yet to innovate independently.					y				Story of apathy to innovate / lack of innovation
(The plant is) off the 'head office radar' - meaning that it is not viewed as a problematic plant by global executives.	y								Story of plant success
(There is a) lack of support from central (<i>departments</i>).					y				Story of weak cooperation
The plant is under-stimulated.					y				Story of apathy to innovate / lack of innovation
(There is a) lack of feedback after making improvement.	y				y				Infers improvement has occurred, but then is a story about the lack of appreciation for such (apathy to improvement)
(There is a) negative attitude to change.					y				Story of resistance / apathy to change

(There are) cultural differences between plants. People in sister plants are not willing to change to accommodate different ways of working.					y				Story of weak cooperation
(There are a) lot of complaints (but) no actions.					y				The complaints infer a motivation for change; however, the lack of action infers that the complaints are either considered as not-credible or without solutions - a story of apathy to change
Change implemented but not sustained. Not 100% of ideas implemented. We stop on 75% and think that everything will be ok.					y				Story of resistance / apathy to change
Some people are frustrated by the organisation's apathy; others revel in the apathy.					y				Story of resistance / apathy to change
Some people think they know better than everybody else and don't want to listen/cooperate.					y				Story of resistance / apathy to change
People are willing to change if they see the benefits, otherwise they block the change.					y				Story of resistance / apathy to change
If you don't risk you won't win or make huge improvements.					y				Story of resistance / apathy to change
In front of big challenges people don't think in advance but wake up too late.					y				Story of resistance / apathy to change
Majority of staff are either enthusiastic or neutral to continue (improvement). Certainly not apparently negative enough to obstruct improvement.	y								Story of resistance / apathy to change

CHAPTER 3 - ANNEX 2 – BARRIER SURVEY DATA FROM PLANT B

ANNEX Table A-2 - Remarks Received Within the ‘Goals’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
Let's all pull together and make this the number 1 foam plant.						y			Enthusiasm for change - no specifics but infer that there is currently no shared vision.
Quality is not seen as the priority.						y			Goals are not aligned.
RFT is not reported daily or prioritised.						y			Goals are not understood or aligned.
What's happened to the RFT and scrap over the last two months - what's changed?						y			Infers that activities have drifted away from goal direction; not being checked or aligned.
Customer -> production, therefore not quality mind-set.						y			Goals between quality and delivery are diluted and misaligned.
What will happen (product) in September with the RFT and DPU being so bad. Pair this with the (product), same issues and <manufacturing line> rework and scrap will be out of control.						y			Clear pressure for change, but again the RFT issue is unresolved - there is a cry for some leadership / goal alignment to address these issues.
Team leaders to do their own work (i.e., looking after the track) instead of doing the shift co-ordinators work.						y			Goals are misaligned

ANNEX Table A-2 - Comments Received Within the ‘People’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
There is a lack of skills.								y	Lack of skills
Shut down should mean shut down; not give people time off, run the tracks full and then expect the rest of the operators to carry other jobs.								y	Lack of capacity
There is not enough rotation on jobs.								y	Lack of skill/job rotation

Have the working trainer back on each area so training is done as soon as needed; no need to wait. Give them a small incentive to do this; everyone's a winner.								y	Infers a current lack of training availability
No time to follow our <working procedures>								y	Lack of capacity
People from temp agencies that have more work experience should be given a job.								y	Lack of skills
Staffing levels are <inappropriate>.								y	Lack of capacity
Lack of skills gives poor flexibility.								y	Lack of skills
Shutdown! What Shutdown?								y	Lack of capacity
There is a lack of support for logistics; no cover.								y	Lack of capacity
No training courses available for job progression.								y	Lack of training
No opportunities to get trained on different jobs.								y	Lack of training
Contractors are doing jobs that maintenance could do - wasting money.								y	Lack of capacity
The best inspectors are on c shift - the best team work is on c shift.				y					Skill is on c shift
Very happy with my shift; team leaders and managers.				y					Skill is on c shift
Operation description sheets are nearly impossible to follow at the pace we work at.								y	This is a process capability issue but also a lack of capacity/training
More training is required to enable (job) rotation).								y	Lack of training and skill
There is a lack of manning; too many jobs; employees can't cope. Stress.								y	Lack of capacity
Some people don't have the right skills or the correct attitude.								y	Lack of skill
Great team work in repair loop.				y					C Shift have skill
Shift leaders don't get management training.								y	Lack of management skill

Need a 5th person on wires running about like lunatics at the moment. Will it go even faster when new robots are installed?								y	Lack of capacity
Should shift COs be rotated?				y					Infers there is the right management skill somewhere within the organization
There is a lack of job rotation - stuck on the same job.								y	Lack of skill/job rotation
Quality standards training needs improving.								y	Lack of training
Lack of job rotation - especially 8 hours every day on Track – operators feel burnt out.								y	Lack of skill/job rotation
Can't get a holiday when you need it. 3 people off per day is far too little. More people needed on the shop floor.								y	Lack of capacity
There is no job rotation.								y	Lack of skill/job rotation
Why is the chemical farm secret – can I work there?								y	Lack of skill/job rotation
Limited production								y	Lack of capacity

ANNEX Table A-2 - Comments Received Within the ‘Processes and Procedures’

Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
RIE process is ineffective.							y		Inadequate process/procedure
There is no visual management of tank farm for production.							y		Inadequate process/procedure
Procedures not relevant to task.							y		Inadequate process/procedure
Stop doing re-work on break - killing the packing area.							y		Inadequate process/procedure
Quality standards are continually changing - very confusing.							y		Lack of procedural stability
There is too much paperwork.							y		Inadequate process/procedure
Quality specs - 15mm is a joke.							y		No faith in the procedure

Processes are put in place without asking employees if this is beneficial.							y		No faith in the procedure
Communication between shift departments is not good.							y		No process for team cooperation
Insufficient Procedures							y		Inadequate process/procedure
Unrealistic Procedures							y		Inadequate process/procedure
Why don't operators on tracks have 10 mins breaks?							y		Inadequate process/procedure
There are too many meetings							y		A suggestion for efficiency consideration.
No sustainability.							y		Lack of procedural stability
Planning for projects is always rushed and unrealistic.							y		Lack of procedural stability
IT systems too complex. Too much time spent keeping data on file. Everything has a lengthy process.							y		Inappropriate procedures
There is no teamwork between departments and even less within departments.							y		No process for team cooperation
Agreed actions are allowed to drift.							y		Lack of procedural stability

ANNEX Table A-2 - Comments Received Within the 'Building and Infrastructure' Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
Packing area too small.								y	Lack of capability
Not enough space for warehouse, packing, tooling and logistics.								y	Lack of capability
Roof leaks everywhere.								y	Unsuitable capability
We need a proper pedestrian route through the car park to minimise damage to peoples' cars.								y	Unsuitable capability
The shower barely functions.								y	Unsuitable capability
Limited space by racetrack.								y	Lack of capability
Obsolete tooling is taking too much space in the yard.								y	Unsuitable capability

All relevant parts should be turned off when there is no packaging.								y	Unsuitable capability
(not enough) space for goods-in and raw materials.								y	Lack of capability

ANNEX Table A-2 - Comments Received Within the ‘Technology’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
We need the right tools, right jobs, good tools, good jobs.								y	This infers they haven't got the right tools. Lack of capability
Quality Technicians don't have access to quality system - unable to check inserts are correct to drawing when quality issues happen.								y	Lack of capability (access to information)
No problem-solving board in hub area. Need a board so shift can resolve quality issues.								y	Lack of capability (access to information)
Uniform required.								y	Lack of capability
Some new uniforms wouldn't be a bad idea.								y	Lack of capability
New equipment installed which doesn't work properly, then expect the shop floor workers to put it right instead of getting the company who installed it to put it right.								y	Lack of capability and procedural shortfall.
Spares take far too long to get signed off and actioned. Why?								y	Lack of spares (capability)
Tools need to be cleaned and prepared when taken off, not before they go on.								y	Impacts of tool capability
Too many mould changes. Why?								y	Impacts on capacity / capability
PPE for everyone - not just operators.								y	Lack of essential equipment
There are no spares to replace broken or worn-out machinery.								y	An unsubstantiated and over generalised remark.
Race tracks are inflexible.								y	Lack of capacity
Race tracks give consistent takt.				y					A benefit of current technology

Slow the tracks down so you have more time to do your job right.								y	Lack of capacity
4 operators needed around cleaning side of line or get the wax programme right.								y	Lack of capacity
Too many people on the line can make it difficult to clean and wax to procedure.								y	Lack of capacity
What will happen (product) in September with the RFT and DPU being so bad. Pair this with the (product), same issues and <manufacturing line> rework and scrap will be out of control.								y	RFT issues infer a problem with the processing technology

ANNEX Table A-2 - Comments Received Within the ‘Culture’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
We need better recognition.					y				Statement inferring poor management culture
Recognition for clocking in on time for a full month and having not sick days -incentive.					y				Statement inferring poor attendance culture and low recognition
Clock in for 1 minute past the hour and lose 15 minutes. Clock out at 20 minutes past the hour and lose the hours - Get nothing.					y				Coercive management structure
<Middle managers can sometimes appear too cross all the time>.					y				Suggestion of an adverse culture
People don’t take the meetings seriously.					y				Suggestion of helplessness or apathy
Shouting is normal.					y				Suggestion of an adverse culture
There is no cooperation.					y				Suggestion of an adverse culture
Who shall we blame today?					y				Suggestion of an adverse blame (coercive) culture
Lack of leadership training for all levels.					y				Statement inferring poor management culture
No leadership.					y				Statement inferring poor management culture
Leaders should be more understanding.					y				Coercive management structure

Poor communication at all levels.					y				Suggestion of an adverse culture
Where are the equal opportunities?					y				Coercive management structure
Disciplinary can happen too quickly									Coercive management structure
Stop ignoring things - sort them out.					y				Suggestion of helplessness or apathy
In a nutshell, nobody is happy.					y				Coercive management structure
Not really happy – feels like a massive blame culture.	y								Coercive management structure
Long service awards are no good - who on the shop floor wants a paper weight.					y				Suggestion of helplessness or apathy
Management talks down at you sometimes when we know the job better.					y				Coercive management structure
There is no recognition, no well done, or thank you.					y				Statement inferring poor management culture
Working here for 7 years. Too many people have the wrong attitude - want to come to work and do nothing.					y				Statement inferring poor management culture
We come to work not to get shouted at.					y				Statement inferring poor management culture
More respect should be given from management to all employees.					y				Statement inferring poor management culture
People should do the right things not just say them.					y				Statement inferring poor management culture
Quality should be first priority, not last.					y				Suggestion of an adverse culture
Actions are not being taken after problems are identified.					y				Suggestion of helplessness or apathy
Employees are afraid to speak to management.					y				Suggestion of an adverse culture
Why help you when you don't help anyone else?									Flame war response.
More and more people are leaving the company because of the way they are treated.					y				Suggestion of an adverse culture
By shouting?					y				Suggestion of an adverse culture
RFT problems, blame operators all the time.					y				Suggestion of an adverse culture
Grievances are not followed up.					y				Suggestion of an adverse culture

It seems nothing matters after 2pm on Fridays + night shifts.					y				Suggestion of helplessness or apathy
People not taking ownership.					y				Suggestion of an adverse culture
It's not what you know, it's who you know.					y				Suggestion of helplessness or apathy
There is too much finger-pointing instead of cooperation.					y				Suggestion of helplessness or apathy
Too many people on days doing nothing.					y				Suggestion of helplessness or apathy
<Middle managers can sometimes appear too harsh>.					y				Suggestion of an adverse culture
Some shift managers and T/Leaders have favourites.					y				Suggestion of an adverse culture
Use positive and constructive motivation - being threatened with disciplinary actions doesn't tend to work.					y				Suggestion of an adverse culture
There is little or no cooperation unless urgent or under pressure.					y				Statement inferring poor management culture
Why do operators always get the blame when things go wrong.					y				Suggestion of an adverse culture
Scared of (management department).					y				Suggestion of an adverse culture
People are never on time to meetings.					y				Suggestion of helplessness or apathy
People are afraid of taking decisions; therefore, they think they are not empowered.					y				Suggestion of helplessness or apathy
Shift management talk to operators in a disrespectful way.					y				Suggestion of an adverse culture
Show some respect for operators for doing their job as it's not as easy as management think.					y				Suggestion of an adverse culture
Stop blaming operators for all the issues/problems on the tracks.					y				Suggestion of an adverse culture
Why even bother with this? Management wanting to be seen as if they're doing something? Previous attempts have failed! Just another case of management having too much time on their hands while operators have too little.					y				Suggestion of an adverse culture

If you get hurt rushing about doing your job, you're accused of not concentrating.					y				Suggestion of an adverse culture
<Leadership> has a very bad attitude to operators.					y				An unsubstantiated perspective - but a negative story - leadership skills.
It's not what you know, it's who you know (influence).					y				Indicates favouritism.
People that want to get on, can.	y								Opportunities exist, and can be exploited.
Need better paternity leave for fathers.					y				An unsubstantiated perspective - but a negative story - leadership skills.
Managers walk away from you even when you are talking to them.					y				Suggestion of an adverse culture
How and why do Bradford factor points count when you are signed off by the hospital? Would you prefer us to come back unfit and then go off again to accumulate more points? #heartless.									An unsubstantiated perspective - but a negative story - leadership skills.
Everybody should be treated the same.					y				A positive notion, but unspecific and implies that we are not.
Performing job as easy as possible.									Unsubstantiated and unspecific remark.
No one cares about our health and safety.					y				Could be a lack of communication - welfare.
You only get a good job (days/TL) if you get a manager on speed-dial.					y				Unsubstantiated and unspecific remark.
<list of people> all progressed through hard work.	y								An unsubstantiated perspective - but a positive story - leadership skills.
Too much stress.					y				An unsubstantiated perspective - but a negative story - leadership skills.
Lots of hard-working people here - some just don't want to know.					y				An unsubstantiated perspective - but a positive story - leadership skills.
Why are only male workers doing the track?					y				Interesting equal ops question.
I am glad to work with nice people on my shift.	y								An unsubstantiated perspective - but a positive story - leadership skills.
My Shift - it's the top - the best.	y								An unsubstantiated perspective - but a positive story - leadership skills.
Every man in goods in is on days.					y				This remark is non-specific.

Music on the shop floor please?									There is no music on the shop floor. This is not in-scope.
Over-worked and under-paid.					y				An unsubstantiated perspective - but a negative story - leadership skills.
Money is always put ahead of worker's needs.					y				An unsubstantiated perspective - but a negative story - leadership skills.

CHAPTER 3 - ANNEX 3 – BARRIER SURVEY DATA FROM PLANT C

ANNEX Table A-3 - Remarks Received Within the ‘Goals’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
Focus should be on customer satisfaction						y			Inferring disagreement or misalignment with the goals
Focus should be on ensuring customers are satisfied with our products - no point having good ones if no-one buys them!						y			Inferring disagreement or misalignment with the goals
Let's make what the customer wants, not what we can make						y			Inferring disagreement or misalignment with the goals
- This can work but also you can also make a solution then find a problem (<i>Follow on comment - pioneer of technology</i>)						y			Inferring disagreement or misalignment with the goals
Customer led Priorities. I think it should be engineer lead would be better						y			Inferring disagreement or misalignment with the goals
How do engineers know what customers want?						y			Inferring disagreement or misalignment with the goals
Not enough support from other departments, on shop floor						y			Goal misalignment between departments
Decisions made without consulting the correct responsible parties						y			Goal misalignment between departments
Division management don't assess local impact						y			Goal misalignment between departments
The future for <location>? No Vision, No Roadmap						y			Lack of goals

ANNEX Table A-3 - Comments Received Within the ‘People’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
We don't outsource enough - there are people out there who are more suited								y	Infers a lack of skill on internal people
Sometimes we outsource too much! What about in-house knowledge?				y					Infers a lack of skill development and excess capacity
Make use of people's abilities				y					Infers a lack of skill development and excess capacity
More cross training required for more dynamic team								y	Lack of training for job-rotation
No project leaders								y	Lack of management
Slow responses from some departments								y	Lack of communication
No project leaders								y	Lack of management
Lack of career progression								y	Lack of opportunity
Help develop and train employees (Retain)								y	Lack of training resources
Shop floor - Skill up not skill down								y	Lack of training / skills
Should be more open book - share IP don't guard it.								y	Lack of training / sharing skills
People is the barrier								y	Either a lack of them/skills or cultural
Resolve issues with products we have before introducing more new ones (Sense checking - Moved to People)								y	Lack of resources
Hiding behind the <company> systems to distract from individual inefficiency								y	Lack of people-management
There is zero opportunity now for career progression for shop floor personnel								y	Lack of opportunity
- Two managers started on the shop floor – opportunities!				y					Evidence of progression
- When? Ask after market and product managers for sales directions								y	Lack of opportunity

ANNEX Table A-3 - Comments Received Within the ‘Processes and Procedures’

Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
The <corporate> processes like innovation are a barrier							y		CI systems are felt to be inadequate
<Corporate> systems can be barriers to getting things done quickly							y		No buy in to corporate systems
Engineering focused business decisions							y		Plans are perceived as too biased toward technology or business
Projects not properly finished/documented							y		Lack of procedural coherence
Sometimes our <corporate> systems can slow things down							y		No buy in to corporate systems
Use tools when appropriate							y		No buy in to corporate systems
Driven by managers through definite concise direction			y						Indicates policy does exist and is management driven
Inter-departmental communication and knowledge sharing is lacking							y		Indicates policy does exist and is management driven
Before change, check along the line Eng-Production - Dispatch to ensure change will not affect the product							y		Lack of procedural due diligence
Let people know if visitors are coming. Email the day before							y		Lack of procedure
So, what does <location> need to do to achieve BU strategy?							y		No reinforcement of systems
By Whose measurements? Create our own metrics							y		No buy in to corporate systems
Some metrics do not suit our business							y		No buy in to corporate systems
Improvement initiative has died - Fact!							y		A goal has been apparently dropped due to lack of procedural reinforcement
The future for <location> No Vision, No Roadmap							y		No buy in to corporate systems

ANNEX Table A-3 - Comments Received Within the ‘Building and Infrastructure’

Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
Do we make the most of our space								y	Inferring that space is wasted
There is insufficient space for current products, <product>?								y	Capability shortfall
If we want to be the best, we need to invest								y	Funding shortfall for infrastructure
Some of our sales companies have better work areas, LABs, than us. This should not be the case, they look more <corporate>. Why can we not be the same or better?								y	Funding shortfall for infrastructure
When changing a cell, ensure time and money allocated to do the job. Do not walk away leaving it in a worse state than before								y	Capability shortfall
Insufficient communication on space re-allocation. Taking space where it can't afford to be lost.								y	Inferring that space is wasted
Invest in future!								y	Perception of lack of investment

ANNEX Table A-3 - Comments Received Within the ‘Technology’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
IP must be retained in house				y				y	Infers that IP is developed, but sometimes sub-contracted due to lack of technology
Internet connection very poor								y	Lack of capability
Conical rig required for viscosity testing								y	Lack of capability
3D printed parts for production - New printer Req.								y	Lack of capability
- We should use appropriate suppliers								y	Infers a lack of appropriate materiel
Enovia is NOT the right system for this business								y	Inadequate system capability

- CURRENTLY not good but we can change it – we are smart enough.				y				y	Perception that the system can be changed to suit the site.
Outdated tools/systems making task difficult across the location								y	Lack of capability
Our own MRP system that pays lip service to JDE								y	Inadequate system capability
Corporate IT tools do not necessarily fit our business needs								y	Inadequate system capability
What happened to BU R&D team? Where is the next technology?								y	Perception that there is no BU R&D team. No development of the next technology.
Inadequate planning systems								y	Positive to change.
Too much paper								y	Inadequate system capability
We need to invest in the right equipment to enable the job to be completed								y	Lack of capability
Supplier testing does not match usage								y	Inadequate system capability
Not enough stock to build products (Moved from People)								y	Lack of capability
DSI may be the issue - wrong metrics (Moved from People)								y	Inadequate system capability
We work Saturday and run out of parts on Monday.								y	Lack of materiel

ANNEX Table A-3 - Comments Received Within the ‘Culture’ Category

Remarks	Drivers for Change				Resistors to Change				Comments / Observations
	D1	V1	F1a	F1b	D2	V2	F2a	F2b	
No Blame Culture	y								Infers a positive culture
It’s always someone else’s fault but not followed up					y				Response to the above, inferring a coercive culture
Only wanting to build "product line" for the next 20 years. Resistant to change. Resistant for new products					y				Story of change-resistance
There is a project to update the ‘product’ why has this not happened?					y				Response to the above; story of change resistance
I believe this site should be more positive about its products working environment	y								Positive belief in products
We have tried in the past and nothing has happened					y				Story of apathy and helplessness

Why not try harder? What support do you need?					y				Using the STS board for dialogue infers a lack of overt support within the company
Apathy is a big issue - the "I am not listened to" culture has to change from all levels of the business					y				Infers there is apathy and that people feel that they are not listened to.
Perception of us and them					y				Story of poor culture
Lack of discipline					y				Failure in behavioural controls
- to the right people!!	y								Upon sense-checking; infers there are skilled employees on site that do work hard
Why not all pull in the same direction? Let's see how we can do something instead of how we can't					y				Infers lack of teamwork
That's the way we have always done it attitude - stops/hinders new ideas					y				Story of apathy and dissonance
Can be knowledge is power attitude					y				Coercive power arrangement
A perception no change can come from this process					y				Lack of vision and pressure for status quo.
Invest time to improve people					y				Infers a lack of effort spent of developing people
No encouragement					y				Coercive power arrangement
No Praise					y				Coercive power arrangement
BU to listen					y				Perception that BU team are not involved in the site
We are <corporate>					y				A glib remark to infer that the site is separate from its corporate owners - lack of cultural buy-in
No Fun!					y				Story of negative culture
No willingness to put in the extra hours when the business needs it					y				Story of apathy and dissonance
- It's personal choice					y				Story of apathy and dissonance
Focus should be on confidence in our products	y								Story about pride in the product
We should be proud to sell Parker products and not hide behind branding to sell our items	y								Story about pride in the product
Too much emphasis on process at the expense of ownership					y				Story of apathy and dissonance
Fair Pay structure for production					y				A negative story identifying remunerative power arrangements

Why some people on production are paid more than others?					y				A negative story identifying remunerative power arrangements
A lack of engagement due to "not feeling listened to"					y				Story of apathy and dissonance
BU Management NOT listening					y				Story of apathy and dissonance
I think people are helpful and over all well intentioned individually	y								Positive story for culture with positive behaviours
Is change driven enough by management?					y				Infers a lack of effort spent of developing change
Profits should be shared equally amongst the work force.					y				A negative story identifying remunerative power arrangements
Follow own job through to the end, not leave it for others to finish off					y				Infers a lack of effort spent of developing change
Buy in or get out					y				Infers a lack of effort spent of developing change
Why must we always pass the buck					y				A negative story about the blame culture
BU/Div resource cutting - De-Values staff, Demotivates Staff					y				A poor story about staff feeling devalued
People is the barrier					y				Either a lack of them/skills or cultural
Take ownership, don't wait for others to	y				y				A negative story about the blame culture
Lack of all pulling together "team effort"					y				Infers a lack of effort spent of developing change
No Fun - Smile Enjoy					y				A poor story about negative culture
Are we better or worse than other parker sites					y				A story that wishes to benchmark itself against others rather than pursue perfection
No Ideas. No Innovation					y				A negative story about poor innovation
Culture of negativity due to lack of innovation. Resource.					y				A negative story about poor innovation

CHAPTER 5 - ANNEXES

CHAPTER 5 - ANNEX A – QUESTIONNAIRE FRAMEWORK FOR TEAM MATURITY ASSESSMENT

Average ratings for each behaviour are developed for each team. Team maturity scores for each behaviour are as follow:

- 1-2=Forming
- 2-3=Storming
- 3-4=Norming
- 4-5=Performing

An average across the mean score for each behaviour indicates the overall team maturity.

7 Team Behaviours		
Behaviours	Rating	Definition
1. Involvement	1	No or low involvement - majority team members are any of the following: disengaged, cynical, or even obstructive. 0% Cat-Champ involvement
	2	Minor involvement - some team members trying, others believe system will work if leadership can lead it, others still disengaged, 25% Cat-Champ involvement
	3	Average involvement - 50% are positively involved, minor cynicism, 1 or 2 members disengaged, 50% Star Point involvement and input
	4	Good involvement - nearly all team members involved (1 or 2 members disengaged) mostly positive experience, 75% Cat-Champ involvement
	5	Excellent involvement - all team members positively involved, team includes everyone in decisions, effective meetings, 90% Cat-Champ involvement
2. Supervisor Dependence	1	Dependent on Supervisor - team cannot make decisions without the Supervisor
	2	Mostly dependent upon Supervisor - supervisor makes decisions most of the time, and validates/corrects decisions the rest
	3	Some independence - team is beginning to make decisions, Supervisor allows some controlled risk, team still requires Supervisor input

	4	Average independence - teams able to function most of the time without Supervisor input, greater degree of controlled risk allowed
	5	Independent - team is able to operate without Supervisor for extended periods, decisions are consistent with Supervisor's regularly
3. Problem Solving	1	Unwilling to solve problems - team complains, takes no initiative to solve problems, blames others, provides no actions that result in improvements
	2	Unable to solve problems - team complains, give ideas, take no initiative in putting ideas into action, some blaming, <5% of actions result in improvements
	3	Attempting to solve problems - team members provide lots of ideas, take no initiative unless given direct instruction, 25% of actions result in improvements
	4	Some problem solving - team members provide consistent ideas, take initiative on actions, using problem solving tools, 50% of actions result in improvements
	5	Problem solvers - Team consistently takes initiative to solve problems without direction, uses of problem-solving tools, 90% of actions result in improvement
4. Supportive Behaviour	1	Not supportive - almost all members are self-serving in their actions and behaviour, may have no desire to be involved, resistant to business changes
	2	Little support - most members are self-serving in actions and behaviour, few have interest in involvement mainly due to Supervisor, majority still resistant
	3	Some support - most make an effort to be unselfish and get involved, some due to direction/coaching and others on their own, 50% resistant to changes
	4	Mostly supportive - most members unselfish and involved on a consistent basis as a result of direction and coaching, 75% acceptance to change
	5	Supportive - nearly all team members consistently collaborative and involved with no coaching/direction, 90% acceptance to change
5. Trust	1	Coercive - team members are reluctant to speak up because they fear retaliation from other members, supervisor, or management
	2	Timid - team members speak up only occasionally because of fear of retaliation from other members, supervisor, or management
	3	Unsure - team members speak up but have concerns/reservations about retaliation from other members, supervisor, or management

		4	Determined - team members speak up on issues as well as specific retaliations
		5	Open - team members speak up without fear of retaliation from members, Supervisor, or management
6	Ownership	1	Team members do not demonstrate a desire to take ownership for results they can impact, no effort to improve business results on their own
		2	Some team members believe they need to take ownership, but feel unable to make an effect on results, 25% attempt to improve business results on their own
		3	Some team members believe they need to take ownership for results, some take action but not consistently, 50% attempt to improve business results
		4	Most team members believe they need to take ownership for results and do so most of the time, 75% attempt to improve business results
		5	All team members consistently take ownership of results, 90% of the team are involved in improving business results.
7	Effectiveness	1	There is a neutral or negative trend on monthly result
		2	There is a no any consistent positive trend on monthly result (more than three consecutive months)
		3	A consistent positive trend on monthly result (more than three consecutive months)
		4	Team is consistently performing on Scorecard above 90 for at least 3 consecutive months
		5	The team is performing above 90% on Scorecard through at least 6 months

CHAPTER 5 - ANNEX B – QUESTIONNAIRE FRAMEWORK FOR TRANSFORMATIONAL LEADERSHIP ASSESSMENT

Average ratings for each behaviour are developed for each team. Transformational leadership scores for each behaviour are as follow:

- 1-2=Coercive
- 2-3=Transactional
- 3-4=Passive
- 4-5=Transformational

An average across the mean score for each behaviour indicates the overall leadership score.

7 Leadership Behaviours		
	Rating	Definition
8 Vision setting	1	Negative - Supervisors & Managers do not communicate a clear and detailed vision for the future
	2	Dysfunctional - A 'war-cry' statement is given but means nothing (has little direct benefit) to HPT members as individuals or groups
	3	Developing - Supervisors and Managers have developed and communicated a vision, but not checked its relevance to HPTs members
	4	Good - Supervisors and Managers have presented a vision, checked its relevance with HPTs, but fail to consistently reinforce it
	5	Mature - supervisors & managers consistently communicate a clear and detailed vision for the future & regularly check its relevance to HPT members
9 Supports development	1	Directed - no team members have a voice regarding team business
	2	Minimal - few team members developed to have a voice in team business but only on occasion and mostly when it relates to their skill/area

		3	Exploratory - some team members developed to have a voice occasionally when it is directly related to their skill/area
		4	Developing - most team members are developed to have a voice in team business in a regular and consistent manner
		5	Established - all team members treated as individuals, developed to have consistent input in both team and plant business
		1	Not supportive - supervisors and managers do not provide encouragement and recognition to the team
		2	Little support - recognition only provided for results on an infrequent (rare) basis
10	Encourages & recognizes others	3	Some support - fixed points in time are there for recognition and rewards are provided, with little ad-hoc opportunities taken to recognize effort
		4	Mostly supportive - frequent opportunities are taken to recognize team efforts, but feedback is not consistent (some efforts are missed)
		5	Supportive - supervisors and managers regularly provide encouragement and recognition to team; all effort is observed with feedback
		1	Coercive - supervisor & manager sets team members against each other to his/her own benefit
		2	Timid - supervisor & manager avoids resolving conflicts and awaits an outcome of such before getting involved
11	Coaches trust & cooperation	3	Unsure - supervisor & manager will resolve conflict and develop cooperation when invited by the team members
		4	Determined - supervisor & manager observe the team, fosters trust and cooperation, resolving most conflicts where convenient
		5	Open - supervisor & manager takes every opportunity to coach trust, involvement, conflict resolution and cooperation amongst all team members
12	Problem solving encouraged	1	Leaders direct action, making ultimatums to achieve results; discourages new ways of thinking and questions
		2	Leaders occasionally ask questions, but make decisions for the team

13	Clear practiced values	&	3	Leaders ask questions regularly to determine the best decision, but still make decisions for the team most of the time	
			4	Leaders ask questions consistently, both to help the team make a decision and to help coach/develop decision making skills	
			5	Leaders encourages decision making (controlled risk), challenges old ways, coaching/developing for better decisions, and supporting team decisions	
			1	Negative - supervisor & leader demonstrates high levels of emotional inconsistency	
			2	Dysfunctional - supervisor & manager communicates their values but fails to consistently demonstrate behaviours that support them (behaviours contradict them)	
	&		3	Developing - supervisor & manager communicates their values, but team members are sometimes unclear or unsure about them	
			4	Good - supervisor & manager is clear about their values, and mostly practicing what they preach; usually when convenient	
			5	Mature - supervisor & manager are clear about their values, routinely explaining them, and always practicing what they preach even if difficult	
	14	Instils inspires pride respect	& &	1	Negative - supervisor & manager do not demonstrate behaviour that holds any team members in high regard
				2	Dysfunctional - supervisor & manager does not inspire everyone, instead plays favourites among team members, not holding others in high regard
3				Developing - supervisor & manager understand the importance of inspiring team members and treating team members well, but struggles to treat all members this way	
4				Good - supervisor & manager well aware of their team, inspires some, but it is still conditional with a few on whether they are deserving of their acceptance	
5				Mature - supervisor & manager consistently treats every team member as a valued asset to the team; instilling pride, respect & inspiration	

CHAPTER 5 - ANNEX C – HPT STANDARD ASSESSMENT QUESTIONNAIRE AND GRADING CRITERIA

For each Plant, this assessment is to be used to identify the progress against the socio-technical work design.

Against each item 1 to 37 is a grading key for the metrics regarding the 0%, 25% 50%, 75% and 100% definitions for assessment.

Item	HPT Standard Items
1	The Plant Manager & the Plant Management Team have completed Transformational Leadership Training.
2	Leadership development action plans exist for all managers.
3	Employee feedback interviews or leadership assessments indicate progression in leadership skills amongst the managers.
4	All management and salaried staff have included a goal related to the HPT system in performance appraisals.
5	The plant has identified the Cat-Champs to be developed, based on the HPT instructions.
6	The Guides have trained and certified all of their respective Cat-Champs.
7	All Cat-Guides have been trained in HPT.
8	Cat-Guides meet with their Cat-Champs based upon the minimum requirements within the HPT implementation instructions.
9	Boundaries have been established using the guidance in the HPT implementation instructions.
10	Cat-Champ HPT certifications are recorded and tracked so that Guides can maintain their development & ensure functions are represented in all HPTs
11	Cat-Champs are being utilized in the plant to communicate relevant information to the rest of the HPT members.

12	There is a balanced Scorecard approved by the Plant Manager, for each boundary defined in the Plant. (Every scorecard is in compliance with criteria and requirements established in HPT implementation instructions)
13	Weekly data is always available on time for scorecard KPIs
14	There is a correlation between scorecard results and plant performance
15	KPIs mandated by senior leadership are on the Scorecard
16	KPIs are within the HPT's circle of influence
17	HPT Scorecard results are part of all salaried staff performance evaluations (some specific metrics from the team Scorecard can be included, such as: % Skill Certification, Cat-Champs, meeting effectiveness, action plans completion). There is documentation of goals and KPIs related to HPT in the supervisor's performance evaluation.
18	HPT's meeting area is established with space for problem solving, and visual standards in accord with the implementation instructions.
19	There is an adhered-to schedule for HPT meetings.
20	There is an established agenda that is followed by the teams.
21	Teams use problem solving tools on regular basis in their HPT meetings.
22	Actions plans close performance gaps.
23	Employees outside of the team-space facilitate the closure of actions plans.
24	Plant managers demonstrate HPT meeting attendance on at least a monthly basis.
25	All meetings use standard template.
26	Cat-Guides attend and support all meetings in response to support requests.

27	Skill Certification is being conducted in accordance with the HPT implementation instructions.
28	Skill Certification is being conducted with plans showing design and implementation of: - Job descriptions - Skills assessments - Individual training plans - Performance reviews and feedback
29	A Training Schedule (Plan) exists for all staff.
30	Training is taking place in accordance with the Training Schedule (Plan).
31	The teams have defined their name, mission, vision, values and objectives in accord with the organisation's business case.
32	Team Maturity Assessment has been conducted in accord with the HPT implementation instructions.
33	The results of maturity assessments have been analysed by the local steering committee. Action plans have been created for the HPTs to increase their maturity level.
34	All plant personnel above the Team level are providing coaching and guidance to HPTs.
35	Teams launched beyond the previous 9 months have advanced through and beyond the Storming Stage of the Tuckman Curve.
36	Rewards and Recognition requirements include provision for HPT.
37	Recognition and Rewards procedures have been declared to all teams and expedited as communicated.

Item	Metrics for the Standard Assessment
1	The Plant Manager & the Plant Management Team have completed Transformational Leadership Training.
25%	Date scheduled for Leadership Training to be delivered to entire management team (new managers to be trained by either local staff who have completed training or external vendor)
50%	Undertaking DiSC Work of Leaders Reports (or similar) for ALL management team, and preparation in advance of the training event
75%	Training completed for ALL management team as a minimum
100%	Vision / Alignment & Execution actions identified
2	Leadership development action plans exist for all managers.
25%	Discussion and agreement on how to identify and create leadership development diagnostics and activities
50%	Partial implementation - 50% of management have actions plans incorporated as part of a formal training plan that is used as part of formal skill development
75%	Majority implementation - 75% of management have actions plans incorporated as part of a formal training plan that is used as part of formal skill development
100%	Complete implementation - 100% of management have actions plans incorporated as part of a formal training plan that is used as part of formal skill development
3	Employee feedback interviews or leadership assessments indicate progression in leadership skills amongst the managers.
25%	Team Maturity Assessments or interviews being implemented, and an agenda item is established for later review by the Steering Committee
50%	Sufficient time passed and data collected & analyzed, but no sustained progression in leadership skills shown since records began
75%	Sufficient time passed and data collected & analyzed, and progression in leadership skills showing but yet to be proven to be sustained
100%	Upward progression in leadership skills firmly established and sustained

4	All management and salaried staff have included a goal related to the HPT system in performance appraisals.
25%	Relevant HPT goals identified / listed for assignment and incorporation within a performance management system
50%	Partial implementation - 50% of the management team have an HPT goal in their performance management goals that support HPT
75%	Majority implementation - 75% of the management team have an HPT goal in their performance management goals that support HPT
100%	Complete implementation - 100% of the management team have an HPT goal in their performance management goals that support HPT
5	The plant has identified the Cat-Champs to be developed, based on the HPT instructions.
25%	Discussion with candidates on scorecard categories; volunteers sought or candidates selected through testing or talent-spotting
50%	In accord with the plant implementation plan, Cat-Champs have been identified for training
75%	Selected Cat-Champs are publicized
100%	Further (deputy) Cat-Champs (for either HPTs expansion and/or next generation Champs for rotation) are identified
6	The Guides have trained and certified all of their respective Cat-Champs.
25%	In accord with the plant implementation plan, Cat-Champs have been scheduled for training
50%	Partial implementation - as a minimum, all active members of the first team within an HPT Boundary are Cat-Champs certified
75%	Majority implementation - +65% of the teams within HPT boundaries have been or act as a Cat-Champs (certified)
100%	Complete implementation - +90% of the teams within HPT boundaries have been or act as a Cat-Champs (certified)
7	All Cat-Guides have been trained in HPT.
25%	Cat-Guides and Deputy Guides (or similar) selected and all training requirements scheduled
50%	Partial implementation - +50% of all Guides and Deputy Guides certified by the Plant Manager
75%	Majority implementation - +75% of all Guides and Deputy Guides certified by the Plant Manager
100%	Complete implementation – 100% of all Guides and Deputy Guides certified by the Plant Manager

8	Cat-Guides meet with their Cat-Champs based upon the minimum requirements within HPT implementation instructions.
25%	Guide to Champ meeting requirements are identified upon a meeting calendar / schedule
50%	Partial implementation – meeting schedule not fully adhered to, and Champ's development and support needs area awaiting a response
75%	Guides meet all of their Cat-Champs on at least a monthly basis, to develop and maintain Champ skills
100%	As well as on a monthly basis, Guides and/or Deputies meet with Cat-Champs on an ad-hoc basis to support problems solving and action closure
9	Boundaries have been established using the guidance in the HPT implementation instructions.
25%	A pilot HPT Boundary has been identified either on a plan or as part of an implementation
50%	Partial implementation - +50% of direct & indirect staff have been included within an HPT Boundary as part of a plan and/or actual implementation
75%	Majority implementation - +75% of direct & indirect staff have been included within an HPT Boundary as part of a plan and/or actual implementation
100%	Complete implementation – 100% of direct & indirect staff have been included within an HPT Boundary as part of a plan and/or actual implementation
10	Cat-Champ HPT certifications are recorded and tracked so that Guides can maintain their development & ensure functions are represented in all HPTs
25%	Scorecard Categories (and hence Cat-Champ Categories) are reflective of the implementation instructions
50%	Scorecard Categories are reflective of the instructions, with Cat-Champs established for each Category
75%	Champs established for each Category in accord with the instructions, with Champ certification activities shows
100%	A Champ is established for each KPI Category as per the instructions for each HPT, with Certification status clearly tracked by Guides for new HPTs and Champ Rotation
11	Cat-Champs are being utilized in the plant to communicate relevant information to the rest of the HPT members.
25%	There is a plan / meeting schedule to utilize Cat-Champs as part of daily start-of-shift briefs or similar.
50%	Managers are preparing Cat-Champs for short briefs (coaching) and informatics (how to ensure the information is ready)
75%	Communication processes (meeting schedule) implemented but not completely happening in accord with the planned routine
100%	Cat-Champs send routine/regular messages of HPT progress / issues to members within their Boundary and beyond

12	There is a balanced Scorecard approved by the Plant Manager, for each boundary defined in the Plant. (Every scorecard is in compliance with criteria and requirements stablished in HPT implementation instructions)
25%	Scorecard Categories and KPIs are in accord with the requirements of the instructions and business case
50%	Scorecard drafted/developed for every HPT and ready for Plant Manager approval
75%	For every HPT, an approved and compliant Scorecard has been simulated and evaluated using historical data and (new) KPI targets set according to simulation data
100%	Plant Manager approves the Scorecard for every HPT
13	Weekly data is always available on time for scorecard KPIs
25%	Weekly KPI data needed for scorecard updates is identified
50%	Mechanisms for collecting weekly data are identified
75%	Weekly data available between 50-75% of the time
100%	Weekly data consistently available for HPT Scorecard KPI update
14	There is a correlation between scorecard results and plant performance
25%	Theoretical links established between Scorecard KPIs and Plant KPIs
50%	<=40% of plant direct and indirect staff (across all shifts) are covered by HPT, with scorecard trends showing signs of influencing plant performance
75%	+65% of plant direct and indirect staff (across all shifts) are covered by HPT, with scorecard trends showing signs of influencing plant performance
100%	+90% of plant direct and indirect staff (across all shifts) are covered by HPT, and +6 months of data show that HPT scorecard trends closely match ALL of the plant performance trends
15	KPIs mandated by senior leadership are on the Scorecard
25%	Plant Manager and Ops Director are made aware of their responsibilities to the HPT Scorecard
50%	Cascaded and Plant-Level KPIs, that can be influenced by HPT, identified and integrated into the Scorecard
75%	All HPT Scorecards are approved by the Plant Manager to ensure Plant-Level-Influential Goals are integrated
100%	All HPT Scorecards are approved by the Ops Director to reflect Cascaded Goals are integrated

16	KPIs are within the HPT's circle of influence
25%	Scorecard KPIs have been theoretically developed from Plant Level goals into a measurable and relevant quantity for each HPT
50%	Partial implementation - +50% of Scorecard KPIs have been simulated by the Committee and then tested in the field to ensure that they are within the HPT Members' influence to change
75%	Majority implementation - +75% of Scorecard KPIs have been simulated by the Committee and then tested in the field to ensure that they are within the HPT Members' influence to change
100%	Complete implementation – 100% of Scorecard KPIs have been simulated by the Committee and then tested in the field to ensure that they are within the HPT Members' influence to change
17	HPT Scorecard results are part of all salaried staff performance evaluations (some specific metrics from the team Scorecard can be included, such as: % Skill Certification, Cat-Champs, meeting effectiveness, action plans completion). There is documentation of goals and KPIs related to HPT in the supervisor's performance evaluation.
25%	Planning – Scorecard KPIs have shared goals and interests with salaried staff and supervisors
50%	Salaried champions/leaders for the KPI s and categories have been identified and co-opted
75%	Supervisors' evaluations use HPT Scorecard Performance so that they share the responsibility and accountability of HPT success
100%	Wider salaried staff have been identified with specific responsibilities to the HPTs (i.e., support functions) and have such responsibilities formalized within their performance evaluations
18	HPTs meeting area is established with space for problem solving, and visual standards in accord with the implementation instructions.
25%	Planning – requirements, resources and potential locations for all types of HPT meetings have been captured at the planning stage
50%	Meeting area(s) as close to the Gemba as possible established with priority and capacity for HPT meetings
75%	As above and 100% of Visual Standards within the meeting area implemented and compliant with the instructions
100%	As above with dedicated resources / space for simple problem solving
19	There is an adhered-to schedule for HPT meetings.
25%	Planning – requirements, duration, people and timings (rhythm) for all HPT meetings have been captured at the planning stage for integration into plant routine
50%	All meetings occur >40% as per the plan/schedule
75%	All meetings occur >65% as per the plan/schedule
100%	All meetings occur >90% as per the plan/schedule

20	There is an established agenda that is followed by the teams.
25%	Planning – meeting agendas developed for the plant’s HPT meetings using guidance from the Playbook.
50%	>50% of meetings use the established agenda(s) for all HPTs
75%	>75% of meetings use the established agenda(s) for all HPTs
100%	100% of meetings use the established agenda(s) for all HPTs
21	Teams use problem solving tools on regular basis in their HPT meetings.
25%	Simple problem solving (SPS) tools in within the HPT area and the Cat-Champs are trained
50%	SPS is coached regularly by Guides and Supervisors
75%	SPS is integrated into meetings as a routine
100%	SPS is regularly used and documented through CI tracking
22	Actions plans close performance gaps.
25%	Planning – plant has devised a method of monitoring action plans and performance gap closure
50%	Training and coaching have been implemented to support gap closure
75%	Action plans are showing signs of closing performance gaps
100%	Action plans are consistently closing performance gaps
23	Employees outside of the team-space facilitate the closure of actions plans.
25%	Planning – the plant has identified employees outside of the team space who may need to support action plan closure
50%	Employees outside of the team space provide data for HPT meetings
75%	Employees outside of the team space guest into HPT meetings and interact in problem solving
100%	Action plans involving employees outside of the team space consistently help close performance gaps

24	Plant managers demonstrate HPT meeting attendance on at least a monthly basis.
25%	Planning – the plant has considered how every HPT will be visited by the Plant Manager throughout the year, and ensure her/his attendance on at least a monthly basis
50%	Plant Manager briefs new HPTs during the launch / forming phase on the features and importance of HPT
75%	Plant Manager starts to guests into HPT meetings and supports / encourages
100%	Plant Manager consistently guests into HPT meetings and supports / encourages
25	All meetings use standard template.
25%	Planning – meeting templates have been developed for the plant’s weekly HPT meetings using templates and guidance from the instructions
50%	>50% of weekly meetings use the established template for all HPTs
75%	>75% of weekly meetings use the established template for all HPTs
100%	100% of weekly meetings use the established template for all HPTs
26	Cat-Guides attend and support all meetings in response to support requests.
25%	Planning – Cat-Guides across all scorecard categories have resources and plans to establish and support new and existing HPTs
50%	Guides across all scorecard categories regularly visit HPT meetings to coach new Cat-Champs and support SPS
75%	Guides across all scorecard categories routinely visit HPT meetings to support SPS
100%	Guides across all scorecard categories visit HPT meetings in response to support requests
27	Skill Certification is being conducted in accordance with the HPT implementation instructions.
25%	Planning – Job Skill certification is planned to include Safety, Environmental, Quality, Process, and Maintenance, with written and practical exams plus behavioral performance
50%	Partial implementation - >50% of every hourly paid HPT member (not just Champs) show training progress on the requirements of their job
75%	Majority implementation - >75% of every hourly paid HPT member (not just Cat-Champs) show training progress on the requirements of their job
100%	Complete implementation - >90% of every hourly paid HPT member (not just Champs) show training progress on the requirements of their job

28	Skill Certification is being conducted with plans showing design and implementation of core requirements: - Job descriptions - Skills assessments - Individual training plans - Performance reviews and feedback
25%	Planning – Job Skill certification is planned to cover the 4 core requirements
50%	Partial implementation - >50% of every hourly paid HPT member shows training progress on the requirements of their job
75%	Majority implementation - >75% of every hourly paid HPT member shows training progress on the requirements of their job
100%	Complete implementation - >90% of every hourly paid HPT member shows training progress on the requirements of their job
29	A Training Schedule (Plan) exists for all staff.
25%	Planning – the entire training suite for HPT to be provided to all employees is identified from the instructions
50%	Training Plan Partially Complete - >50% of all training requirements are incorporated into a plan
75%	Training Plan Majority Complete - >75% of all training requirements are incorporated into a plan
100%	Training Plan Complete – 100% of all training requirements are incorporated into a plan
30	Training is taking place in accordance with the Training Schedule (Plan).
25%	Planning – the entire training suite for HPT to be provided to all employees is identified and incorporated into a plant-wide plan.
50%	Partial implementation - >50% of every employee shows training progress with reference to HPT
75%	Majority implementation - >75% of every employee shows training progress with reference to HPT
100%	Complete implementation - >90% of every employee shows training progress with reference to HPT
31	The teams have defined their name, mission, vision, values and objectives in accord with the organisation's business case.
25%	Planning / Preparation – developing appropriate training for preparing a Vision and/or business case
50%	Teams are coached to develop Team rules and values / self-developed and agreed codes of behavior
75%	Teams have developed their own vision for HPT and fed this back to merge this with the management level version
100%	Team names, visions, values and objectives are published within the HPT area

32	Team Maturity Assessment has been conducted in accord with the HPT implementation instructions.
25%	Team Maturity is introduced to the HPTs including the Tuckman Curve and the Types of Leadership, and they are trained in the use and interpretation of the Assessment
50%	Partial Implementation – Team Maturity ran ad-hoc in a sample of plant HPTs
75%	Majority Implementation - Team Maturity ran in all HPTs but not embedded as part of a monthly or quarterly routine
100%	Complete Implementation - Team Maturity Assessments a part of all HPT routines and administered by/with the team accordingly for all HPTs on at least a monthly or quarterly basis
33	The results of maturity assessments have been analysed by the local steering committee. Action plans have been created for the HPTs to increase their maturity level.
25%	Team Maturity introduced to the Steering Committee including the Tuckman Curve and the Types of Leadership the assessment can identify
50%	Team Maturity assessment review commenced
75%	Historical Team Maturity Data for all HPTs analyzed for themes, trends and opportunities for improvement
100%	Steering Committee able to develop effective apposite actions to improve HPT maturity
34	All plant personnel above the Team level are providing coaching and guidance to HPTs.
25%	Planning – the plant has identified sufficient employees outside of the team space who may need to provide the HPT coaching and guidance
50%	Employees outside of the team space provide coaching and guidance to HPTs but no spare capacity exists to adequately support existing or new HPTs
75%	There are spare employees outside of the team space that can provide coaching and guidance when requested and support HPT growth
100%	Coaching and guidance is effective

35	Teams launched beyond the previous 9 months have advanced through and beyond the Storming Stage of the Tuckman Curve.
25%	Planning – the plant has identified teams that have been launched for 9+ months (+9 months old)
50%	Partial Implementation – +50% of teams that are => 9 months old have progressed into the Norming Stage of the Tuckman Curve
75%	Majority Implementation - +75% of teams that are => 9 months old have progressed into the Norming Stage of the Tuckman Curve
100%	Complete Implementation - 100% of teams that are => 9 months old have progressed into the Norming Stage of the Tuckman Curve
36	Rewards and Recognition requirements include provision for HPT.
25%	Planning – Playbook and Standard guidance identified
50%	Policy being drafted
75%	Policy drafted pending approval
100%	Plant R and R policy approved and now includes a full provision for HPT
37	Recognition and Rewards procedures have been declared to all teams and expedited as communicated.
25%	Communication plan developed
50%	Partial Implementation – Policy declared to +50% of all staff
75%	Completed Implementation – Policy declared to 100% of all staff
100%	R and R for HPT reinforced / implemented

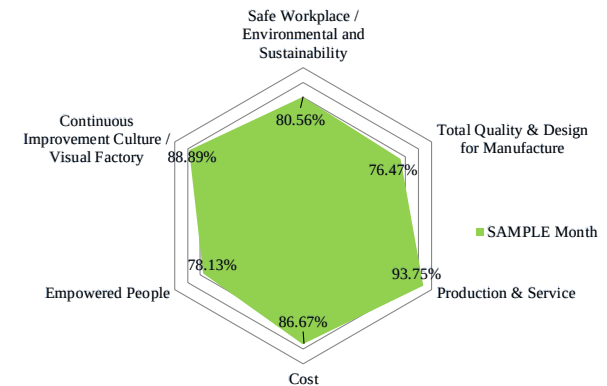
CHAPTER 5 - ANNEX D – A SAMPLE HPT SCORECARD

Team: SAMPLE Team

Facilitator : SAMPLE Person

Month: SAMPLE Month

Points	Category	Target	Scoring Guide	Weight (Total Points Available)	HIGH PERFORMANCE TEAMS			
	Key Performance Indicator				Score Month:	SAMPLE Month	Totals	
					Points	%	Total Points	%
					Performance At A Glance			
18 Safe Workplace / Environmental and Sustainability								
Safety Walks completed & minor issues closed		2 Walks per week and issues closed	100%=5; 90-99%=4.5; 80-89%=4.0, <80%=2	5	4.50	90%	15	81%
Safety / Ergonomic Suggestions / Challenges		1 suggestion per month (4-week ave.)	2/week=6, 1/week=4, <1/week=0	6	5.00	83%		
On-Time Safety Improvement Implementation		Local plan/time target set with Guides	On-Time=7, <25%late=5,<50%late=4,>50%late=2	7	5.00	71%		
KO	Recordable Accident / Incident = Zero points for SWES for the current scorecard							
17 Total Quality & Design for Manufacture								
RFT		100%	100%=6,90-99%=5, 80-89%=4.5,<80%=<4.4	6	4.00	67%	13	76%
Rework		0%	<=10%=6,10-15%=5,16-20%=4,>20%=0-3.9	6	5.00	83%		
Layered Process Audit (3 laps)		95%	0%=5,>95%=4,85-94%=3,75-84%=2,<74%=0	5	4.00	80%		
KO								
16 Production & Service								
Units per shift (to target)		100%	100%=9,90-99%=8,80-89%=7,<80%=0 to 6	9	9.00	100%	15	94%
Machine / Equipment Utilization		85%	>=85%=7,78-84%=6,70-77%=5,<70%=0 to 4.9	7	6.00	86%		
					0.00	0%		
KO								
15 Cost								
Scrap		<= 1% - Only team impact	<=1.0%=5, 1.1-3.0%=4, 3.1-5.0%=3, >5.1%=0 to 2.9	5	4.00	80%	13	87%
PPE & Consumable Usage / Month		\$300	<=\$300=5, \$301-\$350=4, \$351-\$400=3, >\$401= 0-2.9	5	5.00	100%		
Amount of Work In Progress (3 lap audit)		\$1,000	<=\$1000=5,\$1001-\$1500=4,\$1501-\$1800=3,>\$1801=0	5	4.00	80%		
KO								
16 Empowered People								
Attendance, excluding authorized absence		100%	100% = 4, 96-99% = 3.5, <96% = 0 to 3.49	4	3.50	88%	13	78%
Training Matrix Completion		75%	>=75%=7, 72-74%=6, 69-70%=5, <69% =0-4.9	7	6.00	86%		
Team Maturity		>=4 (Average Score)	>=4=5, 3.0-3.9=4, 2.0-2.9=3, <2.0=0	5	3.00	60%		
KO								
18 Continuous Improvement Culture / Visual Factory								
Area 5S Score		80%	>=80%=9, 75-79%=8, 70-74%=7, <70% =0-6.9	7	7.00	100%	16	89%
CI Improvement Suggestions		1 per month (agreed with Guide)	>=12/year=5, 9/year=4, 7/year=3, <5/year=0	5	5.00	100%		
Team Actions Completed on Time		Local plan/time target set with Guides	On-Time=6, <25%late=5,<50%late=4,>50%late=2	6	4.00	67%		
KO								
					TOTAL		84%	
					100	84		
HPT Performance Levels							0 - 79	Needs Improvement
							80 - 89	Strong Contribution
							90 - 100	Outstanding Contribution



CHAPTER 5 - ANNEX E – HPT MEETING MINUTE TEMPLATE

TEAM:			FACILITATOR:		SUPERVISOR:				
AREA:			DATE:		START HOUR		END HOUR		
ATTENDANCE & MEETING EVALUATION					Balanced Scorecard Results				
#	ATTENDEES	SIGNATURE	EVALUATION FACTORS	SCORE	KEY INDICATORS	TARGET	GOAL	REAL	%
1			1 Every team member attended the meeting on time	/10	SAFE WORK PLACE, ENVIRONMENT & SUSTAINABILITY				
2			2 The Safety Star Point led the discussion on the safety topic	/10					
3			3 Facilitator brought the previous meeting minutes & reviewed action plans from previous meeting.	/15	TOTAL QUALITY				
4			4 Score Card results (KPIs) reviewed by the team.	/15					
5			5 Actions were established to improve the Team's performance	/20	SERVICE / PRODUCTION (VOLUME)				
6			6 Star Point updates were presented to the team members	/5					
7			7 The Meeting Minutes form was fully completed	/5	COST / SCRAP				
8			8 The agenda's timeline was followed (countdown clock was used)	/10					
9			9 The conduct respected team members' ideas and comments.	/5	EMPOWERED PEOPLE				
10			10 This evaluation was communicated to the team at meeting end	/5					
Safety Topic:				Total:	CI CULTURE / VISUAL FACTORY				
Comments on Evaluation:				/100					
Six Questions		Root cause analysis		Action Plan / Activities to do/ compromises		Responsible		Due Date	
What is the target?									
What is the current situation?									
What are the obstacles (issues)?									
Which one are we addressing now?		Why we have this issue?							
What is the next step?				What we can do to solve it?		Who is in charge?			
When will we see the learning from taking that step?				Validate by seeing				Deadline?	
Comments / Highlights:								Supervisor Signature	

APPENDICES

APPENDIX 1 – COPY OF UCS ETHICS TEMPLATE USED FOR CHAPTER 3

UNIVERSITY CAMPUS SUFFOLK

ETHICS APPROVAL APPLICATION FORM FOR NON-CLINICAL RESEARCH INVOLVING HUMANS/ANIMALS

Please give an answer to ALL questions. Failure to do so will result in automatic voidance of application. You may use the term ‘not applicable’ where necessary.

Please consult UCS Student Guide to the Ethics Approval Process, available on the intranet for guidance on completing this form

1. APPLICANT DETAILS

1.1 Name of applicant Ian Newman

1.1 Student ID S146077

1.3 School/Department/Centre PGR – Business School

1.4 Course/Programme PhD – Part Time

1.5 Date of application 14 April 2016

2. I AM CARRYING THIS PROJECT OUT AS:

Staff Research Project	☐	Postgraduate Masters Research	☐	Postgraduate Doctoral Research	☒
Externally Funded Project (State Funding Body)	☐	Undergraduate (Degree or Diploma Dissertation)	☐	Other <i>please describe</i>	

3. PROPOSED DURATION OF PROJECT

From: ^(dd/mm/yy) **To:** ^(dd/mm/yy)

If you are unable to start and finish by these dates, please inform the relevant School/Centre Ethics Panel in writing

4. RESEARCH STUDENTS. Please give details of your supervisor(s)

TITLE & SURNAME	FIRST NAME	PHONE	EMAIL (UCS e-mail address only)
Dr Chowdhury	Daba	079309263 74	D.Chowdhury@UCS.AC.UK

5. STAFF RESEARCHERS. Please give full details of all researchers involved in the project

TITLE & SURNAME	FIRST NAME	PHONE	EMAIL
Mr Newman	Ian	077714329 61	iannewman841@btinternet.com

Additional lines can be included

6. TITLE OF RESEARCH PROJECT AND A BRIEF DESCRIPTION:

Please consult the UCS Student Guide to the Ethics Approval Process (available on the intranet) for more information. Proposals that do not give sufficient information will be rejected by the School/Centre Ethics Panel and this will delay the start of your research.

Identifying the mechanisms to support rapid cultural change for Lean Transition.

A manufacturing plant perspective of change management through cultural analysis.

7. METHOD OF DATA COLLECTION (Tick as many as apply)

	✓
Questionnaire (attach a copy)	✓
Interviews (attach a copy)	✓
Observation (Please attach an observation proforma)	
Audio-taping interviewees or events (with consent)	
Focus Groups	
Biometric measurement (Please attach a measurement proforma)	
Physiological measurement (Please attach a measurement proforma)	
Performance measurement (Please attach a measurement proforma)	
Physiological self-assessment (Please provide details)	
Psychological self-assessment (Please provide details)	
Psychological experimentation (Please provide details)	
Animal Feeding/Therapeutic trials (Please provide details)	
Adding to or changing an aspect of an animal's environment (including enforcing physical exercise) (Please provide details)	
Animal Breeding projects (Please provide details)	

Wild animal trapping – license will be required for some animal species (Please provide details)	
Other <i>Please explain. Use no more than 50 words:</i>	

8. TARGET PARTICIPANT GROUP:

Please indicate those groups from which your participants may be drawn. You must ensure that your participant selection methods will prevent you from selecting participants from any other group not mentioned. You must have considered the appropriate actions and safeguards and be able to reassure the School/Centre Ethics Panels that you have considered the nature and abilities of the potential participants

Where a CRB check is required, this must be completed before approval for research is granted (you should submit evidence with your application)

Students or staff of this University	☐	People from non-English speaking backgrounds	☐
Adults (over 18 years old and competent to give consent)	☒	Vulnerable Adults (over 18 years old with learning disabilities, mental health difficulties, confusion, dementia physical illness and other impairment preventing informed consent) *	☐
Children/legal minors (under 18 years old) *	☐	Vulnerable Children with learning disabilities, mental health difficulties, confusion, and other impairment preventing informed consent)*	☐
Parental or Guardian consent	☐		
Adult or youth offenders detained at Her Majesty's convenience	☐	Other:	☐

* CRB check must be complete prior to approval

Number of Participants

9. RECRUITMENT

Please state the method of recruitment of participants.

With senior management consent, all staff will be asked to participate in the research during Industrial Fellowship activity at Vanilla Electronics UK Plant.

10. **RELATIONSHIP WITH PARTICIPANTS:** As the researcher do you have any relationship with the participant such as a familial friend, colleague, patient, client, student?

NO ☒ YES ☐ If YES, you need to explain the relationship and the steps to be taken by you to ensure that the subject's participation is purely voluntary and not influenced by the relationship in any way. You should also explain any further measures you might take to ensure their privacy, confidentiality and anonymity. Attach a separate document in which these issues are explored.

11. **LOCATION OF RESEARCH**

UCS ☐ Other ☒ **Location(s)** Please identify location(s):
<locations identified on submitted copy>

Is a risk assessment required for this location? If so, please attach N/A

12. **DISSEMINATION OF RESULTS**

Other than submitting your research project for assessment purposes, please state if you intend to communicate your findings elsewhere.

YES ☒ NO ☐ (If YES, please state how you intend to communicate your findings): Possible opportunity to publish results; paper presentation.

13. **CONFIDENTIALITY**

How will you ensure information on participants remains confidential?

Contributors will remain anonymous through an open STS survey forum. I will keep the results secured. This document will remain password protected and stored upon college servers.

14. **ETHICAL CONSIDERATIONS**

With reference to the Key Principles of Ethical Research, please note the ethical considerations and how you intend to uphold them.

Key Principle of Ethical Research	How is the Key Principle upheld
The emotional wellbeing, physical wellbeing, rights, dignity and personal values of research participants should be secured;	The line of enquiry will not be unnecessarily intrusive, and not personal information is being requested; only qualitative statements on their perspectives on organizational belief and habits.

Research participants and contributors should be fully informed regarding the purpose, methods and end use of the research. They should be clear on what their participation involves and any risks that are associated with the process. These risks should be clearly articulated and if possible quantified;	A pre-prepared brief will be given to every participant with an immediate opt-out should they not wish to proceed with the dialogue.
Research participants must participate in a voluntary way, free from coercion. Participants have the right to withdraw at any time;	Participants will be free to opt out at any time, and have any record of their decision removed from any document (digital or otherwise)
Research must be independent and any conflicts of interest or partiality must be explicit;	Dialogue will be held in a private area on a 1-1 basis, with anonymity assured.
Normally information provided by the participants should be anonymous. At all times confidentiality must be assured.	Names will not be used on the interview forms, only reference numbers.

Additional information – please attach to this form. Your application will not be able to be progressed until these documents are available for consideration. For undergraduate applications, please **do not** attach your research proposal. In addition to any elements indicated in sections 7 or 10 above, please indicate other additional information that is attached:

☐ Participant information sheet

☒ Informed Consent form

☐ Other (*Please list*)

DECLARATION BY RESEARCHER

- The information contained herein is, to the best of my knowledge and belief, accurate.
- I have attempted to identify all risks related to the research that may arise in conducting this research and acknowledge my obligations and the rights of the participants.
- I understand that my research work cannot commence until FULL ethical approval has been given by the School/Centre Ethics Panel.

	Signature	Date
Applicant	< Ian Newman >	11 Feb 2016

DECLARATION BY SUPERVISOR

I have reviewed this form and accompanying documentation and am satisfied that this application is appropriate for consideration for ethical approval by a UCS Ethics Panel.

	Signature	Date
Supervisor One*		

* For staff projects where there is no direct supervisor, this application should be countersigned by a member of the UCS Ethics Committee.

School/Centre Ethics Panel outcome

☐ *Approved*

☐ *Approved with Recommendations (see comments section)*

☐ *Approved with Conditions (see comments section)*

☐ *Not Approved (see comments section)*

Comments:

Chair of School/Centre Ethics Panel

Date

APPENDIX 2 – COPY OF UEA ETHICS DOCUMENTS (TEMPLATE) USED FOR CHAPTER 6 INVOLVING ACCESS TO HPT STANDARD ASSESSMENT DATA

BRIEF for CONSENT

To: Global Leader for Empowered People for The Company⁴

Research Title: Research in to the mechanisms of rapid cultural change to support lean implementation – Socio-Technical Data at a Manufacturing Plant Level

Researcher: Ian Newman, Part Time PGR Student NBS, University of East Anglia

The Research

As part of my studies to attain the qualification of Doctor of Philosophy (PhD) at the University of East Anglia, I am interested in how effective socio-technical work design can rapidly impact organizational culture.

I would like to collect data on the socio technical arrangements within ‘The Company’s’⁸ EMEA manufacturing plants using the HPT Standard Assessment data that The Company collects as part of its annual audit process. I would like to use this data in order to test a linkage between good socio-technical work design (and specific sub-sets thereof) and organizational culture through focused interviews to be arranged with participants at a later stage of the research.

How I will use the information

I will collect the information from the established process of HPT Standard Assessment calibration. Plants names will be coded on a separate file, with coded documents aimed for research purposes then saved on a password-protected folder of my The Company laptop (that already included layered Symantec protection). I will not collect any more information than is needed, and it will be stored for no longer than the duration of my research degree, and thereafter deleted. By submitting your response to this application, you are giving consent for me to use your data for the purpose described above. The data will be used for thematic analysis when cross-referenced with qualitative interview data in an attempt to identify and validate aspects of socio-technical work design that have significant impact of rapid organisational culture change and performance toward lean transition.

You will have full access to the information and results of the research, along with a debriefing on any analysis resulting from the research at any time.

Sharing your information

The data will not be shared for any marketing purposes, or with any company except as described in this notice, unless required by law.

How we keep the information

⁸ ‘The Company’ refers to the automotive component manufacturing company that hosts the plants undertaking the HPT implementation as part of the its Manufacturing Excellence campaign.

The information will be stored securely on The Company pre-coded) and thereafter on encrypted hard drives (after coding). It will not be transferred outside the European Economic Area. Access will be limited to UEA staff whose roles require it, and information will be securely deleted at the end of each calendar year.

If you would have any questions about the research, please contact me at ian.newman@uea.ac.uk

You have the right to withdraw consent at any time. For or additional details, including contact information, how we maintain the security of the data, and your data protection rights, see the UEA further information page:

<https://portal.uea.ac.uk/information-services/strategy-planning-and-compliance/regulations-and-policies/information-regulations-and-policies/data-protection/further-information>.

If you have any concerns about the research please contact my supervisor Professor Kevin Daniels: kevin.daniels@uea.ac.uk.

**UNIVERSITY OF EAST ANGLIA
NORWICH BUSINESS SCHOOL
RESEARCH ETHICS COMMITTEE**

RESEARCH ETHICS CHECKLIST

This form should be completed by all staff and students planning to conduct research that involves collecting data from human participants.

Before completing this form please read the University research ethics principles at:

<https://portal.uea.ac.uk/rin/research-integrity/research-ethics/research-ethics-policy>

Students should also discuss the ethical aspects of their proposed research with their supervisor before completing the form.

1. Applicant Details

Name: Ian Newman

Student no. (if applicable): 1002317 1 NBS

Status (circle appropriate): ~~PGT student~~ / PGR student / ~~Staff~~ / ~~Other~~

Course (if applicable): PhD (Part Time)

Contact telephone number: 07771432961

E-mail address: iannewman841@btinternet.com

Primary supervisor's name (if applicable): Prof. Kevin Daniels

2. Project Details

Title of project: Research into the mechanisms of rapid cultural change to support lean implementation – Socio-Technical Data at a Manufacturing Plant Level

NOTES:

This is part of the research involves collecting Socio Technical plant-level (not personal or individual) data that is already collected on behalf of the Global Leader for the Empowered People Principle (the data owner). This data is a 37-question survey to test % progress against socio-technical aspects of work design (progress measured as 0%, 25%, 50% and 75% with

definitions listed for each one). This survey is internally known as the HPT Standard Assessment. Plants self-assess their scores against a guidance document, which is overseen by a Regional Leader or 3rd Part Subject Matter Expert to ensure that the self-assessed score matches the evidence within the guidance. Only the % scores will be used within the research. Plant names will be coded separately, and the research data held on a separate hard drive. The data owner will be sought for consent, and debriefed on the research findings and storage arrangements. Both the Standard Assessment and The Guidance Document have been included with the submission as APPENDICES 1 and 2. The consent brief included at APPENDIX 3.

3. Research Ethics Checklist

Please answer all questions by ticking the appropriate box:

	Yes	No
1. Does the study involve participants who are particularly vulnerable or unable to give informed consent? (e.g. people under 18; people with learning disabilities; students you teach/assess)	☐	☐
2. Will it be necessary for participants to take part in the study without their informed consent at the time? (e.g. covert observation)	☐	☐
3. Will any financial inducements (other than reasonable expenses / compensation for time) be offered to participants?	☐	☐
4. Will the study involve discussion of sensitive topics in a personal, social, cultural, or commercial sense? (e.g. sexual activity, bereavement, drug use, illegal activities, whistleblowing)	☐	☐
5. Could the study place participants at risk of physical or psychological harm, distress, or negative consequences beyond the risks encountered in normal life?	☐	☐
6. Will the research involve any appreciable threat to the health and safety of the researcher(s)?	☐	☐
7. Will the study involve any incitement to, encouragement of, or participation in, an illegal act? (by participant or researcher)	☐	☐
8. Will the study involve recruitment of patients or staff through the NHS?	☐	☐
9. Will participants be informed about the purpose of the research and the nature of the research procedures?	☐	☐
10. Will participants be debriefed after taking part in the research?	☐	☐
11. Will arrangements be made to ensure that data obtained from/about participants remains confidential?	☐	☐
12. Will participants be informed about the use to which the data will be put?	☐	☐

13. Will the consent of participants be obtained?	☐	
14. Will it be made clear to participants that they are free to withdraw from the research at any time, without negative consequences?	☐	
15. Will your research involve investigation of or engagement with terrorist or violent extremist groups?		☐
16. Does your research have environmental implications?		☐
17. Is there potential for your research to affect cultural objects?		☐
18. Will the research give participants and other data subjects information to help them understand how (and why) their data will be used (processed) and make them aware of their data protection rights (i.e. a privacy notice that meets the standard required by the UK data protection law – see relevant UEA guidance on writing a privacy notice)?	☐	

If you ticked a **WHITE** box for **ALL** questions in the checklist, further ethical approval from the NBS Research Ethics Committee is not required. Simply sign and return this form as indicated on page 3. You will also need to attach to this E1 form the completed **‘Privacy Notice Checklist for Norwich Business School Researchers’**.

If you ticked a GREY (i.e. shaded) box for ANY question, you will also need to complete form E2: NBS ETHICAL APPROVAL FORM. The form asks you to provide more information about how you plan to deal with the ‘grey area’ ethical issues raised by your research. This does not mean that you cannot do the research but your proposal will have to be considered and approved by the NBS Research Ethics Committee.

Important: Please note that it is your responsibility to follow the University research ethics principles and any relevant academic or professional guidelines in the conduct of your study. **This includes providing participants with appropriate information sheets and consent forms, and ensuring confidentiality in the use and storage of data in accordance with the General Data Protection Regulation (GDPR) and Data Protection Act 2018.** Any significant change in the research question or design of the study may require completion of the new E1 (including the ‘Privacy Notice Checklist for NBS Researchers’) and/or E2 forms.

4. Signatures

Signature of Applicant:



Date: 25 June 2018

Supervisor declaration (for student research only)

Please tick as appropriate:

- ☐ I have discussed the checklist and ethical implications of the proposed research with the student and am satisfied that the study does not raise ethical problems that must be considered by the NBS Research Ethics Committee.

- ☐ I have discussed the checklist and ethical implications of the proposed research with the student. One or more potential ethical issues have been identified which require completion of form E2: Ethical Approval Form for consideration by the NBS Research Ethics Committee.

Signature of Supervisor:

Date:

Submitting your Form(s)

**PLEASE PHOTOCOPY THIS FORM FOR YOUR OWN RECORDS
AND SUBMIT THE ORIGINAL; IF YOU ALSO NEED TO COMPLETE AN
ETHICAL APPROVAL FORM (E2), PLEASE SUBMIT IT WITH THIS FORM (E1)**

Please return your completed form(s) as follows:

PGT Students: NBS Teaching Office/Module Organizer

PGR Students: SSF Postgraduate Research Office/Chair of the NBS-REC

NBS Staff: Chair of the NBS-REC

APPENDIX 3 – COPY OF UEA ETHICS DOCUMENTS (TEMPLATE) USED FOR

CHAPTER 6 INVOLVING QUALITATIVE INTERVIEWS

PARTICIPANT INFORMATION STATEMENT – Interviewee Consent Form Mechanisms for Rapid Organizational Culture Change toward Lean Transition

(1) What is this study about?

You are invited to take part in a research study about mechanisms for rapid organisational culture change. This study aims to identify and prove the key combination of socio-technical work design aspects that have the most and quickest impact to organisational culture when undertaking changes against challenging timelines. You have been invited to participate in this study because of the position you hold within the organization. This Participant Information Statement tells you about the research study. Knowing what is involved will help you decide if you want to take part in the study. Please read this sheet carefully and ask questions about anything that you don't understand or want to know more about.

Participation in this research study is voluntary. By giving consent to take part in this study you are telling us that you:

- ☐ Understand what you have read.
- ☐ Agree to take part in the research study as outlined below.
- ☐ Agree to the use of your personal information (opinions / thoughts and responses) as described.

(2) Who is running the study?

The study is being carried out by the following researchers: Ian Newman, Part Time PGR Student at the University of East Anglia.

There are no financial benefits to Ian or the participants within the study, and the research responses are intended solely for research purposes.

(3) What will the study involve for me?

You will be asked your opinions and ideas on what aspects of the socio-technical work design as part of the implementation of high-performance teams, had impact in developing valuable HPT (and if such had value at all). You will be asked your thoughts of the quality of local arrangements and implementations, as well as your thoughts on what could be improved. Your responses will be coded, so that only the researcher can link your answers to your name. This data will remain confidential.

(4) How much of my time will the study take?

The interview should take no longer than 45 minutes, and can be carried out by telephone.

(5) Do I have to be in the study? Can I withdraw from the study once I've started?

Being in this study is completely voluntary and you do not have to take part. Your decision whether to participate will not affect your current or future relationship with the researchers or anyone else at the University of East Anglia.

If you decide to take part in the study and then change your mind, you are free to withdraw at any time and your data will not be included in any publications, up to the point we have analysed and published the results. You can do this by contacting the researcher iannewman841@btinternet.com. There are no consequences from withdrawing from the study at any time.

(6) Are there any risks or costs associated with being in the study?

Aside from giving up your time, we do not expect that there will be any risks or costs associated with taking part in this study.

(7) Are there any benefits associated with being in the study?

The broader discussion of this topic/area and the positive effects of that process will be worthwhile, and that research may benefit others to more quickly identify and develop the sociotechnical arrangements to help them develop the cultures needed for positive change.

(8) What will happen to information about me that is collected during the study?

I will collect your name and position (previous or otherwise relevant to the study), which will then be replaced with a code for any future data processes. Only the researcher will be able to link your responses to your name and position.

The data will be recorded manually by the researcher in written notes.

Once the data is coded and reviewed for themes against wider interviews, UEA research professionals and supervisors will also have the research.

Personal information will be kept confidential. This information may be accessed by contacting the researcher.

The results of the study will be published as a research thesis to review by reviewing academics as part of the student's studies. The results of the analysis will be embargoed for a period of 10 years. Beyond then the results may go on to form part of a research paper for publishing at a later date. Any such papers may be used for future research.

The hand written data will be transferred into electronic notes, whereupon written notes will be immediately destroyed. The electronic data will be stored on an external hard-drive, with security-password encryption. After the study is completed, the data will be destroyed.

By providing your consent, you are agreeing to us collecting personal information about you for the purposes of this research study. Your information will only be used for the purposes outlined in this Participant Information Statement, unless you consent otherwise. Data management will follow the 1998 Data Protection Act and the University of East Anglia Research Data Management Policy (2013).

Your information will be stored securely and your identity/information will be kept strictly confidential, except as required by law. Study findings may be published, but you will not be identified in these publications if you decide to participate in this study. In this instance, data will be stored for a period of 5 years or until the research is completed (whichever is sooner) and then destroyed.

(9) What if I would like further information about the study?

When you have read this information, Ian Newman will be available to discuss it with you further and answer any questions you may have. If you would like to know more at any stage

during the study, please feel free to contact Ian Newman via +44 (0) 777 143 2961 or iannewman841@btinternet.com.

(10) Will I be told the results of the study?

You have a right to receive feedback about the overall results of this study. You can tell us that you wish to receive feedback by emailing iannewman841@btinternet.com or by ticking the relevant box on the consent form. You will receive this feedback after the study is finished.

(11) Data Protection & How we keep the information

The data will not be shared for any marketing purposes, or with any company except as described in this notice, unless required by law.

The information will be stored securely on UEA systems (after coding to protect anonymity). It will not be transferred outside the European Economic Area. Access will be limited to UEA staff whose roles require it, and information will be securely deleted at the end of each calendar year.

If you would have any questions about the research, please contact me at iannewman841@btinternet.com

You have the right to withdraw consent at any time. For or additional details, including contact information, how we maintain the security of the data, and your data protection rights, see the UEA further information page:

<https://portal.uea.ac.uk/information-services/strategy-planning-and-compliance/regulations-and-policies/information-regulations-and-policies/data-protection/further-information>.

(12) OK, I want to take part – what do I do next?

You need to fill in one copy of the consent form and return this by email or mail to: iannewman841@btinternet.com or hand it to the researcher (where interviews are conducted in person). Please keep the letter, information sheet and the 2nd copy of the consent form for your information.

This information sheet is for you to keep

PARTICIPANT CONSENT FORM (1st Copy to Researcher)

I, ... [PRINT NAME], agree to take part in this research study.

In giving my consent I state that:

☐ I understand the purpose of the study, what I will be asked to do, and any risks/benefits involved.

☐ I have read the Participant Information Statement and have been able to discuss my involvement in the study with the researchers if I wished to do so.

☐ The researchers have answered any questions that I had about the study and I am happy with the answers.

☐ I understand that being in this study is completely voluntary and I do not have to take part. My decision whether to be in the study will not affect my relationship with the researchers or anyone else at the University of East Anglia now or in the future.

☐ I understand that as I am completing a non-anonymous questionnaire/interview, I can withdraw from the study at any time.

☐ I understand that personal information about me that is collected over the course of this project will be stored securely and will only be used for purposes that I have agreed to. I understand that information about me will only be told to others with my permission, except as required by law.

☐ I understand that the results of this study may be published, and that publications will not contain my name or any identifiable information about me.

I consent to:

• Completing a questionnaire YES ☐ NO ☐

• Would you like to receive feedback about the overall results of this study?
YES ☐ NO ☐

If you answered YES, please indicate your preferred form of feedback and address:

☐ Postal: _____

☐ Email: _____

.....
Signature

.....
PRINT name

..... Date

PARTICIPANT CONSENT FORM (2nd Copy to Researcher)

I, ... [PRINT NAME], agree to take part in this research study.

In giving my consent I state that:

☐ I understand the purpose of the study, what I will be asked to do, and any risks/benefits involved.

- ☐ I have read the Participant Information Statement and have been able to discuss my involvement in the study with the researchers if I wished to do so.
- ☐ The researchers have answered any questions that I had about the study and I am happy with the answers.
- ☐ I understand that being in this study is completely voluntary and I do not have to take part. My decision whether to be in the study will not affect my relationship with the researchers or anyone else at the University of East Anglia now or in the future.
- ☐ I understand that as I am completing a non-anonymous questionnaire/interview, I can withdraw from the study at any time.
- ☐ I understand that personal information about me that is collected over the course of this project will be stored securely and will only be used for purposes that I have agreed to. I understand that information about me will only be told to others with my permission, except as required by law.
- ☐ I understand that the results of this study may be published, and that publications will not contain my name or any identifiable information about me.

I consent to:

- Completing a questionnaire YES ☐ NO ☐
- Would you like to receive feedback about the overall results of this study?
YES ☐ NO ☐

If you answered YES, please indicate your preferred form of feedback and address:

☐ Postal:

☐ Email:

.....
Signature

.....
PRINT name

..... Date

SURVEY - BACKGROUND

The research expands the science of Socio-Technical Systems work design by taking the conventional socio-technical network design from Clegg et al (below), wherein all work systems comprise of interconnected 6 nodes that influence each other:

- PROCEDURES, POLICY & PLANS
- GOALS
- PEOPLE
- CULTURE
- INFRASTRUCTURE
- TECHNOLOGY & TOOLS

At the inherent level (#1) the nodes comprise of the following:

- PROCEDURES, POLICIES & PLANS - Documented procedures for organisational management i.e. for maintain operations and adding value to their product or service compliant with PESTEL (Political, Economic, Social, Technological, Environmental and Legislative) requirements.
- GOALS – Organisational mission and aims pertaining to PESTEL opportunities and threats, often with a specific focus on business development and/or sustainability/continuity.
- PEOPLE – An appropriate blend of people and skills needed in order to meet the requirements of GOALS and PROCEDURES, POLICY & PLANS.
- INFRASTRUCTURE – The building, services, welfare and communications fabric needed to support the social and technical needs of the network.
- TECHNOLOGY – The technologies used to either generate or convey value-added products and services.
- CULTURE – The learned pattern of beliefs and assumptions that support People to internally adapt to external problems / shortfalls in other nodes (culture as an output) that are considered valid enough to be passed from person to person in order to inform their behaviour and decisions (culture as an input).

This research is testing the application of wider scientific concepts / theories in how this network can be used to generate culture change to support lean (Continuous improvement). At the lean-culture level (#2), shown overleaf in more detail, the wider concepts are indicated and linked to their socio-technical nodes (all of which are still interconnected and influence each other). At the lean-culture level (#2) the nodes expand as follow:

- PROCESSES / POLICIES - Vision / Business Case (BC) for Implementation, Planning, Reviews, Problem Solving Elevation, Implementation Risks, Employee Benefits / Rewards including Hygiene Factors such as Salary & Policies
- GOALS – HPT task(s) development, strategic alignment with section-targets through area KPIs (from the Business Case, improvement practices & guiding behaviours
- PEOPLE - Team Design, Terms of Reference (RACI) for leaders and champions, Gemba operators, technicians / SMEs and wider support actors to drive accountability
- INFRASTRUCTURE – Specific IT, communications, dashboards, meeting areas/rooms, safe innovation / sharing space and branding
- TECHNOLOGY – Tools such as software, performance reports, equipment, charts, problem solving tools / templates, team & leadership assessments, PDCA-trackers
- CULTURE - Hygiene factors such as supervisor and co-worker relationships, working conditions, coaching, transformational leadership and priority-setting.

SURVEY - QUESTIONNAIRE

The following questions are posed given the participant's experience with the implementation of such a work design.

OBSERVABLE PERFORMANCE DIFFERENTIAL

What positive performance changes / improvements did you see as a result of HPT implementation?

What was the feedback from the members of the organization (who and what)?

Did the rate of improvement (Lean and/or Financial) change as a result of HPT?

Was there a business case and / or vision led by senior leadership (i.e. what commitment was observable or was this a directive that was tolerated)?

Did the implementation meet the needs of the business case / vision set out by senior leadership (if so, then how)?

OMMISSIONS FROM THE DESIGN

What parts were difficult / impossible to implement?

Where did you see a weakness in the implementation (what, who why)?

What affect did these challenges or omissions have?

WEAKNESSES IN THE DESIGN - RECOMMENDATIONS

What would you do differently (different to or not within the instructions / guidance about implementation)?

FREE COMMENTARY

Any other comments?