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Resumé


Mens denne form sikrer en effektiv implementering af lean praksis, understøtter den ikke et fokus på de omkostninger en decentrale produktionsenhed afholder i mødet med omfattende, ekspertdrevne forandringer af enhedens arbejdssystemer.

Nærværende studie har derfor beskæftigit sig med at afdække de udfordringer de lokale enheder møder som konsekvens af sådanne implementeringsprojekter. Endvidere har studiet beskæftigt sig med at afdække hvorledes lokale enheders erfaringer med disse projekter og i bruktagning af implementerede systemer bidrager til udviklingen af adfærd og systemer i overensstemmelse med lean tankegangen. Ud fra disse perspektiver søger studiet at indsnævre nogle karakteristika ved en vedvarende transformationsproces.

Studiet baserer sig på interviews, ophold og observation i berørte produktionsenheder. Som et omdrejningspunkt for afhandlingen præsenteres erfaringer fra tre forskellige fabrikker. Studiet illustrerer at spændingen mellem forandring og drift giver sig udslag i at en række initiativer der kunne etablere fortsat udvikling og transformation bliver begrænset i deres virkehelt.

Denne spænding kan forstærkes af den måde forandring er organiseret. Anvendelsen af programorganiseret implementering skaber et stort fokus på succesfuld implementering. Implementeringsprojektet og lokale enheder har imidlertid forskellige succeskriterier og i mødet mellem disse kan hensynet til den fortsatte transformation sættes på spil.

Studiet illustrerer et dilemma i tilrettelæggelsen af organisatorisk transformation. Det kræver betydelige ressource at opnå et effektivt implementeringredskab i form af implementeringsprojekt og programorganisation men netop omfanget af disse omkostninger kan gøre det vanskeligere at tage hensyn til udviklingen af en vedvarende transformation.
PART I

Narrowing in on a research topic

The process associated with the research presented can be described as a process of translation; translating experiences and perceptions into researchable concepts and mechanisms. The PhD process is research training and as students we should learn how to produce knowledge. As an engineer I have a pragmatic stance towards paradigms and ontology, I will take what ever works for me. Still, finishing up the writing of this thesis my concern has mainly been that of telling and relating of my experience and conclusions such that the reader may also perceive them as results. In communicating the results of the project, the lessons I have learned, I face the challenge of stripping my subjective opinion off these lessons, identifying the parts that may be valuable to those with different opinions, taking care to expose the assumptions upon which the messages are build, considering and communicating the limitations, and maintain the focus on those aspects contributing to the topic at hand. I value all the insights I feel I have gained within the fields of lean transformation and change management. Yet, the lessons learned in regards to production of knowledge are connected with the questioning these insights are subjected to in the communication process. I will therefore maintain this dual focus of knowledge about lean transformation on the one side and the questioning of this knowledge on the other side in the beginning, in the middle, and in the end of this thesis.

Background experiences

In this project I am investigating the transformation process towards lean production in a large multinational company with head quarters in Denmark. The project is partly sponsored by this global concern,

In 2003 the company initiated efforts to develop and adopt its own lean business system with improved business processes in production, sales, purchasing, R&D, and possibly other areas as well. Inspiration for the initiative came from among others Danaher, that in the 1980s launched an improvement programme with a collection of manufacturing improvement tools that has developed into Danaher Business System - “a set of values
and a series of management processes that collectively define who we are and how we do what we do” (Danaher homepage).

Within the case company, a sub-programme targeted at production improvement was launched in 2003 as a “productivity programme”. It utilized standardized project setups to implement a package of lean practices and thus spear-head change in the more than 50 factories that are distributed worldwide. The short term goal was to obtain lead time and productivity improvements as well as implementing a common approach to performance measurement, work organization, and operations improvement while the longer term goal was to obtain lean production characterized by continuous improvements.

Personal interests
Prior to this PhD project I worked 3 years in the case company. The first half of those years as a trainee in the case company and the last part as assistant in the productivity programme making my acquaintance with various units, aspects, and cultures within the company. This was my first working experience as an engineer. Being young and only having a rudimentary understanding of organizational dynamics, I ran into many unforeseen obstacles and was puzzled by many observations. Perhaps the most puzzling circumstance was that, in spite of the shared engineering background between my change agent colleagues and me, I could not make use of our common ground to understand and explain what I was observing and listening to within their group.

During my employment in the programme organization I had ample opportunity to talk to corporate change agents as well as employees, supervisors, local change agents, and other people from the involved factories. I was often startled by the powerful appearance of the corporate change agents, the amount of control enforced by programme heads, and the span from enthusiasm over indifference to traumas communicated by the receiving organizations.

I believe that my sensitivity may have been heightened in that period by the many contrasting factors between me and the environment in which I was working. I was young, female, base my decisions on emotions (“feeling” based on Myer Briggs Type Indicator Questionnaire), I was dealing with shop floor personnel and discussing experiences with a colleague with a systemic organizational development approach whereas the change agents and leaders of the productivity programme were 5-15 years older, male, mainly “thinkers”, dealing with managers and production systems, primarily discussing experiences within the group of change agents.
To me, some of the corporate change agents had a, perhaps too strong, conviction that the changes they were implementing were all for the better. I was not convinced that they appreciated the concerns of the involved shop-floor employees. Some claimed to “love change” – but considering the tales of the people experiencing the change I was not so sure that all of them had experienced difficult change themselves or appreciated that employees could experience changes at the work place as difficult and so central that it could affect their well-being.

As Shapiro (Shapiro 2003) points out, the mental models we hold of change determine how we approach change management but these mental models of what change is and how it happens are often underdeveloped. Shapiro therefore urges managers to explore and widen their understanding of change.

I think that a personal experience from a stay at a maritime school helps explain what change in my perspective can entail and how it appeared to be felt by some of the involved parties in the production areas participating in the productivity programme. The following questions should portray some of these feelings: When did you last do something you knew you could not do, something you were afraid to go through? Did you jump out from a ship even though the distance to the water was further than your mind could accept, even though you knew you could not swim and of course not touch bottom either, did not know what to do if you for the second time in your life found yourself below the surface, was afraid that you would panic and lose control of your own actions while you had to stay alert to keep clear of the screw, knew you had no chance to stay adrift until you reached shore, just hoping for, if not a risk free and pleasant, then at least a course that would not be too detrimental, hoping that your fellow travelers knew what they were doing, hoping that if they could cope you might too?

It should be noted that the distance was probably less than 15m, we were equipped in dry-suits and life jackets, and there was a support team waiting to pick us up from the water. But all of that did not matter to me; it did not make the experience any safer. I knew that there would be parts of the trip I could not control and I knew I would be subjected to that panicking fear I had of water once I was underneath the surface. Similarly, that, which seems to be the slightest change in a production setting, may be connected with fear, worry, anger, and frustration for others.

Concerns as those described here mainly relate to anxiety of the unknown. For a large part of the project that is how I have understood what is commonly termed “resistance against change”. I thought that such anxiety was based on an image of lean that was unnecessarily dreadful. Perhaps I should admit that I had been seduced by the
management literature on lean claiming that lean entails liberation of shop-floor employees and facilitates their creative engagement in the development of their work. I have thought that employees experiencing unfortunate consequences of the implemented systems just had not developed the right understanding of the lean concept and their options within the new paradigm. Based on this, I thought that a teaching approach (Huy 2001) aimed at changing employees’ understanding of causal links and their perception of their possibilities within lean could reduce such anxiety. At the same time I was preoccupied with the notion that we, as individuals, are free to change our perception of the world. Kegan (Kegan 1994) suggests that today society as well as employers demand of us that we take active part in (re)shaping our roles and contributions to society. According to Kegan this demands of us that we undergo a mental transformation that allows us to change our perception of work or any other conditions we tend to feel fused with and relate to through our subjective experiences. To meet these new demands, we should start to see these conditions as objects upon which we can operate. That is, such conditions should not be perceived as shaping us but rather be seen as the result of our own interaction with our surroundings. I thought that, if only employees could grasp the true meaning of lean, they would see the options provided to them for engaging actively in reshaping their work and grasp these options. It has taken me a long time to accept and adopt the opinion that there may be no right or wrong perception of the possibilities or constraints provided by a lean setup and there may be no possibility for the individual to identify any positive consequences of lean. Thus I had to change my perception of the expressed anxiety and frustration. Rather than being the product of a wrongful understanding, such anxiety and frustration should be seen as conditions that affect and were affected by the organizations’ approach.

Implementation of lean could be considered an operations management issue to be analyzed with statistical tools typical of the positivistic paradigm. The positivistic paradigm is one of the obvious choices for an engineer to engage with and perhaps also my unconscious preference. However, I did not find many answers in quantitative based research on lean manufacturing. My encounters with real production settings have provided me with a perception of organizational issues as so complex that I felt that a traditional cause-effect analysis could not provide me with any answers. The influencing factors and stakeholders are so many, interpretations of events so individual, reasons for acting in certain ways so unclear, that predictions about outcomes of a given course of action seemed useless. And in any case I was not interested in the plain and obvious commonalities but rather the small nuances that in my perception made the difference. Still, in retrospect it is clear to me that I let myself be misled by the prescriptive
managerial advice typical of so many lean books. For instance it was difficult for me to distinguish between authors who stripped the contextual situatedness off in their advice from those who stuck to describing knowledge related to actual cases and actual settings.

During the past years I have talked with researchers familiar with the “real lean” and its practice in the car-industry. I have also worked together with social scientists studying lean as a social technology. These collaborations have inspired me to try and liberate myself from the enchantment cast on me by lean management literature. The thesis may still reflect a romantic perspective on lean as a production philosophy with endless possibilities and room for employee self-realization but I would encourage the reader to read those parts as “what could hypothetically be” rather than “what should objectively be in practice”. Major parts of my empirical investigations have been conducted based on an understanding of the existence of a “correct lean”. Being misled by the lean management literature I wanted to be prescriptive too. I was well aware that the “correct lean” was not easily accessible; neither in theory nor in practice. Still, I felt that within the literature there were important clues as to the nature of this “correct lean”. And I felt that I could contribute the understanding of this “correct lean” by investigating organizations’ use of lean techniques and point out unfortunate / successful ways of practicing lean. I have tried to tone down this normative basis by adopting an axiomatic style in some of the normative propositions: These propositions are only relevant to the extent that a transformation towards a lean ideal is strived for.

**Focus**

There are many interesting and relevant dilemmas, challenges, paradoxes, and questions related to the successful design and implementation of a pilot project and to the longer term transformation of a factory or a global concern.

Based on my initial understanding of lean, I have, throughout this project, been concerned with understanding the content of a transformation process towards lean and capturing how it may unfold as well as identifying how it perhaps could unfold. More specifically I have tried to investigate the pilot project as a tool in the planned transformation towards lean. I have come to acknowledge that the programme as host for these projects play a vital role in shaping the transformation process but the programme has not been the main focus of my research, it has been the backdrop against which the pilot projects and company transformation efforts unfolds and to the extent possible this backdrop will be considered in spite of the more narrow focus of the project. I have
started out with a shop floor perspective and been concerned with the local practicing of lean techniques. I saw this practicing as the main challenge within the attempted transformation. I have not been concerned with engineering analysis of flow and the application of advanced lean techniques to enhance flow. I perceive the shop floor practice in which the lean tools are embedded to be one of the primary arenas where the results of the transformation should be evident and where long term advantages of adopting lean should be produced. In the latter part of the project I have tried to come back to the backdrop against which the lean implementation takes place. I have found multiple signs that the unfolding of the change process is inseparable from both content and context. Therefore I have set up the following objective for the research:

The objective of the project is to identify advice and insights relevant to the programme organization of transformational change as well as the project driven change process against lean and continuous improvements.

The operationalization of the research objectives will be further elaborated on in Chapter 3. Material providing a basis for the identification of relevant research topics and operationalization will be presented in Chapters 1 and 2, containing a review of lean literature and a description of the organization of the programme and pilot projects, respectively.
1.

Models of lean and lean transformation

In this chapter literature on lean is reviewed. One goal of the review is to establish a conceptualization of lean applicable within this project. A second goal is to establish how lean can be researched empirically, the benefits that can be derived from working with lean, and the general challenges in a transformation towards lean.

Defining lean

There appears to be an abundant amount of literature on lean and is has been difficult to identify any progress in the writings. Panizzolo (Panizzolo 1998) and Hines et al. (Hines, Holwe, & Rich 2004) suggest that the lean concept has undergone a development in the literature and that it is continuously expanding. Based on primarily literature aimed at the practitioner field, Hines et al. suggest 4 different stages with increasing scope and level of sophistication in the conceptualization of lean over time:

— A prescriptive focus on shop floor practices, tools, and techniques applied in production cells and lines for higher efficiency in the 1980’es. Lacking ability to deal with variability and lacking understanding of “the human aspects of the high-performance work system core to the lean manufacturing approach”, p995.

— A widened focus on quality, manufacturing, and material management extending the earlier shop floor focus, still mainly applied within the automotive industry in the early 90’s.

— From mid 90’s the focus extended to flow creation across value streams. But customer value as constituted by cost, quality and delivery was inherited from the automotive supplier sector and lean was mainly applied in repetitive settings.

— From 2000 onwards the lean concept has involved a greater degree of contingency and the scope has increased to value systems with concepts such as demand chain management with increased focus on learning and experimentation rather than prescription.

Hines et al. suggest that each company setting out to adopt the lean concept may have to pass through the same stages of awareness. It is possible that this is also the case for
researchers working with lean and this may be the reason why progress in the writings is
difficult to identify – especially for the researcher new to the field as well as for the new
researcher.

This research has been based on the assumption that lean could be conceptualized as a
set of core principles, a foundation, from which tools, methods and principles could be
derived. Ideally, classical tools as well as methods and principles that have become
associated with lean more recently should relate to the same set of core principles. This
is contrary to a model of lean as an amalgam of diverse techniques, values, and
intervention areas.

Early attempts at explaining the core of the lean concept have not resulted in a clear
theory of lean and associated practices. In fact many sources stress the complex and
composite nature of lean. (Spencer 1994) shows how the related TQM concept combines
elements from the mechanistic, the organic as well as the cultural model of organizations.
Chan et al (Chan, Samson, & Sohal 1990) suggest that Japanese management and
production systems are highly integrated and complementary. In continuation of this, Liker
et al (Liker, Fruin, & Adler 1999) suggest that the core practices of Japanese
management systems need to be integrated with systems and practices in a range of
contextual layers when the concept is attempted transferred to new contexts. Convis
(2001) e.g. suggest that lean should be viewed as an integration of management
principles, philosophy, and techniques. Shah & Ward (Shah & Ward 2003) suggests that
practices are complementary such that individual practices have less effect than bundles
of practices. Among practitioners it is not uncommon to associate failing lean turn-
arounds with management’s failure to understand the concept.

Liker contributed with a long list of management principles fundamental to “The Toyota
Way”. In (Liker 2004) these principles are described in relation to the product
development process. What is characteristic is their emphasis on

- Synergies between goal and system parts
  - Coherence “Pull out a piece of the puzzle and it collapses”.
  - The existence of one goal that is both shared by and at the same time
    also serving all parties: Customers, society, employees, and company.
    This one, unifying goal is described as the good process, as quality, as
    value creation, as value flow.
- Rigorous striving for the one goal and rigorous process adherence
○ The unifying goal is the ideal. Adapt and subordinate everything else to this dogma.
○ Standardization is used in all aspects: Processes, products, supplier cooperation, management approach, culture, people competencies and careers. This results in reduced variability, predictable outcomes, increased planning flexibility, increased learning opportunity and one “Toyota way”.
○ Do not miss out on a learning opportunity and do not let waste sit in the system. Individuals are responsible for learning from any best practice application and to disseminate their learning. Problems should be highlighted rather than hidden.

— Challenge instead of tradeoffs
○ Exploration and exploitation. Processes are both fixed and fluid through a constant exposure to the PDCA approach. People are expected to follow and to challenge standards.
○ Deep as well as broad knowledge in the individual
○ Functional expertise and cross functional integration
○ Dependence on and power over suppliers

The description by Liker may appear idealistic. Some sources e.g. criticize the notion of common goals between management and employees. (Hopp & Spearman 2000) criticize the idea of no trade offs but at the same time acknowledge that lean companies have been able to target improvements on some parameters that were traditionally seen as exogenously specified such as e.g. setup time. Where the use of MRP systems with fixed lead times incentivized the inflation of planned lead time, JIT targeted these lead times. (Koskela 2000) points out that the approach of targeting “givens” as decision variables has turned out to be fruitful for the flow perspective.

Various authors have positioned lean as a new production paradigm, but discussions about shifts in production paradigms have taken place without a definition of a production paradigm. Duguay e.g. (Duguay, Landry, & Pasin 1997) refer to the mass production paradigm as “the set of firm values and techniques characterizing mass production”. Bartezzaghi (Bartezzaghi 1999) associate the broad set of changes experienced throughout manufacturing with a paradigm shift: “Over the past 20 years, industrial companies have experienced profound changes involving all of their activities ... This process of change ... has been so radical as to suggest a paradigm shift”. Mass
customization and agile manufacturing have also been identified as paradigms. Koskela (Koskela 2000) is more thorough and elaborates on the nature of theories in the realm of operations management. He draws on Ranta (1993) to define a production paradigm as “the prevailing rationality, which controls [directs and simultaneously restricts] the development of production as well as the use of production methods, tools and knowledge”. Koskela reminds us that scientific paradigms and production paradigms are different in nature as the development of new production paradigms are fostered by competitive moves, therefore "... the criterion of an idea is its potential for inducing action ... rather than its ability to explain and predict ... the underlying theory is not explicit".

It appears that also the essence of lean manufacturing does not reveal itself easily. (Imai 1986) promoted process orientation as opposed to Western result orientation as a core in Toyota Production System (TPS). Womack & Jones (Womack & Jones 1996) promote waste elimination and the principles of flow and pull. Based on Shingo’s publications about his acquaintance with TPS, Koskela (2000) suggests that flow orientation differs from the transformation orientation that had prevailed in the West. The transformation orientation puts focus on optimizing individual operations but Shingo points out that orthogonal to the issue of operations is the issue of processes. In the traditional transformation orientation either the non-transformation activities between operations were not being considered or they too were viewed as operations to be optimized – but not, as attempted in the flow orientation, eliminated. With the flow perspective, time, not only as a dimension for coordination, but also as a valuable resource, is introduced into production theory. Although time had been acknowledged earlier as a resource by e.g. Ford, time and the benefits of time compression was largely ignored until the publications on Japanese management systems began to occur in the 70’es and onwards (Koskela 2000). More recently, several academics have reduced the centrality given to the role of elimination of waste and non value adding activities as promoted by Womack et al as the core of lean.

Towill (Towill 2007) suggests to use material flow uncertainty as a core metric of supply chain efficiency as this measure is found to significantly relate to financial performance measures while also accommodating for the individual contribution of value stream improvements. Towill furthermore suggests that efficient product delivery processes may be considered the vision of TPS while the design principles discovered by Spear (Spear & Bowen 1999;Spear 2002) may be positioned as the core in driving out volatility. Spear
has identified strict specification of activities as a means for knowledge creation through hypothesis testing in the TPS. With this positioned as the driving principle, waste elimination becomes a tool along with other techniques such as design for manufacture, flow, standardization, and balancing. (Towill 2007) This approach to production as a flow of physical entities which can be modeled and simulated is also taken by Hopp & Spearman. In Factory Physics (Hopp & Spearman 2000) and the later follow up paper (Hopp & Spearman 2004) they argue that the benefits of the pull systems introduced in lean settings is not only time compression but more broadly the reduced variability and optimal capacity utilization associated with many lean practices. Hopp & Spearman use queuing theory to point out the costs of variability and unlimited capacity loads allowed for in traditional MRP environments. They state that the aim of lean is to “minimize the cost of buffering variability”. The notion of variability reduction as the central principle of lean production has later been picked up in new definitions of lean. Shah & Ward (Shah & Ward 2007) suggest a conceptual definition of lean as: “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”. According to Spearman & Hopp this would however be the wrong order of terms since the cost of buffering variability may take other forms than waste. de Treville et al (de Treville & Antonakis 2006) define lean as “lean production is an integrated manufacturing system that is intended to maximize the capacity utilization and minimize the buffer inventories of a given operations through minimizing system variability”. Following Spear & Hopp however, the goal should not be stated as maximizing capacity utilization but rather optimizing the capacity utilization at the best level. Note that in this definition, de Treville & Antonakis do not incorporate workforce motivation and respect – they position this as a subsystem of TPS which may be necessary to achieve lean; “the glue that holds the other lean production factory physics together”. Such distinction between a core and supporting mechanisms has been suggested earlier. (Nakamura, Sakakibara, & Schroeder 1999) distinguish between core JIT practices and practices that provide important infrastructure for JIT. They find that the infrastructure (product manufacturability and modularity for mixed model production, workforce management, quality management and manufacturing strategy deployment) has larger impact on performance than the JIT core practices. If the infrastructure or glue has a stronger impact on performance than the core techniques and practices, the terms may be misleading and the distinction unnecessary.
Both de Treville & Antonakis as well as Shah & Ward position lean practices as potential means for achieving the conceptual objective of lean. de Treville et al point out that each lean practice is geared towards achieving one or more elements of capacity utilization, buffer reduction, variability reduction and/or respect for workers. de Treville et al suggest that the lean practices affect worker wellbeing through synergistic effects of various psychological states. Focusing on the effects of lean practices on performance, Shah & Ward (2007) suggest that the practices should be conceptualized as configurations representing "commonly occurring clusters of attributes ... that are internally cohesive" and work through "non-linear, synergistic effects and higher-order interactions". All in all de Treville, Shah, and co-authors identify relatively compact and unifying definitions of conceptual lean principles. In spite of these compact definitions, the operation of lean practices is still conceptualized as highly complex and integrated, composite and yet synergistic.

Although the issue of lean as complex and composite has not been resolved through this review, it appears that among academics writing from an industrial engineering perspective, a new, common understanding of queuing theory as the basis for explaining lean is emerging. Thus industrial engineers may be concerned with the benefits of flow, WIP constraints, reduced variability, and optimal capacity utilization as the core of lean companies’ supply chain performance. Organizational theorists on the other hand have been more concerned with understanding the source of Toyota’s competitive strengths and dynamic capabilities. Especially attention has been directed at human resource management and other means for knowledge generation and application, see e.g. (Adler 1999a; Adler 1999b; Adler & Borys 1996; Liker & Morgan 2006; Pil & MacDuffie 1999; Spear & Bowen 1999; Spear 2002). While e.g. Towill (2007) position Spear’s design principles for knowledge generation through hypothesis testing as means for achieving smoother flow, Spear position reduced variability through strict dedication and specification as means for knowledge generation. In between are those authors like de Treville & Antonakis (2006) and Nakamura, Sakakibara & Schroeder (1999) who acknowledge that “the core” of lean as reduced variability and optimized flow is not enough to explain different success rates from lean practice implementation; a glue or infrastructure in the realm of HRM, management, and strategy deployment play an important role in supporting the realization of benefits from lean principles.
This debate cannot be resolved here, instead it will be acknowledged that organizational development, learning, and goal directed knowledge application may be just as central objectives as reduced variability. Only focusing on variability reduction in the physical flow appears to be a confined and reactive approach. The advanced lean company may benefit considerably from also addressing potential sources of variability, unused human potential, and uncaptured information as well as from skilled application of manufacturing capabilities in the realization of strategic benefits.

Within this thesis, lean will therefore be conceptualized as a production philosophy companies can adopt as a guiding thought pattern in the restructuring of production and related activities. Lean is not conceptualized as a state, but the term “lean company” may be used to describe a company which is thoroughly engaged in designing its operations according to this thought pattern through activities encompassing variability reduction as well as structures and processes aimed at achieving strategic benefits from this variability reduction such as e.g. the skilled application of knowledge generated from well-designed processes. This perception of lean draws on different streams of literature and is therefore not in complete agreement with any specific stream. It is also a normative perception distinguishing between lean companies thoroughly engaged in the application of lean principles and other companies working with lean with less zealous dedication.

**Clusters of transformation models**

With this brief review of lean definitions, the focus now turns to research on lean transformations. The literature reviewed has been grouped into some clusters according to the research approach and the transformation model implied in the conceptualization of lean. These models or theories will be further characterized in the following pages.

This characterization will touch upon:

— Writings representative of clusters working with the model.
— Contents and challenges in the lean transformation.
— Criticisms.

The review is structured such that each cluster of transformation models contain some criticism of previously mentioned models.

**Lean as a discrete concept**

Lean has been treated as a discrete concept in some writings. (Mason-Jones, Naylor, & Towill 2000b) and (Naylor, Naim, & Berry 1999) e.g. see lean as a different paradigm to
agile manufacturing. They argue that as paradigms, the two concepts will be beneficial in different supply chain settings and that the two paradigms should be viewed as complementary. That is, benefits from both paradigms may be drawn on in the total supply chain; both paradigms promote principles that to some extent can be useful in either strategy – although with different emphasis, and the two paradigms can be combined by applying each in different parts of the supply chain. This is an argument countering the notion that agile manufacturing should constitute a paradigm progress. They define lean as a cost focus also perceiving time as cost, the cost focus being executed through the building of efficient value streams and the striving to obtain level schedules.

Also critiques of the lean concept have treated it as a paradigm. Although Dankbaar (Dankbaar 1997) acknowledges that the concept spans multiple facets, he criticizes the concept as a paradigm that incorporates many Fordist principles. Other critics have blamed the concept for reducing the innovative capacity of companies adopting it or alternatively they criticize adopting companies for not utilizing the concept in a strategic manner, see among others (Ewyk 1995; Found et al. 2006; Hayes & Pisano 1994; Radnor & Boaden 2004).

![Figure 1: Lean as paradigm. The paradigm affects the organization and leads to lean characteristics; a changed supply chain structure or new goals and values. Contingency factors moderate the result.](image)

**Content and challenges in the lean transformation**

When lean is viewed as an idea or design rule that can be incorporated into or applied in the design of the supply chain (Mason-Jones, Naylor, & Towill 2000a), the transformation
model appears to have only two stages: A stage without leanness and a stage with leanness. The decision to adopt and the benefits from adoption are thought to be influenced by various contingency factors.

**Criticisms**
In this view, a concept has only one form and when adopted it should either result in the promised benefits/illnesses or due to some contingencies fail to do so, see Figure 1. The representative sources do acknowledge that the implementation of the same concept might look different in different companies but mainly ascribe this to how or where it is applied. Several sources, however, indicate that an organizational concept cannot be considered to be either adopted or not adopted as a discrete unit. There is large room for sampling different aspects of the concept and different aspects can be more or less integrated in/with the existing/surrounding system.

**Lean as the application of techniques**
In the literature there is a long standing tradition for operationalizing lean as a set of practices and tools. Thereby lean organizations and non-lean organizations can be distinguished based on the practices and tools applied. Research on lean as a set of techniques is often survey based and relies on the involved companies to evaluate the degree of implementation. Some studies simultaneously investigate financial performance in order to relate the application of techniques to performance increases. This approach shares the view of contingency factors as the main moderator of benefits realized from working with lean. One problem in this approach is that some practices have been widely disseminated and adopted by so many companies, that the practices have no discriminating power. This literature therefore speaks of *degrees of leanness*.

**Representative literature**
(Doolen & Hacker 2005) creates an assessment model based on practices divided into impact areas of Manufacturing Equipment and Processes, Shop-floor Management, New Product Development, Supplier Relationships, Customer Relationships, and Workforce Management. Assessment of individual practices is based on the frequency of use of a list of follow on items created for each practice. Progression through lean implementation is thus indicated through the number of practices engaged in and the frequency of their use.
(Karlsson & Åhlström 1996) distinguish between performance and determinants of a lean manufacturing system. They suggest that the movement towards a lean state should be guided by these determinants. The determinants identified include: Elimination of waste; continuous improvement; multifunctional teams; zero defects; JIT; vertical information systems; decentralized responsibilities; integrated functions; and pull instead of push. In order to operationalize this lean understanding, Karlsson & Åhlström identify a set of indicators or practices that reflect each determinant. Thus progression along the following performance measures should all be indicative of improvements along/application of the lean principle of waste elimination: Reduction in the amount of work in progress; reduction of lot sizes; reduction of set-up times; reduction of machine down time; reduction of transportation time; reduced material moving; reduced amounts of scrap; and reduced amounts of rework. This transformation model includes the aspect of depth or progression within the application of individual techniques or principles.

![Figure 2](image)

Shah and Ward (Shah & Ward 2003) have compiled a list of 21 lean practices to create a lean construct that incorporates the practices identified in 16 earlier versions of such constructs. The resulting construct is sent out to companies for them to evaluate the degree of implementation of each practice from “no implementation” to “extensive implementation”. Yet, the model is developed further as (Shah & Ward 2003) find that bigger performance improvements arise when bundles of practices related to a certain aspect of operations, e.g. flow, are implemented rather than just single elements. They use the term “bean sprout effect” to describe how dense sets of practices will support and direct the growth of the elements it is constituted of. The flat image of lean as constituted
merely by a set of techniques is hereby added some complexity that allows for the formation of a theory of synergies. Synergy is one mechanism through which different benefits from working with lean could be associated with different stages in the transformation process.

Panizzolo (Panizzolo 1998) view lean as a complex and multidimensional concept and acknowledges that the process of adoption can be influenced by factors on the level of the individual company, through relationships between firms, as well as by country level factors. Panizzolo develops a research model that categorizes lean practices into different intervention areas. He applies factor analysis to survey data on practice profiles from 27 internationally renowned lean companies. The results obtained outline clusters of companies based on different usage of these practices:

— The set of practices related to manufacturing planning and control; process and equipment improvement; and human resource management have no discriminating power as all the surveyed companies had adopted these practices to a high degree.

— On top of this some companies had achieved operational integration with customers and suppliers in order to access more information to optimize logistics.

— On top of this some companies had formed partnership relations with suppliers in order to reduce development costs and the risks associated with introducing new technology.

— On top of this some companies had invited the customer to take part in the development process to achieve competitive advantages through new value propositions.

The models presented by Shah and Ward (2003) and Panizzolo (1998) introduce intermediary stages characterized by different densities as well as scopes of the adoption. These densities and scopes outline a maturity scale where different benefits from working with the lean concept are associated with different stages in the development.

**Content and challenges in the lean transformation**

If lean is thought of as a set of discrete techniques there should be no constraints to the implementation process – it could start anywhere in the organization with any technique. Some of the sources reviewed consider the individual techniques as discrete – they are either adopted or not adopted while other sources, e.g. (Karlsson & Åhlström 1996)
consider the transformation process as a progression – also within individual impact areas and levers. The transformation challenge should therefore primarily relate to the issue of resource investment and delayed realization of benefits. The design issues to address in the transformation process could include issues regarding the practice profile to adopt, desired density of practices (Shah & Ward 2003), the set of impact areas to address (Doolen & Hacker 2005), and the level of penetration / level of ambition for each practice (Karlsson & Åhlström 1996).

**Criticisms**

A transformation model depicting lean as a set of discrete techniques does not allow for strong synergies stemming from interdependencies between various techniques and elements in the concept. Without a theory of synergies, the advantages from working with lean techniques should correlate linearly to the number of techniques applied or the level of penetration of each technique. The models proposed by Shah & Ward (2003) and Panizzolo (1998) allow for a more complex relationship between tools application and benefits. But the models can be criticized for promoting a too deterministic relationship between tools and performance. The models do not accommodate for contingency factors incorporated in the model of lean as a paradigm with different effects depending on where and how the tools are used. Neither do they accommodate for different goals, different meanings, different forms of resistance, or any other aspect allowing for a role of the individuals or the organization applying the technique.

**Lean as the right set of capabilities, culture, and principles**

![Figure 3](image_url) A lean model: A catalyst enabling the organization to engage in lean principles moderate the effect of the transition efforts

The focus on lean as a set of techniques are criticized by more prescriptive authors who suggest that tools will not add lean capabilities and high performance without the right
catalyst. Such a model is depicted in Figure 3. Different catalysts have been suggested. In the following section, three areas of concern are addressed: The need for certain managerial insights, competences and attitudes; the need to develop organizational capabilities through certain phases; and the need to have (or achieve?) cultural fit between concept and organization.

Managerial insights, competences and attitudes
(Womack, Jones, & Roos 1990) identified lean companies based on their ability to simultaneously improve performance on many dimensions that had previously been considered tradeoffs. They presented lean as an organizational capability appointing high performance as both the result of and indication of lean. (Womack & Jones 1996) describe examples of some companies’ lean efforts. Early on in the transition efforts these companies replaced a range of leaders and middle management. The book emphasizes that lean involves new skills for employees as well as managers and that the most important learning for leaders during the lean process should be the realization that huge improvement potentials can be harnessed within a short time. Womack et al introduce specific skills, beliefs, and dedication as moderators of the relationship between implementation efforts and lean performance.

Other aspects of the necessary organizational environment, managerial behavior and beliefs, or leadership qualities have been suggested. For instance, (Ballé 2005) suggests that the difficulty in implementing lean practices could be related to managers’ failure to recognize and address lean as an attitude towards work and process improvement. Ballé suggests that only lean leaders with an obsession for lean development as a continuous learning process will overcome the initial challenges in the development process. (Emiliani 1998) suggests that management should engage in value adding behaviors establishing good communication, trust and other elements important to facilitate learning and hinder mistakes from reoccurring.

Such suggestions are generic and could be relevant in many organizational settings as they may be fundamental to establish a strong management team, a good learning environment or other vehicles for promoting change. However, such black and white test does not address how these fundamental conditions could be established.

(Bateman 2005) survey 21 factories to identify the sets of enabling practices adopted in organizations that manage to sustain and even further develop process improvements obtained through blitz kaizen types of events. It appears that areas which manage to
maintain new procedures and problem solve to close out technical issues identified significantly more apply practices aimed at ensuring operator buy-in and contribution, and practices aimed at sustaining focus on new standards adopted. Even more successful are those that significantly more apply practices aimed at ensuring consistent documentation and awareness of new standards as well as practices aimed at ensuring clear goals and support for improvement activities. However, the study by Bateman does not reveal why some organizations fail to engage in the supporting practices. It appears that to some organizations, the engagement in the right enabling practices would also constitute a change – thus requiring the engagement in perhaps yet another set of enabling practices at another organizational level. If the implemented practices are difficult to maintain, problem solve around, and further develop and improve, the necessary enabling practices might also be difficult to engage in - in spite of their generic nature.

**Developing organizational capabilities through certain phases**

Several sources utilize a maturity concept to classify the development stage of companies according to their lean capabilities. The development along the stages may be driven by a search for ways of achieving increased strategic advantage through lean techniques.

Based on a case study and literature studies, Åhlström (Åhlström 1998) suggests that some core principles should be worked on in parallel throughout the lean implementation process while other principles should be worked on sequentially. Striving towards zero defects and de-layering should be emphasized early in the implementation process as these objectives require process control, foster employee participation, and improves co-ordination and decision making. Core principles include the use of multifunctional teams, waste elimination, and pull. According to Åhlström these principles are highly interdependent and should be worked on in parallel. Continuous improvement principles could be emphasized late in the implementation process when systems and capabilities have been put in place. This outlines a development process in which capabilities and systems gradually evolve in a process that can have more than one center.

Other authors are more prescriptive and use the capability maturity model as the basis for comprehensive assessment tools. Continuous improvement is a key element of lean. A maturity model on continuous improvement presented by the English CIRCA program is described in (Bessant & Caffyn
The program suggests that each maturity stage entails different sets of abilities and that progression is ensured through the addition of more abilities. These abilities are made up of clusters of behavioral patterns. Where Hines et al and Panizzolo suggest that the development is formed by the gradual addition of new lean techniques in new functions, expanding lean along the supply chain scope; Bessant & Caffyn see the added abilities as layers that are gradually added to the organization.

The Lean Aerospace Initiative similarly proposes an assessment model build over the capability maturity model (Nightingale & Mizeb 2002). The Lean Enterprise Self-Assessment Tool is a comprehensive list of practices including both strategic and organizational issues divided into three sections: Lean transformation / leadership; product realization processes; and enabling infrastructure. Each section can be assessed on a set of focus areas, each focus area is supported by a set of practices (54 in total), and each practice is defined at 5 different maturity levels. These models outline a development process that should follow a certain path and lead to the same end result regardless the organization involved.

Cultural fit
Some authors argue that the culture of the organization needs to fit the underlying assumptions of the concept to achieve implementation success. Different aspects of culture have been proposed to be central for such a fit.

(Nahm, Vonderembse, & Koufteros 2004) finds a statistical significant correlation between customer orientation as basic assumption within the organization and the adoption of time based manufacturing practices as artifacts.

Kostova (Kostova 1999) suggests that in the transfer of strategic practices within multinational companies, three contextual aspects should be considered: The institutional distance between corporate and recipient unit; the organizational culture of the recipient unit; and the relation between recipient and corporate unit.

<table>
<thead>
<tr>
<th>Generic culture dimension</th>
<th>TQM value</th>
<th>Examples of other values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis of truth and rationality</td>
<td>Manage by fact. Complex relations require scientific analysis.</td>
<td>Personal experience and intuition. Truth is tacit.</td>
</tr>
<tr>
<td>Nature of time and time horizon</td>
<td>Long term commitment.</td>
<td>Here and now “ad hocery”. “Good enough”, risk aversion.</td>
</tr>
<tr>
<td>Stability versus change</td>
<td>Continuous change using existing resources.</td>
<td></td>
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</tbody>
</table>

Table 1 Adopted from Detert et al (2000). Some generic culture dimensions used to describe TQM values.
These aspects should determine the implementation and internalization success and to the extent that a new practice is not internalized, there should be a risk that the practice will not result in the desired performance improvement. (Detert, Schroeder, & Mauriel 2000) identifies and applies eight generic culture dimensions in order to translate the TQM concept into cultural values. Examples from this translation are given in Table 1.

**Criticism and challenges in the lean transformation**

The notion that implementation success may be contingent on cultural fit implies a unidirectional link between lean and organizational culture: Organizations with certain cultures will tend to and more likely succeed with lean implementation. However, the notion that concept adoption requires cultural fit should de-motivate most Western companies from working with Japanese management systems. It appears that the very reason to engage in a lean transformation would be the quest for new ways of doing and thinking. Therefore a more relevant question to pose may be: Given any cultural and institutional differences, how can a specific company benefit from a managerial concept and make it work in new settings? Liker et al (Liker, Fruin, & Adler 1999) address this question in the book “Remade in America” with a focus on Japanese versus Western management practices rather than different cultural values.

It appears that in Detert et al’s attempt to describe the TQM concept along bipolar dimensions some important details are lost with potential high discriminating power. For instance conceptualizing TQM as only pro-change and not also pro-stability overlooks an important use of work standardization and formalization. According to Spear & Bowen (1999), formalization is a means for controlling as many parameters as possible and building in tests so that learning from failure is immediately available. So while production improvements of are driven forward continuously, standards should be updated in order to provide a stable platform for this learning process. This exemplifies how the guiding rules persist in the midst of continuous change.

The issue of lost details may be inherent to any attempt at defining a production philosophy by means of generic culture frameworks. These frameworks have not been developed to discriminate between the nuances in different production systems. Therefore these classifications cannot provide sufficient guidance, for instance the dimensions listed by Detert et al. do not give sufficient guidance to the organization striving to adopt a paradigm such as TQM – long term orientation for instance may not be the competitive answer to all matters.
The transformation challenges implied within some of this normative literature include the establishment of the prescribed managerial insight, competences, attitudes, and practices. It could be stated that the research by e.g. Bateman (2005) shows that some companies are successful no matter what they do as they already have the level of organizational capabilities and resources required to succeed with implementation and the infrastructure to gain from the implementation. But it also points out that successful transformation depends on more than the implementation of a set of core practices.

The sources appear to imply that when fit exists, the realization of performance gains through the application of lean tools should be straightforward. That is, if the organization possesses the necessary organizational capabilities to engage in a proper lean tool implementation, the organization may derive additional lean capabilities from working with lean. If the organization does not possess the right capabilities, the implementation will fail – lean will not be adopted successfully. It is not so self-evident however, that attempts to develop an organization through less than proper efforts is necessarily related to lacking organizational success. It is not so self-evident that less than perfect lean is not good enough to harvest specific benefits from the efforts.

The prescriptive approach appears to reduce the internal context of the organization into the sole objective of adopting a certain concept. The organization may have far more nuanced objectives given a range of contextual factors. However, the prescriptions are convincing and managers may risk confusing means with goals and pursue these prescriptions as the goal of their efforts.

The literature adopting the capability maturity model gives more direction and guidance to the organization attempting to become lean. In these streams, the organization and the adoption of the model develop jointly. That is, the capability maturity model does not prescribe that managers and organizations without the proper understanding or the proper capabilities should not engage in lean development. The model does however prescribe that this development should pass through meticulously defined gateways.

The capability maturity model defines maturity as the ability to produce high, predictable quality at predictable costs along with the ability to further develop the processes producing these results. (Humphrey 1988) However, the stringent focus on standardization implied in lower levels of maturity has been criticized by some as a potential barrier to the development of higher levels of maturity entailing innovation and creativity as these practices are argued to be based on competing values (Ngwenyama & Nielsen 2003).
If this paradox is not paid sufficient attention in the pursuit of maturity, the organization working with the model may focus too much on perfecting the implementation of one value hindering the development of a competing, yet supplementary value.

A Swedish survey based on the CIRCA model finds that Swedish companies indeed have begun to develop routines related to higher levels of maturity even though they had not fully developed the lower level routines. In fact, several of the practices emphasized for lower level maturity development were not considered important among companies that had engaged in higher level practices. (Dabhikar & Bengtsson 2004) The prescriptive sources might argue that this is a typical fast-track approach that will not lead to the same results as the loyal adherence to the model. Alternatively this approach may be seen as a way of avoiding a too narrow focus on perfection.

It appears that the prescriptive sources risk obscuring the original purpose of lean adoption; lean should be the means to obtain new advantages and not the end in itself.

**Obtaining strategic benefits from lean**

**Too successful – balancing capabilities**

Some concerns have been raised regarding a tendency to perceive or apply lean as a cost focus which may hinder the development of other capabilities. According to some authors too much focus on becoming lean and trimmed can result in companies ending in a downsizing spiral, loosing ever more innovative capabilities and market share, see e.g. (Ewyk 1995) and (Ross & Francis 2003). This condition has been termed corporate anorexia and is further explored by (Radnor & Boaden 2004), who describe corporate anorexia as the inability to balance the development of different facets of the organization and loosing sight of long term goals. That is, a lacking realization of the stage of the change journey, the moving beyond fitness for purpose, the imbalance of and possibly overstretching of different facets of the organization, and the potential inability to modify resources for other markets. This condition is not caused by lean it self but by the heavy cost focus companies apply and the misconception of lean manufacturing as a business strategy. (Radnor & Boaden 2004)

Not only may some companies engage in a “blind” chase for cost savings. Companies may also engage in a dogmatic pursuit of the perfect practice adoption. Beyer & Ashmos (Beyer & Ashmos 1997) investigate how the related TQM concept is implemented and enacted in two different organizations. Based on dictatorial versus facilitating change management they characterize the observed implementation approaches as mechanistic and organic. They find that these approaches affect the subsequent use of implemented tools and practices as the approaches lead to a ritualistic application and an educational
adaptation of practices, respectively. (Radnor & Boaden 2004) suggest that leanness should be an aspiration, or a journey, instead of a fixed position or system to be implemented.

This schism between dogmatism leading to coercion versus learning and facilitation is also established in respect to how individual or sets of lean tools are applied and have consequences for workers. de Treville & Antonakis (2006) suggest that excessive leanness will have detrimental effects on worker’s intrinsic motivation and wellbeing whereas the right balance of leanness may be highly motivating. Spencer (Spencer 1994) finds that the related TQM concept combines elements from the mechanistic, the organic, and the cultural paradigm. She argues that the proper dosing of these paradigms may be important and warns that e.g. mechanistically oriented managers may disregard elements from unfamiliar paradigms. Adler (Adler 1999a), (Adler & Borys 1996) finds that work formalization can be used in an enabling or a coercive manner and will result in an environment that is either promoting worker interaction or deskilling workers. Borrowing from usability studies of technology, Adler & Borys (1996) suggest that enabling formalization aims at capturing lessons learned and aids the worker by providing useful mental models of the underlying system which will support interaction with the system. In contrast, deskilling technology aims at decreasing the reliance on the user and is designed for interventions by specialists only. Adler & Borys suggest that the priority worker suggestions are given compared to engineering suggestions for improvements are good indications of an enabling approach. Differences may also be seen in the way in which time-norms are used. Adler & Borys (1996) describe how variations, contingencies and problems arising during production hinder compliance with standard work norms. If norms are implemented in a coercive manner, supervisors let employees improvise ways of speeding up production in order to meet these norms. Adler finds that the approach taken within Toyota is more enabling as formalized procedures are seen as suggestions on how to best accomplish a task and that deviations from procedures rather than time norms trigger action to enhance training or improve the standardized methods.

The practice of work place formalization in lean environments has been criticized by various authors but the sources reviewed here suggest that formalization can be applied and managed in different ways, with different underlying logics and different implications for the involved organizations. It appears however, that managers need to be aware of the risks involved in engaging in practices which lend them selves to such negative dynamics.
**Lean without direction**

Individual techniques may or may not add value to an organization, but Hayes and Pisano (Hayes & Pisano 1994) argue that pursuing imitation of other companies will not add strategic advantage in terms of unique resources. (Naylor, Naim, & Berry 1999) on the other hand argue that the lean concept may add value through the mechanism of strategic fit if implemented in the right context.

Hayes and Pisano (Hayes & Pisano 1994) see lean as a best practice programme; as such it can be applied to achieve manufacturing improvements but it is best used as a vehicle for driving change efforts towards strategic advantage by building the skills and capabilities needed to pursue a specific strategy (Hayes & Pisano 1994).

Outside academia this message is reflected in debates on the Internet following the historical automotive bankruptcy filing in 2005 by Delphi - the winner of 24 Shingo prizes for manufacturing excellence. These debates have centered around the difference between looking lean versus being lean and as competitive as Toyota Production System, (Waddell 2005). Performing well on lean indicators does not automatically translate into competitive advantage. To achieve strategic capabilities from lean implementation efforts, the organization needs to direct the efforts towards those challenges that may have particular strategic leverage as depicted in Figure 4. If lean efforts are given a strategic direction, the situation of anorexic cost cutting may be avoided as this is primarily a short term strategy.

![Figure 4](image)

**Figure 4** Lean techniques and capabilities leading to competitive advantage given strategic planning.

**Lean as imitation**

The Total Quality Management (TQM) concept is in some aspects similar to the lean concept; they are both Japanese inspired and can be viewed as a set of tools, practices, a culture or managerial principles, and they share the notion of continuous improvement
through problem solving and employee involvement. (Powell 1995) suggests that the TQM concept might provide an organization with imperfectly imitable resources. Several companies have gone through failed implementation efforts indicating that such concepts may not be easy to imitate and indicating causal ambiguity regarding the practices. Powell draws on diffusion theory to argue that TQM lacks trialability and observability which underlines that implementation of TQM requires a set of complementary, “difficult-to-imitate” resources. He suggests that such resources could include “a culture receptive to change, a motivation to improve, people capable of understanding and implementing TQM’s peculiar set of practices, corporate perseverence, leadership qualities such as the capacity to commit, and perhaps some exogenous chance factor that may motivate change and learning”, (Powell, 1995, p22).

(Bolton 1993) points out, that Japanese companies build on centuries of tradition for data collection and cultural borrowing or assimilation from external sources. Therefore Japanese companies have access to several knowledge sharing/promoting mechanisms/agencies such as government agencies, trade organizations, keiretsu fellowships etc. (Bolton 1993). So imitation and development of Japanese management systems among and within Japanese companies has taken place in an environment characterized by considerably larger access to and tradition for knowledge sharing than what is traditionally seen in Western societies. Embarking on a mission to imitate the best lean manufacturers therefore might be ambitious as good implementation of the techniques requires extensive knowledge. This knowledge may be considered a complementary resource in line with Powell’s argumentation. Figure 5 depicts how such resources moderate the effects of transformation efforts.

Figure 5 A lean model: Tools and principles working together to achieve a lean state given the right set of complementary resources.
This model may be criticized along the same lines as the prescriptive models as it indicates that some companies possess the resources required to be successful and others do not. Powell’s notion of complementary resources does not recognize that working with a concept like lean or TQM may be the vehicle through which resources can be established.

**Combining different transformation models**

The models presented in the lean literature reviewed in the previous sections may be combined to form a set of contiguous models incorporating all the challenges addressed in the same frame. This model is depicted in Figure 6. Overall the model shows that lean is thought to potentially provide resources needed for operational capabilities but the realization of these operational capabilities also requires extensive organizational capabilities, technical insight, and access to knowledge and learning. There is a risk that a company might fail to engage in a constructive implementation process, due to a lack of complementary resources, negative system dynamics or lacking enabling practices. If the organization does establish the required complementary resources it might be able to develop lean organizational capabilities and establish an understanding of the complexities of lean principles and use this understanding to achieve manufacturing skills and operational capabilities. Once an organization engages in a quest for operational capabilities the alignment with strategic concerns will determine to what extent the organization benefits from these capabilities in terms of strategic advantage. Collectively the various lean models reviewed show that there is a challenge in understanding the interplay between different techniques, in understanding how the techniques can benefit the organization, and in realizing these benefits.

The model juxtaposes ideas from different traditions within the same frame. This is based on the notion that research traditions may be seen as different perspectives and theories that can be applied and contribute to analysis of the same problem area. The illustration depicts these perspectives as if they were different aspects of the same system. However, each perspective would define and delimit the system differently. Perspectives may even be so different that a system of interacting structures and processes defined in one perspective may not exist in another perspective. However, all perspectives appear relevant to the research of the lean transformation because they repeatedly appear in the literature; this may indicate their potential explanatory power.
Managerial concepts – translated and transformed

Some sources are concerned with the cultural gap between conceptual managerial innovations and their actual practice in real life settings. These sources are concerned with the ways in which managerial concepts are adapted to local settings and priorities.

(Lozeau, Langley, & Denis 2002) suggest that managerial tools and organizations are incompatible when they are modeled over opposing assumptions about forms of authority and sources of power. Lozeau et al perform multiple case studies in the study of how the same managerial tools are adapted differently within organizations with different assumptions. By comparing observations, interview data, and content analysis of documented plans with the discourse of the managerial tools, they find that existing assumptions can be reproduced in new managerial tools even when the assumptions were evaluated to be in opposition to the assumptions underlying the new tools. Addicott et al (Addicott, McGivern, & Fertile 2007) show that the political and historical context also need to be considered in order to understand discrepancies between concept and
enactment as for instance central authorities can *distort* a concept before it is implemented in the local unit.

In a previous section, sources concerned with the issue of cultural fit were reviewed. These sources promoted the notion that fit between organizational culture and concept would promote practice adoption. However, as Lozeau et al point out, concepts as well as organizations can be transformed. The gap between concept and organizational culture does not predict adoption but it may affect adaptation and Lozeau is more concerned with the resulting gap between actual practicing and concept.

Harris & Ogbonna (Harris & Ogbonna 2002) perform comparative case studies in companies that acknowledge having failed at some culture intervention program. They identify 8 types of unexpected or unintended outcomes of culture interventions and describe how these appear to have arisen. Examples of such unintended outcomes include:

*Ritualization* which may occur when change programmes succeed one after another in a predictable pattern and becomes a ritual that the organization engages in, knowing that another will soon follow.

*Reinvention* which is a process in which existing practices are repackaged using the lingo of the new programmes or trends. I.e. the existing culture is repackaged or reinvented but not changed.

(Harris & Ogbonna 2002) argue that the outcome of cultural change cannot be conceptualized dichotomously. Rather than merely identifying employee resistance they also point to management’s role in distorting the change processes. Employees and management both play active roles as change agents and as resisters.

Westphal et al (Westphal, Gulati, & Shortell 1997) find that research based on diffusion theory tend to regard managerial innovations as discrete phenomena overlooking the variation that can occur in the way the same innovations are adopted and developed within different organizations. In their research on adoption of TQM practices within hospital networks, they find that early adopters in the networks tended to select a set of practices customized specifically to their needs whereas late adopters tended to adopt the set of practices that had become institutionalized within the specific network at the time of the adoption. They find that those units seeking a customized practice profile achieved greater efficiency improvements while late adoption of a conform program tended to deteriorate efficiency.
These approaches to investigating lean or related transformation challenges are more difficult to integrate with the previous models reviewed. They pertain more to the logics behind the implementation and transformation efforts. The issue of adaptation may have completely different effects depending on the underlying logics and different logics may obsolete or obscure some of the challenges identified in the previous sections. For instance the challenge of establishing strategic benefits through the adoption of lean tools and principles may not appear relevant to the organization seeking legitimacy only.

**Perfect and successful or twisted and beneficial**

Throughout the review of literature on lean transformation, the adoption of lean has primarily been positioned as either successful or unsuccessful – in the reviewed sources as well as in the accompanying text. During a transformation process however, this dichotomy will not suffice, instead the nuances will have to be drawn out.

This classification rests on an unpronounced ideal model of the lean company which is able to draw considerable strategic advantage from its lean capabilities. The notion of an ideal lean company implies that there is a right way of applying the techniques and alternative ways which are less interesting to researchers and companies. Pettersen (Pettersen 2009) suggests that discourses surrounding management concepts are continuously developed as success stories of skilful application of the concept are fed back to the discourse. However, application cases that do not result in an isomorphic adoption of either practice or ideas/discourse, are usually not fed back as positive contributions to the management discourse. Instead, they are conceptualized as failures or unrelated inventions.

However, this ideal model obscures the view of another ideal – the ideal organization that manages to draw inspiration and insights from the concept and develop its own discourse, practices, and capabilities without emulating the lean ideal model, without becoming anorexic, without investing resources and upsetting the organization with a change process that will end up being announced dead and failed, without engaging in a discourse that reveals the source of inspiration to researchers, and perhaps even without any significant short term gains.

In an in-depth study of lean implementation in two plants within the same firm (Crute et al. 2003) elaborates on how decisions taken during the implementation process affect implementation experiences and resulting outcomes. In one plant, lacking performance was considered a risk – potentially leading to the loss of an important client. This perception led the organization to prioritize and establish resources for improvement efforts. In another plant immediate performance pressures stressed the organization
which resolved to minimizing change projects in order to avoid further deterioration of delivery performance. So while one organization managed to engage in a constructive transformation process and address performance issues, another organization was trapped by its focus on performance issues. (Repenning & Sterman 2001) draws a model of such negative and positive system dynamics and the two scenarios can be considered a first order and second order approach respectively – one addressing the performance gap at hand with existing means and one addressing the underlying problems. Alternatively, the plant that manages to minimize the efforts spend on the lean project may be seen as successfully engaging in second order learning. It may be, that management in this plant succeeded in addressing the assumptions underlying the lean implementation, just to realize that lean was not the right fit for their plant in spite of top management claiming the opposite.

**Lean models between simplicity and complexity**

In the literature there is a tradition for characterizing the stage of lean implementation by the level of tool penetration, the amount of techniques engaged in, or the scope of tools application within the supply chain. But a broader review of literature shows that there is a range of challenges in the development of lean and several of these challenges will be specific to the given transformation process. There may not be only one way to develop a lean system and one way to overcome the challenges inherent in the process. In the attempt to design a solid transformation process the kind of considerations described by (Åhlström 1998) about interrelationships between various capabilities and practices may be helpful for transforming organizations. The combination of various streams of literature supports a characterization of the transformation process that goes beyond the successful versus unsuccessful result. The process may be successful in establishing performance and/or system improvements but fail to establish capabilities for change and continuous development. Similarly, adaptation or customization of the lean concept may be seen in a positive light – as the result of efforts to make the concept fit the organization and its needs, see for instance (Bolton 1993) and (Hayes & Pisano 1994). All in all the sources reviewed show a range of facets along which the lean transformation may be conceptualized as either quite simple or quite complex. A range of these facets are summarized in Table 2, p29 with the more simple conceptualizations on the left hand side and the more complex conceptualizations on the right hand side.

In the sources reviewed here, some of the more complex conceptualizations of lean show how the concept may be subjected to local adaptation or reinvention and several of these sources argue that this may hinder the organization from obtaining significant results from working with lean or other moldable concept. Other sources argue that the adopting
organization needs to put considerable thought into the strategic application of lean to achieve benefits from working with the concept. In combination the more complex conceptualizations emphasize that the organization may not achieve significant benefits from working with lean, and/or that the benefits will be highly specific to the specific organization. The successes obtained by organizations working with lean is seen in the organization’s unique combination, integration and reinvention of structures, tools, capabilities, and cultures and possibly some additional type of input. The assessment criteria should therefore not be a model of lean found in literature but the actual engagement in practices, in the skillful development of and strategic application of new or strengthened capabilities.

The more simple conceptualizations on the other hand argue for more certain benefits from lean implementation (given the right fit, the right understanding, the right approach). Critics of lean warn that over-emphasis on doing things the “right” way, on doing lean as much as possible may lead to anorexic pursuits of performance improvements along lean performance measures which may not necessarily lead to long term strategic benefits. These various sources show how lean is a concept that lends itself to various conceptualizations, and it appears that different conceptualizations will entail different approaches to implementation and/or transformation efforts. It furthermore appears from this review that different kinds of risks for the transitioning organization emerge depending on the way lean transformation is conceptualized.

Table 2 Facets along which lean transformation conceptualizations can vary from simple models to complex and diverse models.

<table>
<thead>
<tr>
<th>Implementation</th>
<th>Joint transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lean as discrete concept</td>
<td>Lean as a composed concept open to local choice</td>
</tr>
<tr>
<td>Binary adoption of lean or tools</td>
<td>Gradual development of lean characteristics</td>
</tr>
<tr>
<td>Deterministic, linear relations between tools and performance</td>
<td>Contingencies and internal synergies affect the resulting performance</td>
</tr>
<tr>
<td>Lean conceptualized as one or a few types of elements, e.g. techniques</td>
<td>Lean conceptualized as multidimensional and composed, e.g. techniques, competencies, capabilities, and values</td>
</tr>
<tr>
<td>Pre-specified benefits</td>
<td>Strategic efforts to realize individual benefits</td>
</tr>
<tr>
<td>Fit between concept and organizational values and capabilities is required to achieve benefits from lean</td>
<td>Both organization and practices must undergo development to achieve benefits</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>A fixed list of elements, fixed transitioning path</td>
<td>Many possible constellations and experiences with implementation</td>
</tr>
</tbody>
</table>
2. The programme management challenge

The case company is a multinational company with more than 50 factories worldwide. The company is family owned and one of Denmark’s largest industrial companies with 18,000 employees globally supplying components and control devices to primarily OEM customers and wholesalers. It is organized around three business units with separate management, production, purchasing, and R&D and with clear market foci and own identifiable strategies and competitors. The primary shared functions are corporate sales resources. While in principle IT and most other of the corporate functions operate on a market basis. As part of a strategy to improve return on assets from a mediocre 5% in 2003 to 10% in 2008 the company had initiated efforts to develop and adopt its own lean business system.

The global presence of company activities entails many sales and production sites in many different regions. This poses some challenges in regards to designing and executing an efficient transformation process. Each single site can possess some inertia that will act against the transformation process within the sites. Each type of plant setup and each organizational culture might pose some new challenges in terms of customization of the lean concept and the interpretation of its practices. The amount of resources needed to introduce the lean concept to 50 sites dispersed globally requires that the effort is spread over time.

The case company had chosen to establish a large programme organization with the goal of ensuring the transformation. This approach can be seen as means of:

— overcoming inertia
— ensuring centralized coordination and standardization of methods and tools so as to facilitate knowledge sharing and learning
— engaging in simultaneous transformation of several sites so as to maintain a certain momentum and reduce the time lack between first movers and the last to engage in lean
allowing for top management control over content, speed, and outcome.

At the same time, the organization of the implementation efforts within a programme creates a visible entity against which frustration and different kinds of challenges can be directed. These appear to be some of the potential challenges the transformation of a large multinational company faces. In the following sections the organization of the transformation process is further described.

**The case programme**

**Initiation and rationales**

Martinsuo and Lehtonen (Martinsuo & Lehtonen 2007) have investigated the initiation phase of programmes. They interviewed a number of people with key positions within a programme. Through this, a number of different rationales for the programme initiation were identified. Such rationales included the need to update operating systems, competitive pressures, and envisioned future developments that the company would need to keep up with. Based on Regnér 2003, Martinsuo and Lehtonen characterize the reasoning as inductive, that is, primarily explorative, developed through trial and error, and primarily externally oriented.

Also in the case company of the present research, various lines of reasoning were in use in the promotion of the necessity of change. These lines of reasoning drew on a mix of organizational and environmental creep (Dunphy & Stace 1988) as the primary reasons or threats.

**Background stories and rationalizations**

The following stories were typical explanations heard in various corners of the company regarding the background for the initiation of the corporate change programme.

Historically the company was characterized by centralization. Some parts of manufacturing were carried out in a functional setup. Central plants provided stamping, coating, injection molding, hardening, and also expertise on a range of production processes to other plants. In the past decades however, the company had been characterized by a low degree of coordination, and mergers, acquisitions, segregations, and sales had incurred a configuration that was in risk of being perceived as a conglomerate of different businesses with a variety of manufacturing systems and different degrees of operations capabilities among the different plants.
Employees in the company related of a long history of both local and corporate improvement projects in which the company had not been successful in capitalizing from efforts nor in sustaining gains. Project leaders stated that there appeared to be a strong “change project”-fatigue in the local organizations. A perception that local “change targets” had learned just to “duck down while the programme was ongoing and get up again when the turmoil was over”.

Internal and external consultancy studies indicated that the company was strongly lacking in both financial performance and in the application of best practices compared to both peers in similar industries and other world-class companies.

Increased competition and pressure arising from globalization challenged the company’s long standing history of showing interest in and taking responsibility for local community development. This approach had been particularly important for the company in the area where head quarters and one third of the company’s activities were located. The area is a semi remote part of Denmark with a sparse presence of other industrial players. Still moving production to lower cost countries had been going on for a number of years. The executive committee of the company expressed an intention to preserve as many jobs in Denmark as possible. Cutting costs, becoming lean, and increasing sales were the identified means of achieving this.

Another well known study within the company was an employee perception study that had recently been conducted at the outset of this study. The perception study showed that many managers in the company were perceived as lacking leadership competencies. This study was used to argue for the need for exchange of experiences among managers. Standardized business processes should facilitate this and was one of the goals of the change initiative. Such formalization would also provide a basis for performance evaluations. This was important as internal promotion was the primary source for management recruitment within the company. Transparent processes were therefore needed for new leaders to quickly gain an overview of staff performance.

Finally it was well known that the family owned company was facing an introduction to the stock market in the coming years. So it was in the interest of current share holders to move the company out of the conglomerate shadows and into a company known as well run and perhaps progressive. Results achieved through lean implementation could possibly support this goal.
So, many different stories were in use to rationalize the need for a lean transformation. In the words of (Kotter 1995) the basis for creating a sense of urgency of change existed. But the different lines of argumentation had different appeals to different interest groups.

Programme setup

The transformation efforts were organized in a programme of programmes with each sub-programme directed at a specific function, e.g. production, sales, R&D, or purchasing. Each sub-programme was dedicated to design and undertake portfolios of projects within its specific function to realize its goals. The first part of the corporate change initiative was targeted at production and was launched late 2003. The programme aimed at a transformation of the manufacturing systems to establish a lean production system ensuring both short term productivity (and capacity) gains, reduction of inventory levels, as well as capabilities for performance management and continuous improvement. The programme had developed a transformation model shown in Figure 7. The model depicts how the establishment of lean and continuous improvements was hypothesized to be spawned in the tension or interplay between three elements: New methods and capabilities; managerial direction setting; and performance management.
The primary operating mode adopted by the programme involved deployment of four months long pilot projects in all production areas. Changes during these projects primarily took place on shop floor; they involved common, basic lean tools and were lead by corporate change agents. The pilot projects should work as training grounds for local project members and management who were responsible for sustaining, evolving, and cascading new systems within the factory so as to drive a transformation of the entire production organization. In turn more than 50 factories would become involved in this corporate-wide transformation and most factories would over time host several pilot projects in disjunct production areas. Thus the cascading of lean practices would take place through both local and corporate initiatives; the pilot project being the main vehicle for implementation. During the first couple of years in the programme life, plans for how to cover all production areas with pilot projects or variants thereof were being detailed for each factory. These plans laid out the sequence and timing of projects, the resources to deploy (e.g. local or corporate change agents), important focus areas for each project, and estimated outcome potentials. These plans were termed “roadmaps”.

In parallel to the development of roadmaps, the programme developed 10 principles that should characterize the lean and continuously improving organization. These principles

1. **Adding value** – as seen from the customer perspective
2. **Pull, not push** - flow driven by the pull of the customer
3. **Standard operating procedures** – foundation for continuous improvement cycle of stabilization, sustain and improvement
4. **Frontline teams** - with team coordinators to ensure coordination at all times
5. **Stretched targets** – constant drive to improve the current situation
6. **Real-time performance management** – deviations from normal production are seen and reacted on immediately
7. **Visual management** – management approach at all levels to “go and see”
8. **Continuous improvement** - systematic problem solving and continuous drive to remove waste
9. **Improvement plans linked to budget** – planned activities always linked to both performance and financial results with focus on total cost
10. **Respect for people** – active support and involving our people through the change process with commitment to [company] values

*Figure 8* Ten principles for the future manufacturing organization identified as transformation goals within the productivity programme.
are displayed in Figure 8 in a 2005 version. They may be perceived as defining the content of a cultural transformation that the organization should undergo in order to adopt these structural guidelines. As such they supplement the roadmaps and together they outline two strings in the transformation process: Implementation of lean tools in interplay with the adoption of lean principles.

**Project content**

The scope, organization, planning, and execution of the four months pilot projects were somewhat standardized. The typical pilot project scope involved a production area with 18-100 employees and was primarily carried out within the span of control of one production supervisor. The project teams consisted of around 5 people; all full time committed to the projects:

- 2±1 corporate project leaders – one leading the project, and one or two training to become certified project leaders.
- 3±1 local project members – typically white collar employees with close relations to the production area.

In addition, the supervisor of the area could work part time on the team or, as the very least, participate in most of the daily team meetings to stay in contact with the plans and issues in the project.

The projects followed a standardized schedule, implied standard meetings and trainings, and all drew on the same toolbox. Some of the tools were mandatory for the project leaders to implement others were developed for different types of manufacturing. Changes primarily took place on shop floor and the most commonly applied tools included:

- Current state materials and information flow analysis and future state design
- Possibly layout changes to obtain flow, cell layout, and team ownership of processes
- Establishment of autonomous production teams and a team coordinator role
- Standardization, e.g. setup reduction activities and creation and implementation of standard operating procedures, especially for direct work
- Mapping and displaying of operator skills within teams. Target setting on operator flexibility through cross training
- Tracking of machine downtime and stabilization of equipment to improve availability and quality
- Lead time reductions via inventory and flow management, e.g. implementation of kanban or FIFO lines on parts of the material flow
- Hourly target setting and registration of the teams’ production outcome
Shift meetings within teams to highlight/discuss problems, results, and priorities
— Weekly meetings between supervisors and teams with focus on various performance indicators
— Shop floor audits on the implemented/agreed practices
— Daily or weekly problem solving sessions in smaller teams involving supervisors, production technicians, engineers, or other support functions and possibly also team coordinators
— Weekly and monthly performance and actions plan reports and reviews between supervisor/plant manager and between plant manager/business unit manager.
— Monthly plant performance reporting to programme headquarters
— Creation of local action plan for a 4-6 months period after the pilot project
— During the first period the former project leaders would visit the area monthly for auditing and follow up.

The toolbox contained more elements which could be applied when other areas were identified as bottlenecks; such elements include preventive maintenance and decentralization of support functions.

Panizzolo (Panizzolo 1998) accumulates a list of 48 practices related to lean and identifies 32 practices to be basic. In Table 3 the degree of implementation of these practices during the pilot projects are attempted evaluated. Several practices are core to the standard pilot project while others are used only in particular settings. The projects mainly focus on shop floor issues and also involve some support functions, but the complete set of basic practices described by Panizzolo is not fully adopted.

Table 4 lists the practices identified by Panizzolo as advanced. The pilot projects do not target any of these practices. Based on these assessments the programme content in terms of lean practices is characterized as basic practices.

**Project execution**

Initially an external consultancy company was engaged to develop the programme concept, including the pilot project concept, and to provide material and training for both project and programme execution. A maritime terminology was adopted to promote the programme and positions related to it. A clear distinction was made between the corporate project leaders; local change agents; other project members; newly recruited project leaders (corporate project leader trainees); project advisors; and programme head. Late 2003 the first 8 corporate project leader trainees were recruited internally in the company. 2 pilot projects in the vicinity of head quarters were initiated with consultants from the external company as project leaders and advisors.
Table 3 Lean practices identified as basic by Panizzolo (1998) and their implementation in the case programme. The assessment has been based on the generic project contents and insight into some of the first years of projects. A use-score of 0 indicates a very low or no implementation, 3 indicates a high degree of implementation during pilot projects.

<table>
<thead>
<tr>
<th>Practice</th>
<th>Use</th>
<th>Practice</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process and equipment improvement</strong></td>
<td></td>
<td><strong>Production planning and control</strong></td>
<td></td>
</tr>
<tr>
<td>Setup reduction</td>
<td>3</td>
<td>Leveled production</td>
<td>2</td>
</tr>
<tr>
<td>Flow lines</td>
<td>3</td>
<td>Synchronized scheduling</td>
<td>0</td>
</tr>
<tr>
<td>Cellular manufacturing</td>
<td>3</td>
<td>Mixed model scheduling</td>
<td>2</td>
</tr>
<tr>
<td>Rigorous preventive maintenance</td>
<td>2</td>
<td>Under-capacity scheduling</td>
<td>NA</td>
</tr>
<tr>
<td>Error proofing equipment</td>
<td>1</td>
<td>Small lot sizing</td>
<td>3</td>
</tr>
<tr>
<td>Progressive use of new process technologies</td>
<td>0</td>
<td>Visual control on shop floor</td>
<td>3</td>
</tr>
<tr>
<td>Process capability</td>
<td>2</td>
<td>Overlapped production</td>
<td>NA</td>
</tr>
<tr>
<td>Order and cleanliness</td>
<td>3</td>
<td>Pull flow control</td>
<td>2</td>
</tr>
<tr>
<td>Continuous reduction of cycle time</td>
<td>1</td>
<td><strong>Product development</strong></td>
<td></td>
</tr>
<tr>
<td><strong>HR practices</strong></td>
<td></td>
<td><strong>Supplier relationships</strong></td>
<td></td>
</tr>
<tr>
<td>Multifunctional workers</td>
<td>3</td>
<td>JIT deliveries</td>
<td>1</td>
</tr>
<tr>
<td>Expansion of autonomy and responsibility</td>
<td>2</td>
<td>Open orders</td>
<td>1</td>
</tr>
<tr>
<td>Few levels of management</td>
<td>1</td>
<td>Quality at the source</td>
<td>1</td>
</tr>
<tr>
<td>Worker involvement in continuous quality improvement programmes</td>
<td>3</td>
<td>Early information exchange on production plans</td>
<td>0</td>
</tr>
<tr>
<td>Work time flexibility</td>
<td>2</td>
<td><strong>Customer relationships</strong></td>
<td></td>
</tr>
<tr>
<td>Team decision making</td>
<td>3</td>
<td>Reliable and prompt deliveries</td>
<td>2</td>
</tr>
<tr>
<td>Worker training</td>
<td>3</td>
<td>Commercial actions to stabilize demand</td>
<td>0</td>
</tr>
<tr>
<td>Innovative performance appraisal and performance related pay systems</td>
<td>0</td>
<td>Capability and competence of sales network</td>
<td>0</td>
</tr>
</tbody>
</table>

4 corporate project leader trainees were participating along with local staff as project members on each project. After their first pilot project experience most of the trainees were promoted corporate project leaders and a new batch of trainees were recruited primarily from within the company. Training of project leaders was done using a train the trainer approach. Depending on prior experience, training to become a corporate project leader required participation as trainee in one to two, occasionally three pilot projects. The skill building process relied on learning by doing and coaching performed by more experienced corporate project leaders and exchange of experiences with colleagues.
Table 4 Lean practices identified as advanced by Panizzolo (1998) based on their effect in discriminating between more advanced adoption profiles among excellent lean companies.

<table>
<thead>
<tr>
<th>Product development</th>
<th>Supplier relationships</th>
<th>Customer relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product modularization</td>
<td>Supplier involvement in quality improvement programmes</td>
<td>Early information on customer needs</td>
</tr>
<tr>
<td>Mushroom concept</td>
<td>Reduction of number of sources and distances</td>
<td>Flexibility on meeting customer requirements</td>
</tr>
<tr>
<td>Design for manufacturability</td>
<td>Long-term contracts</td>
<td>Service enhanced product</td>
</tr>
<tr>
<td></td>
<td>Total cost supplier evaluation</td>
<td>Customer involvement in product design</td>
</tr>
<tr>
<td></td>
<td>Supplier involvement in product design and development</td>
<td>Customer involvement in product design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Customer involvement in quality programmes</td>
</tr>
</tbody>
</table>

The pilot projects followed a standardized schedule but the focus of each project was partly adapted to the particular business needs in the area – e.g. some focused on stabilization and delivery issues, some on capacity or productivity issues, some on handling product mix. The projects were executed in parallel and between two rounds of project execution a couple of months were spent on preparing for the next round and exchanging experiences among corporate project leaders. In the first years this sharing of experiences resulted in decisions aimed at easing and improving project execution. Such decisions included demands for management support from business unit and production managers hosting the pilot projects, awareness of stress symptoms, and teambuilding events.

In several factories, the use of projects as an implementation approach continued. These local projects were conducted by local change agents who had participated in corporately driven projects. In some factories, the pilot project toolbox, time plan, and organization was applied as template for these projects. This increased the amount of projects running in parallel although these local projects were being run by less experienced, uncertified project managers.

Project outcomes
The espoused short term goal of the pilot projects was to ensure lead time reductions and productivity or capacity gains. In the long term the espoused goal was to build a lean company with a strong continuous improvement culture and a common way of manufacturing and performing business processes. Standardization of practices played a central role in the programme since it was conceived as a means of building this common
Cpt 2 The programme

way, a means of sustaining productivity gains, as well as a means of obtaining a platform for continuous improvement.

As per September 2005 when this PhD project started, a total of 25 different pilot projects had been carried out in 4 batches. The project settings had differed on many dimensions: Different business units, different countries and regions, different market settings, different production characteristics, different pre-knowledge of the programme, different backgrounds of project leaders, and different competencies locally just to name some obvious sources of variations. In spite of similarities in project planning, setup, and execution different degrees of success with the projects were observable regarding:

— observing action plans and schedules laid out for the local organization regarding the finalizing of the changes.
— reaching and maintaining targeted productivity levels.
— sustaining and developing implemented changes.
— engaging in a new performance review agenda incorporating action plans in the review performed on various organizational levels.

In particular the issues regarding lacking sustainability of the project results was a concern within the programme organization. In Figure 9 some productivity developments from various project areas are listed. The three columns in each graph indicate from left to right: The targeted productivity improvement for the specific project, the results achieved through the project, and the target for a follow up period where changes would be finalized by the local organization. The curves in the graphs display the developments from the end of the project period and onwards. Ideally the achieved project result should equal the target. These targets were set based on analyses of current state production and the design of future state operations during the first month of the projects. Similarly, the lines tracking the reported performance should show a steady 15% annual increase as this was the announced goal for continuous improvement efforts. Project results in terms of productivity improvements should average 25% as this was set up as one of the goals of the programme. However, for some projects lower targets had been identified and in some cases these lower targets were met during the project. Other projects identified higher potentials that were not achieved. Several of the lines tracking the performance display a smaller slope than the annual 15% increase, and several of the lines display huge fluctuations. Within the programme, speculations regarding causes and effects led to a conclusion that the more stable and steadily inclining productivity results were reached when improvements were embedded in new layout and hardware (the top right graph in Figure 9 stem from such a project). Projects primarily relying on new
manning schemes, increased attention, and other behavioral changes were generally perceived to be more fragile, less sustainable.

Figure 9 Productivity developments in some project areas, as reported by the plants involved. The columns in each graph indicate from left to right: The targeted productivity improvement, the project results, and the target for a follow up period. The dotted lines display an annual 15% productivity increase from project target. Top left: A result from the first round of projects. Bottom four: Results from the second round of projects – still in the early stage of programme life.

New developments

Within the project executing part of the programme, the experiences from corporate project leaders and project advisors during the first years resulted in decisions and
initiatives to improve the results and sustainability of intervention initiatives. Such initiatives include:

- Mandatory trainings and a list of mandatory tools to implement during projects.
- Mandatory project management elements including alignment meetings, evaluations, information elements, coaching.
- Mandatory follow up from top management.
- More focus on ownership through coaching of the local change agents, supervisors, and production managers after the pilot. Role clarification for team coordinators and supervisors.
- Awareness of and communication about change curves and stress symptoms.
- Employee suggestion boxes and barometers for testing the mood. Teambuilding events and celebration of results.

It could be expected that project outcomes would improve as the programme matured. Over time the corporate project leaders and advisors gained deeper insight in the lean techniques as well as more experience in successful project execution. Over time the programme evolved and, as described above, incorporated experiences into a range of measures to strengthen the sustainability of the pilot projects. And over time the receiving organization accumulated experience with the projects. This should be reflected in the programme’s ability to ensure consistently high levels of project performance such as:

- High project targets, indicating good analytical skills and technical insights.
- High project results, indicating analytical skills as well as project execution competencies.
- Small deviations between target and result, primarily indicating realistic target setting and good project execution competencies.
- High continuous improvement rates, indicating the establishment of good information and performance management systems, involvement of relevant support staff, and possibly good follow up after the project.
- Small performance fluctuations from month to month, indicating that relevant parts of the surrounding system had been stabilized.

In Figure 10 the project outcomes are grouped according to programme age. The schedule of the programme is split into project execution periods (waves) and periods allocated to project manager resting and preparing. It appears that the average project outcome more or less settled on a fixed level after the first three project execution periods. Meanwhile from the standard deviations among project outcomes within one period (the right hand part of Figure 10) it appears programme maturity does not ensure
a high level of consistency among projects after 3, in fact performance consistency deteriorated in the sixth project execution round.

In the first 6-8 months after its launch, the programme underwent several organizational changes and quickly became organized with two project leaders promoted to the position of project advisors. These advisors substituted the advisors from the external consultancy company in regards to the management of the group of project leaders and in regards to the execution of the portfolio of projects. They also started consulting factories on tactical issues regarding their efforts to become lean and took part in developing the factory roadmaps. Within the programme the establishment of a pool of trained corporate project leaders was identified as a bottleneck. The programme experienced some exits from the pool of active project leaders – some were redeployed in the line organization, some were promoted within the programme, and some took a break from project management in other jobs within the programme. Moreover, the number of highly qualified applicants to the position as project leaders did not reach the expected levels as not many production managers expressed interest in the position. The programme therefore started recruiting externally and the new project advisors declared that corporate project leaders were expected to stay with the programme for at least 2-3 years. Still, in period six only 4 of the 13 project leaders employed during the first two project periods were still working as active project leaders. Turn over of project leaders may have been a driver of the decreased performance consistency experienced in period six. But also other drivers may have played a role.

In Table 5 some numbers indicating the development in the scope of the programme are listed. The programme ramped up during the first three project execution periods from conducting 2 parallel projects to conducting around 10 parallel projects. This ramp-up period also entailed a steep increase in the number of factories and business units that
were being involved in a project for the first time. As a result the programme experienced increased complexity in terms of involved business units, factories, and cultures, and perhaps maturity had not been reached after 3 years although the ramp up had been completed after 1½ years.

Table 5 Programme mechanics: Period by period the programme roll out gradually involves more factories and a larger programme organization.

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Period 4</th>
<th>Period 5</th>
<th>Period 6</th>
</tr>
</thead>
<tbody>
<tr>
<td># of parallel projects</td>
<td>2</td>
<td>6</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td># training project managers</td>
<td>8</td>
<td>6</td>
<td>7</td>
<td>10</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td># project mgr exits to line</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td># prj mgr recruited – acc.</td>
<td>8</td>
<td>13</td>
<td>17</td>
<td>24</td>
<td>29</td>
<td>32</td>
</tr>
<tr>
<td># factories involved – acc.</td>
<td>2</td>
<td>8</td>
<td>16</td>
<td>21</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td># business units involved – acc.</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td># different host countries – acc.</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>7</td>
<td>9</td>
</tr>
</tbody>
</table>

Programme typologies

Traditionally a programme has been considered a portfolio of projects. As hosts for series of projects, Pellegrinelli (Pellegrinelli 2002) suggests that programmes need to accommodate a dynamic environment. At the same time programmes should create a more stable environment for the projects they host by shielding them from an unstable environment. To accomplish these objectives, programmes need flexibility to shape their own context via negotiations, lobbyism, or other political “back stage activities” and programmes need to retain flexibility to incorporate emergent change. (Pellegrinelli 2002)

A well-designed project execution mechanism

An examination of classical recommendations for successful project planning and execution as listed in (Minarro-Visera, Baines, & Sweeney 2005) reveals no large gaps in the performance of the programme as project host. Benchmark studies and effective communication strategies have been used to ensure employees’ acceptance of the need for new approaches. Recruitment and training procedures ensure that project leaders have planning skills, a strong goal orientation, experience with similar projects and the ability to clearly communicate the planned change process and target. General authority and status of project leaders are ensured through a selective recruitment process and an exclusive job title.

During the early years of the programme, various problem areas revealed themselves but these were often handled through the deployment of new tools and practices. Examples
include the issue of maintaining a pool of corporate project leaders within the programme which was addressed by establishing clearer career path options and more incentives for project leaders. Such incentives included interim positions in the programme administration for exhausted project leaders and the securing of production management or other high status positions for project leaders exiting the programme. The programme established a means for bypassing the filter embedded in the reporting structure used in the line organization by introducing new performance measures and new performance reports that were brought directly to top management. Through this new reporting system, the programme succeeded in bringing top management attention to the issue of sustaining performance improvements. The programme also addressed the resistance some projects encountered from lower middle management by putting pressure on the line organization and in some cases this resulted in relocations and the engagement of more progressive managers.

So both on the programme management level and on the project execution level, several initiatives were being directed at strengthening the pilot projects in terms of results and sustainability. Through these efforts, the programme was fulfilling part of its role as a protective unit shielding the projects from wider political conflicts.

**Programme objectives: Systems update and/or replacement**

Pellegrinelli (Pellegrinelli 1997) develops a typology to broaden the understanding of programmes. Pellegrinelli points out that in addition to hosting projects, programmes can also incorporate the capacity to generate projects. The typology includes three types of programmes: Portfolio programmes hosting a range of related projects, “heart beat” programmes with a continuous and repetitive project development and application, and goal oriented programmes which include a capacity to be self-unfolding – growing while developing an initially vaguely defined strategy. Based on these models Vereecke et al. (Vereecke et al. 2003) identify two parameters that can be used to distinguish different types of programmes:

— The level of outcome expectations for the programme - is the programme aimed at continually modifying or more discontinuously replacing existing procedures.

— The extent to which the projects hosted by the programme exist at programme start or are being generated by the programme.

The combination of these two dimensions results in four characteristic types of programmes as displayed in Figure 11.
The case programme displayed a range of different characteristics that each would fit into different parts of such typology. One programme role was to host the pilot projects. Although this project concept was initially developed by the programme, the repetitive pilot project application does not demonstrate any generative power of the programme. After the first three years of programme life, a new project concept was developed: The brush up project aimed at reestablishing deteriorated practices in former pilot project areas. These two types of projects may be classified as aiming at systems modification and maintenance respectively (circle A in Figure 11). The development of roadmaps (circle B in the figure) may be seen as a separate project. These roadmaps addressed entire production areas and outlined how these areas would be renewed through a series of pilot projects or similar efforts. Where the application pilot project may be seen as a matter of isolated systems updating, the roadmap initiative demonstrates that the programme aimed at a systems replacement. In combination the series of pilot projects would replace former management systems on shop floor. The roadmap and the brush up initiatives demonstrate the generative power of the programme and both are aimed at strengthening the implementation of the lean systems achieved through the pilot projects. These different roles within the case programme merge characteristics from different types of programmes as defined by Veerecke et al. (2003).
Lean as tacit knowledge

The programme may be seen to have spanned different types of objectives. On the one side the repetitive project application resembles the heart beat type of programme aimed at systems modification (Pellegrinelli 1997). The roadmaps on the other hand outlined a complete coverage of the production areas and thereby implied a systems replacement in which lean would be installed as a new system.

From one perspective lean production is an existing concept and several implementation approaches also exists and are well known. Large amounts of management literature on lean is available and several organizations offer education programmes in lean. Yet, from another perspective lean is new to the company and the way lean is to be interpreted, developed, and maintained within this company is company specific.

This insistence on lean implementation as highly company specific is also mirrored in the approach to knowledge transfer between manufacturing units and the central programme. Ferdows (Ferdows 2006) characterizes production knowledge by the speed by which the know-how is developing or becoming outdated, and by the level of codification. Ferdows matches the type of know-how with means for its transfer. I.e. highly codified but slow-changing production know-how can be transferred via the use of instruction manuals and lectures. Slow changing and tacit production knowledge is suggested to be transferred from one location to another by transferring experienced staff. Fast changing production know-how should be transferred via experts – either to download knowledge during projects via intensive contact with local receivers in the case of un-codified knowledge or via the collaboration between multiple experts on multiple sites in the case of codified, fast changing knowledge which facilitates knowledge sharing.

In the programme, the knowledge that was being build and transferred was not production knowledge but knowledge on lean tools, knowledge on project execution, and knowledge on how to operate a lean system. As trained experts the corporate project leaders were being transferred from unit to unit to design future state operations that incorporated knowledge of lean principles. At the site, transfer was taking place via two main mechanisms: The corporate project leaders carried out a project during which lean knowledge was being embedded in the production system through lean practices, and the experts taught and guided the staff in how to operate the new lean systems. This latter transfer mechanism involved “intensive contact with local receivers” and thus signals that knowledge on the operation of the new tools and systems was regarded as un-codified.
Within the group of corporate project leaders – or lean experts – knowledge on lean tools was being codified and shared in a central database. The group of project leaders communicated extensively with each other both during project execution and during the in-between periods. This signals that the pool of knowledge was growing and that the knowledge required by individual project leaders was fast changing in the sense that for every new project they may have needed new knowledge.

The basic knowledge needed for project execution may have been considered to be more slow-changing and was treated as tacit knowledge. Training project leaders were being co-located with experienced project leaders for an extensive training period.

So even though a lot of knowledge on lean practices is codified in literature and thus available to transfer via lectures and instruction manuals, the programme was dealing with three types of knowledge related to lean:

- A fast developing or expanding pool of knowledge on lean tools and their application that to some extend was being codified in a central database.
- A slower changing basic pool of tacit knowledge on project execution transferred through co-location of inexperienced and experienced project leaders and the use of project advisors.
- A tacit pool of knowledge on the operation of lean systems that was being transferred by co-location of corporate project leaders and local managers.

**Knowledge flows and gaps**

Regarding this latter pool of knowledge a gap in the transfer process appears to have existed. The programme recognized that the various staff groups involved in operating the new lean systems needed to develop their knowledge on this aspect. For this purpose two staff fora were established: One forum for supervisors and one for local change agents. Furthermore the company academy was being involved in developing and providing courses for team coordinators which also provided an informal forum for knowledge sharing. However, knowledge shared in these fora was not being transferred back to the project leaders in charge of downloading such knowledge to the various staff groups during the projects.

**Knowledge and authority**

Analyzing the programme approach to lean implementation and project execution from a knowledge transfer perspective highlights some aspects of the chosen transformation approach that may work to slow down the transformation process. Treating knowledge on lean tools as un-codified and primarily transferable through co-location increased the
bottleneck effect stemming from project leader turn over. However, it also provided the programme authority to counter critiques of its approach to lean implementation. The programme was developing its own pool of knowledge and its own implementation approach which may have differed from advice offered by lean literature. This lean literature was available to any member of the organization and thus potentially a source for critique of the programme approach. However, since the programme did not draw on the codified knowledge on lean but rather the pool of company specific knowledge developed within the programme the programme retained the expertise and authority to judge which was the right approach. This approach would exemplify the boundary drawing which as described by (Pellegrinelli 2002) is the traditional project approach to externalizing risks and uncertainties.

**Summary**

This chapter has provided some details of the organization of a programme established to carry through a lean transformation in a multinational company. The programme operated through pilot projects and had established an environment that supported these projects. This was the primary short term challenge and it may be argued that the programme fulfilled its role as project host and demonstrated some benefits related to grouping projects in such a programme.

The pilot project approach results in parallelism – it allows the organization to create a broad frontline of development (Gustavsen et al. 1996). This is a way of ensuring a critical mass of similar projects and to facilitate learning from implementation. In the case programme, the pilot project approach was standardized. This is a means for facilitating the transfer of learning across different projects. However, the range of technologies, geographical locations, industries and markets, ownership histories etc. present in the multinational case company entailed that implementation experience from one set of cultural settings had to be drawn on in projects taking place in other cultural settings.

The application of pilot projects as main drivers of change enables an organization to control the implementation speed. The case programme ramped up within 1½ years and reached a capacity to undertake 10 projects in parallel. However, using project performance consistency as an indicator of programme maturity, it appeared that the programme had not reached full maturity within the first three years of programme life. Recruitment and training of project leaders was identified as a bottleneck within the programme but also other factors added to complexity of the programme task. Over time
the programme engaged in several initiatives to strengthen the pilot projects and shield them from resistance from the surrounding organization.

As an approach to rolling out changes the pilot projects have some benefits but some drawbacks have also been identified. The controlled implementation approach facilitates implementation speed as experience increases and methods are being refined, but the control of “lean knowledge” and the use of certified experts, adopted by the case programme, limit the amount of projects that can be undertaken in parallel. This control also appears to lie behind a knowledge feedback gap identified: Locally produced knowledge on operating the lean systems and the transformation was not extensively fed back or solicited.

Some of the programme management literature emphasizes the need to manage programmes in a more flexible way than projects. It appears however that most of the initiatives developed within the programme were aimed at improving the outcomes and sustainability of the projects and can be considered first order improvements. It appears that the programme to some extent has locked in on or at least prioritized successful project roll out as its main goal during the first years of programme life.

The reported productivity results demonstrate that the pilot projects delivered productivity improvements but the reports also indicate that the issue of sustainability and continuous improvements was challenging the results achieved during the projects. The local challenge of receiving, operating, and possibly further develop the systems implemented during the projects will be addressed in the next chapters.
PART II:

Investigating transformation processes and results

As stated in the previous part, the overall aim of the present study is to investigate the organizational transformation process towards lean and continuous improvements driven by a pilot project approach organized in a corporate programme.

In the previous chapter, it was outlined how the programme appears to have locked in on or at least prioritized successful project roll out as its main goal during the first years of programme life. Productivity data from the involved factories show that pilot projects do provide the factories with systems that can establish increased productivity. This indicates that the implementation approach can move organizations past initial transformation challenges. It appears that in the case where the involved factories do not possess the complementary resources needed to engage in successful implementation, these resources and capabilities may be temporarily provided by the programme and the projects for the duration of the pilot project. The programme may establish sufficient focus and momentum for the projects to proceed. The project setting and skilled project managers may provide a zone free from disturbances from daily operations in which the project tasks can be prioritized. Project managers may have sufficient insight into the lean tool package to ensure that the tools best fitting the given context are applied. However, the reported productivity levels indicate that the local units faced some challenges in sustaining and further developing pilot project results in terms of productivity.

The programme engaged in a series of first order improvements, these improvements contributed to externalizing the risks associated with a set-up in which the responsibility for pilot project results were handed over to local factory management after the projects had finished. Factory management's interest in and pull for further transformation efforts may not be sufficient to drive a transformation forward. Therefore the lacking control over continuous improvement processes posed a risk to the realization of programme objectives. To counter these risks, the programme established a package of practices and tools for following up on achieved results via audits and performance reports. Also the creation of implementation roadmaps for each unit may have contributed to creating pressure on the factories for driving local transformations forward. Overall the programme
appears to be successful in creating a fertile ground for the project execution and projects appear to be successful in achieving productivity improvements. The programme seems to be a strong tool in the implementation process and it appears that it has been able to strengthen its position and chances of delivering the promised productivity improvements. From this characterization, the combination of pilot projects and programme may be assumed to be a success – it appears that the approach moves factories beyond initial challenges and implements sustainable systems along with a sustained focus on maintaining new productivity levels and new practices.

However, while the first order improvement activities engaged in by the programme may have strengthened the sustainability of results and new practices, these dimensions may not be sufficient to ensure the long term sustainability of a lean transformation. The successful transformation may entail more than productivity results and practice maintenance. This issue forms the basis for a problem area to address within this project:

1. What are the characteristics of a sustainable transformation process?

Continuous improvement as transformation outcome was one of the programme goals. Proof of this capability may also indicate that factories have engaged in a sustainable transformation process. In relation to the specific programme settings also other arguments point to the need for continuous development as a measure of transformation success. In the case company the applied change projects implement a basic lean package. This basic lean package is not considered to provide the business unit with any strategic benefits in itself. According to Hines et al (Hines, Holwe, & Rich 2004) it can be expected that companies can develop from a basic version of lean to an advanced version. According to Panizzolo (Panizzolo 1998) up and down stream relationship management for improved delivery and for collaborative R&D are advanced lean practices that can deliver strategic benefits to companies. Within the case company, improvements of sales, purchasing, and R&D practices are tackled by other subprogrammes in the overall programme aimed at establishing a new business system. In that sense, it could be argued that once all subprogrammes have been completed, the organization should have realized - or be in a position to realize strategic benefits from the transformation efforts. However, this argument implies that techniques and practices can be added as discrete units. Within the lean literature this perspective is mainly applied in survey studies using the number of techniques engaged in as the independent variable. Several sources however point out, that techniques have to be integrated with several contextual layers. Other sources point out, that the development of techniques
and capabilities is interrelated. Yet other sources investigate the enactment of implemented practices and stress that practices can be used such that the organization avoids engaging in the underlying thinking and fails to benefit from the underlying principles. These issues are thought to be important risks in an implementation approach that relies on pilot projects to establish a lean foundation on top of which advanced lean elements are needed in order to realize significant strategic benefits.

Based on these arguments establishing the development of lean capabilities and strategic advantage as the transformation goal, the successful transformation process must reach beyond the pilot project maintenance and embed practices, principles, and thinking, foster capability development, and establish ties to a range of practices and principles embedded in contextual layers not addressed during the pilot projects. Alternatively, the successful transformation process can be envisioned as the local units’ own experimentation and transformation efforts inspired by, but not directed towards, lean. In that case, a local unit may gain some strategic advantages at the expense of the benefits the company could harvest from having a shared production and management template in all units. Therefore the local receiving, operating, and developing of the lean systems plays a central role in relation to the sustainability of transformation processes and in relation to the direction of these processes. These two aspects will be addressed further:

2. **What are the local unit’s challenges in receiving, operating and developing the lean systems implemented?**

3. **How do local activities and initiatives contribute to establishing a transformation towards lean and continuous improvements based on pilot projects and related programme activities?**

Investigating these three problem areas should provide insights relevant to the research objective of identifying advice relevant to the project driven change process against lean and continuous improvements.
3.

Methodology

The approach taken to address the stated objective has evolved gradually throughout the project. Initially, the main lever identified in the transformation process was the pilot projects. Therefore, the transformation process was mainly assumed to take place within the factories, and it was assumed to evolve from the pilot project initiatives. This transformation model was promoted within the case company early in programme life, and the researcher adopted this understanding of the pilot projects as main transformation drivers. This lay the basis for attempts to assess the transformation processes within the factories based on the pilot project as initiator. Local challenges and initiatives may manifest themselves at multiple levels, in particular within the pilot project area, within the factory, and within individual thoughts and actions. The implemented systems are engaged in by individuals; their actions and collective approach towards these new systems shape the effects these systems have locally.

An inductive and exploratory qualitative approach was adopted in a first round of interviews focusing on the effects, consequences, and challenges factories faced on shop floor following a pilot project. A set of four Danish factories, each hosting a set of pilot project areas, was selected for this study. For each factory, interviews were conducted over a couple of days. (More details on the design of this study will be presented in the next section.)

Initially, the interview data was analyzed from an evaluation perspective aimed at investigating the pilot project success. For an evaluative approach, some theory of the successful transformation process and the mechanisms by which pilot projects may facilitate such process is necessary. Ideas for these mechanisms were strongly present when the data was collected and subjected to the initial analyses. These ideas were formed by the time spent in the programme organization along with readings of literature on lean. The literature review presented in Chapter 1 exceeds the initial literature review shaping the initial data selection, collection, and analysis. Initially, literature portraying lean as a discrete concept, as sets of practices and techniques, and also a series of prescriptive sources were reviewed. These sources were summarized in the model presented earlier. In Figure 12, it is depicted how this model of lean transformation challenges was used to focus the case studies and data analyses. The review had
provided a basic understanding of the successful transformation process as long lasting, involving learning and development, and embedding new practices and principles. The study was initiated with an underlying assumption that the pilot projects constituted the first step on such a journey towards lean and continuous improvements within each involved factory. This was the goal of the corporate programme and activities were organized around that goal.

The initial data selection, collection and analyses were inspired by a collection of lean transformation models presented in Chapter 1.

The data collection and analyses focused on the approach taken to the various challenges of developing lean further – especially on the challenge of diffusing the techniques and tools and the challenge of learning and growing capabilities, performance, and culture.

Within this first round of data collection and analysis, individual opinions and problems pertaining to the new systems and to the experience of the implementation process was one topic that presented itself strongly among many employees and supervisors. Many interviewees had experienced the pilot projects as very intense periods and rather than pursuing further change they expressed a need to settle down and rest, and come back.
to normal conditions. A second topic that presented itself was that of transformation visions – several interviewees did not perceive to have undergone or be in the middle of any transformation and “working with lean” was associated with using the implemented systems. However, it did not appear that this work spurred initiatives that contributed to changing the characteristics or the capabilities of the areas. These two aspects appeared to be central to the sustainable transformation process initiated by pilot projects. To investigate these two topics further, an additional study of involved factories was engaged in.

This second round of data collection aimed at developing two concepts: Making room for further change and Change drivers. To this end, three additional case studies of involved factories were engaged in, one in Denmark, one in England, and one in Slovenia. Approximately 9 working days were spent in each factory. Observation studies were undertaken to establish how the lean systems implemented were engaged in in order to identify how these systems contributed to the transformation process as change drivers. Observations were carried out during daily operations and included shop floor activities as well as different kinds of staff and managerial meetings. The study furthermore entailed interviews aimed at exploring interviewees’ concerns and thoughts about having or making room for further change.

In between these studies of involved factories, the central programme organization was occasionally visited, project advisors were interviewed, and the course of the study was presented to members of a group of internal consultants attached to the overall programme aimed at establishing a new business system. Most interviews were audio recorded and some were transcribed. Observations were recorded in field notes. Also informal talks with various staff members have contributed towards shaping an understanding of the study object.

During the second round of studies of involved factories, some aspects related to the concept of change drivers presented themselves. These aspects included the issue of driving activity rather than change; the issue of obscuring the identification of problems and improvement opportunities through work arounds; the issue of engaging in joint “surfacing only” but not digging deeper; and the issue of suppressing the principles aspired to when they interfered with implementation plans. This caused the study to touch upon the issue of local adaptation and decoupling as described by Lozeau et al (Lozeau, Langley, & Denis 2002). But it appeared that this adaptation could not be understood looking at the micro level only. The programme had to be given a role in these
processes. Similarly a second round of data analysis of the data collected during the first case studies substantiated how factories engaged in a series of initiatives to drive the transformation further following the pilot projects. The lists of initiatives were quite extensive and much broader than implementation according to the roadmap, application of auditing, and performance tracking tools which were the primary tools identified by the programme management for ensuring sustainability and continuous improvement. Some of the initiatives were surprisingly similar across the set of factories. And many of them did not appear to have any direct effect in terms of performance improvements or more leanness. It appeared that factories associated a transformation with more kinds of change dimensions than the programme and that local management identified other challenges than the ones identified by the programme.

In the following the design of the first round of exploratory case studies is presented. Additional studies, data collection, and analyses have been engaged in in order to further explore the issues presenting themselves during the first studies. However, the first round of studies remain the backbone of the project as this data has been reviewed and analyzed more thoroughly.

**Research design of study 1**

Study 1 was designed to address questions 2 and 3:

2. *What are the local unit’s challenges in receiving, operating and developing the lean systems implemented?*

3. *How do local activities and initiatives contribute to establishing a transformation towards lean and continuous improvements based on pilot projects and related programme activities?*

The effects of the interaction between organization and pilot project may reveal themselves over time as the successful project should foster a development process. The local units may adopt different approaches to hosting projects and driving transformation towards lean further. The multinational company hosts a large variety of organizations and even across a small set of differences, transformation approaches may vary a lot. To accommodate for time and organizational differences as the hypothesized primary aspects affecting pilot projects and their effects, the following design has been chosen. Case studies in a set of factories which each have been involved in a set of pilot projects at different times. Hereby the effects of different factory approaches as well as effects of pilot maturity may be investigated.
This first round involved a small set of factories but a much larger amount of pilot projects as each factory hosted several projects. The sampling evolved during the interview round and was agreed with the programme management. All the factories visited share the commonality of not having completely failed in using the new systems and maintaining some performance improvements. The factories have all invested some resources in the transformation process in terms of allocated project management resources. This is in contrast to factories that have not engaged in further activities to support the transformation mainly due to managerial issues of various kinds. Such factories represent extreme cases and in the eyes of the programme management such cases do not shed light on the pilot project as a transformation tool. This limitation in the data selection is the result of using convenience sampling – choosing the data sources which are available where availability is influenced by other parties.

In the interviews from the first factory visit – Factory Beta – the presence of operator resistance and frustration was very strongly felt. Opposing this force was a strong managerial focus on rolling out the roadmap laid out for the factory. The roadmap contained both corporately driven pilot projects as well as locally driven projects more or less copying the corporately managed project and these two types of projects appeared to follow different logics. Based on these impressions it was agreed that additional factories to be studied should differ along:

--- Different coverage – the factories should be in different stages of their road maps – that is in different stages of covering their production areas with implementation projects and involving the production organization in the new concepts. At the early stages of roll out, normally only a small part of the support staff would have been involved. So the differences among factories in implementation degree could shed some light on the interplay between the surrounding support organization and shop floor area. The different stages of roll out could also shed light on the existence of phases in the implementation. While Factory Beta was fully engaged in roll out, other factories could still be “warming up” and yet others could be concerned with challenges that follow implementation.

--- Different approaches to local implementation efforts. In Factory Beta, local change agents were the main drivers of further implementation as they undertook locally driven pilot projects. Since locally driven projects in Factory Beta appeared to follow a different logic than the corporate projects other factories using locally driven pilot projects should also be visited to explore the variety of approaches. Some factories involved in the programme used alternative ways of diffusion from that of copying
pilot projects. Studying such factory could shed some light on the local pilot project as a diffusion mechanism versus other initiatives for spreading or improving the systems. Different degree of corporate involvement – in two factories only 1 centrally managed project had been undertaken while in the other two factories 2 centrally managed projects had been undertaken. The amount of locally managed projects undertaken varies from 0 to 2 between the factories. Local change agents receive less training than corporate change agents. This difference in corporate involvement might shed some light on differences in corporate and locally managed projects.

After three additional studies had been conducted it was felt that additional interviews would not shed further light on the transformation effects caused by the pilot projects. An overview of the four factories studied within this study 1 is given in Table 6, p74. In the next chapter, three of these factories are presented as case studies. All of the material has been reviewed several times but material from the three factories was considered to be sufficient to illustrate important differences and similarities.

All of the factories are located in Denmark, three of them part of the same division – and two of these located in the same business unit. The factories varied a bit in size but all fall within the medium-size category based on head count. Large factories were excluded from consideration at it is thought that it would be too difficult to gain an overview of the transformation process in such factories. No small factory has been chosen for this sample but within the set of factories some of the involved production areas are run quite autonomously with dedicated support and management resources which is thought to cover another aspect of size. In particular the factories chosen for interviews differ in the degree of functional organization. The larger factories have a more functional organization while the smaller factories use a value stream or team structure. The factories varied on number of shifts and degree of automation but their processes were quite similar - all entailing some machine operations and some mix of manual and automated assembly.

Three of the involved factories are located near to head quarters in an area where the company is the main employer. Factory Beta is located in a large industrial area. This is a common distinction made within the company when talking about culture and company/employee loyalty in various units. Another common distinction often referred to within the company relates to the duration of ownership history of various units within the company. This aspect will not be covered in
the first set of interviews where all factories have a long ownership history within the company.

As indicated in Table 6 there were some structural differences in the implementation process among the factories, e.g. in the speed by which they were rolling out the implementation. All four factories had or had had change agents employed with direct report to the factory manager. These change agents had participated as team members in the centrally managed pilot projects in the respective factories. In Factory Beta and Alfa this change agent had driven locally managed pilot projects; this appeared to be the main driver behind different implementation speeds. Factory Beta and Gamma were both large factories but where Factory Beta had been / was engaged in five pilot projects, Factory Gamma had only been engaged in two pilot projects. Yet, the managerial coverage may be considered to be larger in Factory Gamma where the factory manager, two operations managers, and two supervisors out of five had been involved whereas in Factory Beta, the factory manager and four supervisors out of seven had been involved. Factory Alfa had reached a high share of coverage both in terms of managers involved and in terms of production areas and employees involved early in programme life - more than 6 months before the interviews took place. It is thought that such structural differences play a role in shaping managerial as well as employee perceptions of change. E.g. such differences may have an impact on the stage of change found in the factories. Where one factory may still be in a stage of informing managers about the lean concept, managers in another factory may be in a stage of dealing with this information and designing a vision of a future state incorporating lean principles, while a third factory might be on the outlook for the next steps or improvement opportunities. In each case, informants directly involved in or affected by the projects were chosen based on a dialogue with plant management. The lists of informants therefore varies from factory to factory but all entail shop floor employees, supervisors, some support personnel, production management, and where possible also local change agents. In some factories shop stewards and HR personnel were also included. As a starting point for the interviews, a list of themes relevant to a transformation process was developed based on input from researchers in the field of operations management and lean implementation. During the interviews also probing questions were asked based on observations of shop floor practices as well as issues based on earlier experiences with the change programme.

The following chapters present the data analyses from these studies
Table 6 Comparison of sampled the four factories for the first exploratory studies

<table>
<thead>
<tr>
<th>Factory</th>
<th>Alfa</th>
<th>Beta</th>
<th>Gamma</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timelines:</td>
<td>Wi03</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L – local</td>
<td>Su04</td>
<td>L</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>C – corp.</td>
<td>Wi04</td>
<td>C</td>
<td>L</td>
<td>C</td>
</tr>
<tr>
<td>Su05</td>
<td>C</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wi05</td>
<td>C</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su06</td>
<td>2L</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brush up winter 06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervisors involved</td>
<td>4/4</td>
<td>4/7</td>
<td>2/5</td>
<td>2/4</td>
</tr>
<tr>
<td>Operations team managers involved</td>
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<td>0/0</td>
<td>2/2</td>
<td>2/3</td>
</tr>
<tr>
<td>Estimated percentage of production area</td>
<td>80%</td>
<td>50% → 60%</td>
<td>40%</td>
<td>70% → 100%</td>
</tr>
<tr>
<td>Size:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head count</td>
<td>100</td>
<td>200-210</td>
<td>210-230</td>
<td>90</td>
</tr>
<tr>
<td># of shifts</td>
<td>1-3</td>
<td>2-5</td>
<td>2-3</td>
<td>2</td>
</tr>
<tr>
<td>Location</td>
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<td>DK</td>
<td>DK, by HQ</td>
<td>DK, by HQ</td>
</tr>
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<td>Ownership history</td>
<td>Original line</td>
<td>Original line</td>
<td>Original line</td>
<td>Original line</td>
</tr>
<tr>
<td>Interviewees Total</td>
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<td>14</td>
<td>15</td>
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<td>3</td>
<td>3</td>
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<td>Team coordinators</td>
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<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Supervisors</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Change agents</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Planners</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Production engineers</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Human resource Mgr</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shop stewards</td>
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<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Production Mgr.</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Factory Mgr.</td>
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<td></td>
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</tr>
</tbody>
</table>
4. Case studies

The data from the initial case studies engaged in have been analyzed and reviewed in several rounds. In this chapter, detailed case descriptions and some cross case comparisons, that highlight the dynamics engaged in within each factory and pilot area, are presented. The cases have also been analyzed using a structured framework. This analysis is presented in Appendix A and is based on a framework that will be outlined in the next chapter. These structured analyses have provided the platform for the case presentations.

In the following sections, three factories and the pilot project areas within them will be presented as cases and local activities and initiatives contributing towards the establishing of a transformation will be drawn out. In the following sections, “text in quotation marks that is highlighted in italic” refers to interview excerpts.

Factory Gamma (V4)

The Gamma factory produces small mechanical flow control devices. It is split in two operational areas focusing on volume and flexibility respectively. The high-runner area is the largest area characterized by automation with many surveillance tasks but also some semi-automated processes. In this area products are routed from machine center to machine center. The low-runner area consists of two smaller areas, one dedicated to prototype and ramp up production with manual work stations, some shared equipment, and some machining centers. The other area is more automated and facing a series of equipment updates. The production management considers the high-runner and the low-runner areas as two different plants although they share some support resources. The factory has been involved in two pilot projects (A and B) separated by 1½ years. In-between the two pilot projects part of the organization in area A had been swamped in a production ramp up of a new product which experienced a steep increase in demand. Another part of the organization in area B was involved in off-shoring some production. This was part of a large restructuring of the global production within the business unit and it was not considered a part of the lean transformation efforts.

Project A
A corporate project (A) was undertaken in part of the high-runner area during the second round of projects since programme startup. The project focused on creating visibility in various ways, to this end, equipment and machinery was moved into the same area. A kanban system was updated for ease of control and reliability. And the department of technicians was decentralized to achieve a better response time and shop-floor control over the prioritization of tasks. To make better use of the technicians, SMED projects and equipment stabilization projects for increased OEE were undertaken and operators were trained in small maintenance and setup tasks. A package of tools and techniques was adopted but at this time in programme life, the package had not yet been standardized across pilots. The package included: The establishment of team coordinator roles; hourly output registrations; shift meetings; standard operating procedures; cleaning routines; and audits.

The area was semi-automated and equipment was computer controlled, this allowed for a digital system for hourly output registration but this was one of the only factories to adopt this approach. Due to seasonal fluctuations the area made use of temporary workers during the summer period. To better accommodate this, planning tools for staffing and for skill development were developed.

By the end of the project period, the project had not reached all its improvement targets, e.g. productivity was improved 10% which did not live up to the targeted 30%. As input for the next steps in leveraging the performance of the area, several OEE improvement tasks on a range of equipment were identified. A local change agent, a production technician, and the area supervisor were the driving forces behind these improvements. The project appeared to have been well received among employees. Small improvement ideas were continuously implemented but generally there was no wish to alter the standards set up during the project. Shift meetings were used for sharing info on problems and raising ideas. Many of the suggestions and problems related to equipment issues, these were mainly addressed by engineers and technicians and their progress was tracked visually on a board in the team area. Occasionally the employees needed to put some pressure on these technicians to get the work completed but generally no barriers and no major problems were identified by the interviewees from the area. When the interviews were conducted, the area had more than 1½ years experience with the new systems. In the mean time there had been a rotation in the team coordinator position and the employees had participated in a course aimed at improving their team skills, in particular regarding conflict handling.

Project B
A second corporate project (B) had been performed one and a half years later – during the fifth round of projects since programme startup. This project took place in the low-runner area and focused on changing the layout to achieve cell production with balanced work stations. Work stations were moved into cells and balanced for two operators, tall equipment and racks were removed, decentralized storage points were created, the work layout at each station was improved, a 40% rework rate on a critical process was eliminated, and shop floor autonomy was increased by delegating some planning tasks to team coordinators. In addition to the package of common pilot project tools implemented in project A, a formalized problem solving process and tracking system was introduced in area B as part of a standardized tool box.

During the project period, the productivity measure jumped 40%. This high figure was partly explained by the off shoring of some labor intensive products which changed the product mix in the area. The last part of improving the work layouts within the cells were completed after the project period. The project had exceeded the budget for new equipment by a factor 3 which led the factory manager to require low budget changes only in the remaining cells in the area. Still the productivity measure increased +60% on some products. During a run-in period the problem solving process was altered to allow for a better flow of problems solved without drowning the organization or individuals in tasks.

The productivity increases in the area was to some extent tied into the new cell and work layout which balanced the work of the employees and created well defined / confined working areas and roles. In the new system, the operators had to help out colleagues when finished with their own jobs. The resulting, more level distribution of work between employees was welcomed by some who described the former imbalance as unfair. However, a couple of aspects were not so welcomed by employees, especially the need for a team coordinator position was debated.

Additional initiatives and developments

The two pilot projects and possibly also other programme initiatives seem to have inspired or triggered some additional change initiatives in Factory Gamma. The factory manager was oriented towards further development and had taken initiatives in several areas to further a transformation process. To the factory manager, the changes in area B demonstrated the future shop floor setup and work mode. The factory manager saw the information system including boards for team communication, use of team coordinators, and team meetings as the back bone of the productivity increases achieved in the pilot areas. The motivation to further the transformation process was the outlook to create more experiences of doing a good job in the organization.
The programme management had persuaded the factory manager to let the change agent, who had been involved in project A, enroll in the programme as corporate change agent. The plan was that he would return to the organization after some years in the programme. The factory manager saw this partly as a contribution to the programme and partly as a way to build up the competences within his organization. Meanwhile the organization was without a dedicated change agent for shop floor changes and the transformation process proceeded in smaller steps. The two area managers and their supervisors had been challenged to adopt a team structure with team coordinator roles and to implement information systems resembling the ones implemented during the pilot projects. In some areas, boards with weekly KPI tracking, list of key problems, overview of employees’ holiday plans, and other available information were displayed. An intern and a trainee had been the driving forces behind these implementations. The online system for data collection of hourly outputs from machine-centers had furthermore been extended to other machines. The system resembled the manual registrations used throughout the corporate programme where employees’ comments on problems could be collected hourly, however, only the former pilot project area utilized this functionality of the system. It was thought that in the future, the data would be useful for statistical analyses of recurring problems. These initiatives to spread the use of information systems beyond the pilot areas was seen as preparation for future pilot projects in these other production areas. Furthermore the factory manager made good use of the tracking system as the data facilitated his as well as his area managers’ interaction with supervisors. As a new initiative, the factory manager had initiated some new dialogues in the management group, the aim was to translate and operationalize the ten future organizational principles lined out by the programme (see Figure 8). To the factory manager this was a way of aligning the organization, clarifying mutual expectations, changing the “service demanding attitude” that was the outcome of a functional organization, and creating a vision of a more coordinated and proactive organization. At the time of the interview, the factory manager thought that supervisors needed some further education in order to elevate and make use of the information systems for improvement efforts and in order to proactively involve employees in improvement work. In the area involved in the first pilot project (A), the employees had participated in a session aimed at improving the teams’ conflict handling as a step towards increased autonomy. Team autonomy was the supervisor’s stated focus. The employees from the second pilot area (B) had later participated in a similar program. Apart from these initiatives, the factory manager was relying on the programme to supply further training and conduct other projects to transform the area.
Transformation orientations

Some of the goals stated by the factory manager were concrete – e.g. implementing information systems – but some of the initiatives were not formally planned and followed up on. Some goals were less concrete but could be considered to lead to more concrete transformation plans – e.g. the discussion and concretizing of the future organizational principles. Other ideas and visions were awaiting help from the programme – e.g. education of supervisors for a more proactive role. The initiative to implement information boards in the production teams was not followed up and as such it exemplifies a tendency not to operationalize these kinds of development goals. However, it appears that the initiative was engaged in to initiate the learning processes normally brought about by the pilot projects.

Area A

The area manager in area A was similarly aware that he had “to keep stirring the pot” to keep a development process moving. He was challenging his staff to apply more of the lean principles introduced in the pilot area. For instance he engaged the staff in the task of standardizing change over procedures, in coordinating activities among different staff groups and shop floor on a daily basis, and in discussing local opportunities for improving performance rather than focusing on excuses for lacking performance. The area manager reviewed weekly output targets with his direct reports and discussed the outcomes of the initiatives or countermeasures agreed on in previous meetings. These discussions addressed targets, actions, and experiences. It appeared however, that several development initiatives had no clear target, and analysis was not used to identify potentials. The process of challenging the organization to identify solutions to problems rather than excuses seemed to be more important than the achievements.

The supervisor in area A considered the lean transitioning as finished. He expressed that the current rate of dealing with problems within the team of support staff was satisfactory. He did not see the use of or need for any improvement targets set from above as his focus areas were highlighted by the problems occurring in operations. The supervisor participated in promoting the implementation of the team structure in other areas and encouraged colleagues to implement hourly registration and problem solving initiatives using the standardized boards as preparation for future pilot projects. He was interested in staying updated with new tools but conveyed that the potential in working with lean had been achieved. He did not judge the local organization capable of engaging further in 5S or SMED activities. In his perspective, this would require training performed by corporate experts. His dedication lay in dealing with daily production issues and in the development of team capabilities and team autonomy. He envisioned that he would engage the
operators in debates on the local interpretation and operationalization of the ten organizational principles outlined by the programme.

Also the team coordinator in area A stated that the transition to lean had been finished with the project. However, lean principles of goal directed improvement efforts and continuous testing and development of work standards were not communicated:

- Interviewer: "This process of getting good ideas is that supported somehow or systematized, ... time is allocated for this?", TC: "No, it isn’t", Interviewer: "Would it be better if it was?", TC: "I am not sure, ideas they just pop up, you can’t say at this or that point we will have a meeting and then just bring along your ideas, I think we need to deal with them as they pop up"

- Interviewer: "Is there any goal for the things you work with, are there certain things you try to improve?", TC: "Yes, both productivity and efficiency and our quality and everything and then of course our climate out there"

- Interviewer: “Do you use standards”, TC: “yes we do”, Interviewer: “do you then sometimes change them?”, TC: “No, we do not tamper with the things implemented by the project - it works”

The team coordinator, supervisor, and area manager appeared to exert considerable effort in the daily coordination tasks, it was their task to coordinate, remember details, follow up on problems, engage in quick work arounds where necessary and so forth. It appeared that rather than aiming at reducing variability, coping with it was their job. To them, lean tools systematized some aspects of work and provided a better overview of relevant information and lean thinking entailed here and now response to issues at hand.

**Area B**

The area manager in area B also expressed that along with the pilot project, the changes towards lean had finished in that specific area. Overall the goal within the area was improved delivery service and budgeting. The area manager had some ideas for this and these ideas would be implemented in a natural process of development of daily operations. He could see significant value in some of the principles introduced in the project and intended to further the use of worker flexibility and line balancing for more precise manning and increased productivity. For the next round of budgeting and planning he also intended to incorporate parts of the action plan format used in the pilot project. He appeared to convey a perception of lean as the application of tools and did not mention any behavioral changes or challenges related to the transitioning. It appeared that he addressed the system from a structural perspective and new practices that would be introduced were not foreseen to meet any resistance since they would have a clear function in improving some parts of the system. This perception reduces the perceived
complexity of working with lean considerably. The area manager did not want to address
the potential for improvement via lean tools in neighboring departments right away; this
should be deferred to future pilot projects run by the corporate change programme as this
was seen as the best way to achieve results and to ensure new competences among his
staff.

The supervisor in the newly finished pilot area (B) was focused on finishing work station
design and on maintaining new work modes with increased coordination, efficiency, and
problem solving capability. The supervisor engaged actively in changing the system,
establishing learning, and also changing his own behaviors. He preferred to focus on
daily results rather than weekly performance and had moved his desk out into the
production area to be available for quick interaction when problems arose. By this he
wanted to demonstrate the kind of action orientation that he wanted to emanate the shop
floor. At the time of the interview, the supervisor was working against a concrete action
plan outlined by the programme and was heavily involved with these finishing touches but
it appeared that the goal was to complete the actions laid out in the plan rather than to
continue developing new plans. Following the intense transition period, the supervisor
expected to develop the skills of employees and team coordinators further - to an extent
such that he would be able to supervise a larger area. This was a concrete vision of a
future lean organization but it drew on a small part of the lean toolbox. The realization of
the vision was expected to take place as a gradual development process.

To an operator from area B, the challenge had been to digest and get used to the new
roles. The operator saw the project as a reestablishment of some former order and
working rates and he expected that the area would undergo a similar second updating
after an unknown number of years. He expressed that employees had no role or interest
in the problem solving process since technicians and supervisors were expected to deal
with operational problems at a satisfactory rate. The hourly registrations of output
problems were not seen as a driver for continuous improvements neither were they seen
as necessary for ongoing daily coordination.

Employee: “we run [operate] with three men [in our cell] and we run as many as we can get
through and if things act up the others will not be able to do anything about it because we
have to take it apart ourselves and find out what is wrong”

Some employees had been concerned with the approach to managing the colleagues
taken by the new team coordinator. The operator suggested that the role would have
been more acceptable if it had not been filled by a former colleague. It appeared that
employees had managed their work stations quite independently before and the operator
his work had been restrained and confined.
If employees saw some improvement potential in the cell layout or in the work balancing, they would voice this to the supervisor. The operator stated that among employees there was a general perception that greater notice was paid to the problems they encountered and brought up. Problems could be aired at a daily meeting between supervisor and employees and it was thought that “the 20 witnesses” taking part in these meetings had a role in ensuring focus on implementing solutions.

However, the operator felt that the organization had not made a serious commitment to continuous improvements. Two examples of problems with incoming materials were described. In these examples the organization had not wanted to push the problem back to the suppliers nor initiate some corrective work that could have ensured a smooth production flow inside the cells. For some months such issues had taken up an hour of their time on a daily basis and the operator was troubled by the fact that the department was not credited for this work.

Similar to the team coordinator in area A the operator from area B conveyed that the standards adopted during the pilot project were fixed and not meant to be changed. OP: “[it was possible to discuss and find solutions within the team] as long as it is not stated in [the programme] because that is difficult, it is difficult to get anything changed that is written in [the programme]” In his cell they were good at balancing the work on an ongoing basis, shifting work patterns if problems arose at one station. Not all colleagues in other cells were so dynamic or able to think along those lines and therefore the operator did not feel that such approach could be spread or formalized, instead he considered this approach a work around similar to other slight deviations from standards he engaged in to create small pockets of flexibility for himself and his colleagues.

**Reflections based on the Gamma case**

There is a strong sense of sufficiency emanating from the interviews. Middle managers related of a stable need for gradual development of operations. The interviewees shared the perception of the organization as having sufficient capabilities for continuous updating of system capabilities; no drastic change was needed within the organization. The pilot projects had been finished and additional drastic improvements would take place when new pilot projects would be conducted in other areas within the factory. The vision in the factory was a more well-functioning organization, with larger spans of control, better communication, better interaction, and skills. No specific targets were identified for changes in this direction and no potential strategic benefit or manufacturing capability was mentioned as goal or outcome. Yet, all five managers interviewed were aware of improvements that would be relevant to engage in in the future. Many of these improvements were considered to require some resources that the organization did not
possess at the time. E.g. one supervisor lacked financial means to improve cell design and work processes; another would need more training to undertake further initiatives within SMED and 5S. One area manager would need another pilot project to address improvement potentials in another production area. The factory manager was dependent on some interpretation efforts to change the internal attitudes and values. He also expected that some external training and development initiatives would be required before higher levels of proactivity could be established among supervisors.

Two of the managers interviewed appeared to engage more directly with change: The supervisor in area B was very actively engaged in finishing implementation and eliminating problems in the pilot area. The area manager in area A appeared to challenge the organization to higher levels of proactivity and reactivity on several fronts with existing means and resources. This is considered an outlier position compared to other managers in the factory as area manager A engaged actively and directly in change. However, these changes were not seen in connection with some target of improved manufacturing capabilities, rather they were changes aimed at “stirring the pot” and continuously moving and improving which differs considerably from the target directed implementation efforts demonstrated by the pilot projects. Also on factory level this difference between programme and local approach is evident. The steps towards adopting the information systems utilized in the pilot areas may have been inspired by the pilot projects but did not entail the pilot project approach of creating clear team responsibility for performance targets and applying formalization and balancing to allow for more accurate target setting.

All in all the managers in the factory had a different approach towards change than the pilot project management. The common denominator for many of the initiatives appears to be communication – communication in new fora, on new topics, communication as a management style, communication as the main driver of change.

The organization appeared to be highly confident when it came to operations and normal updating of operations. However, the organization was less confident in regards to change; goals were not operationalized and some potentially relevant initiatives were deferred due to a perceived lack of capabilities. The area manager in area B did not relate of a transformation but the factory manager, area manager A, and to some extent also supervisor A were in alignment regarding the perception that they had a journey ahead of them. Indeed, the factory manager and the area manager engaged in multiple initiatives towards this end but the future state vision was vaguely defined and the goals were not operationalized. It appears that the perceived lack of capabilities to directly pursue ideas for improvements along with the notion of a vaguely defined journey may limit the managerial action field.
Even though pilot area A had worked with the implemented systems 1½ years longer than pilot area B, the area did not display more advanced competencies for continuous improvements, target directed change efforts, or other manifestations of lean principles. It may be however, that the passage of time had contributed to the understanding shared between area manager A and factory manager, that more changes should follow; pilot projects could not stand alone as the sole contribution towards a transformation towards a more well-functioning organization. This would be less evident to managers in area B as the recent implementation and the high levels of activity demonstrated a large transition.

The pilot projects and the programme had inspired the organization to take some steps towards a transformation process but the projects had not established new, increased capabilities for continuous improvements of manufacturing capabilities. The communicative change initiatives engaged in addressed some levers not addressed by the pilot projects. They may be necessary to drive a transformation forward but the vision for this transformation did not appear to have strong ties in the lean paradigm. The generative mechanisms identified by management were personal skills such as proactivity and autonomy. The fundamental lean issue of variability reduction did not have a clear role in the transformation vision. In fact, the organization’s ability to coordinate and juggle variability was a source for pride and feelings of achievements in the daily operations.
Factory Beta (V1)

The Beta factory also produces small mechanical flow control devices but for another market. The factory is located in another part of the country. The layout in the factory was functional with forging, machining, and different types of assembly in separate departments. The equipment centers were the smallest in terms of staff but produced the largest volumes as the basic components for all product models pass through these areas. The staff in these areas was mainly skilled while the assembly staff were mainly unskilled. Assembly was a mix of manual and semi-automated processes. The production areas appeared well organized and through the past number of years the employees had been engaged with TPM projects, mainly 5S and employee suggestion systems.

Pilot project A

The first pilot project, A, was conducted as a corporate project during the second round of projects since programme startup. The project took place in the forging area where raw material was cut and forged into the base components for the product line. The project focused on machine stabilization and OEE analysis, 5S, and SMED activities were the main lean tools in use. During the project several investments were initiated to exchange worn down equipment. Operators were made responsible for shift overlap – the last man to go home had to wait for the first man on the next shift (three shift operation). The package of commonly applied practices and tools included: Team coordinators; hourly output registrations; standard operating procedures; problem solving boards for tracking the status of identified problems; audits; meetings between supervisor, team coordinator and repair personnel; daily planning meetings between supervisor and planner; and weekly performance review meetings between factory manager and supervisor.

The project did not result in immediate output improvements – after the project period the supervisor was heavily engaged in motivating the area to make changes work and to benefit from the new systems. Eventually most small stoppages were removed and OEE increased from a pre-project level of 67% to 74% and change-over times decreased from 90 to 50 minutes. As a result, overwork was reduced and outsourced items had been brought back in to utilize the freed up capacity. Teams had become more autonomous and e.g. coordinated leave and holidays internally. In the interview the supervisor described the area as being in a state of continuous improvements – operators and problems had gotten a greater voice and priority and the supervisor’s yearly bonus was tied into a set of improvements – this set included the introduction of planned maintenance, and change over reduction from 50 to 45 minutes. This yearly cycle was
merged into programme terminology as these improvements were associated with a
"implementation plan #3".

Project B
The plant management initiated a locally driven project B immediately following the first
project. For this second project a change agent from the first project was acting as project
manager. This project took place in one of the machining areas – the next department in
the main value stream following the forging department. Some time into the analysis
phase the project scope was extended to run for eight months in order to simultaneously
address issues in a neighboring department. During the interviews it was unclear for the
surrounding organization what had been achieved during this period. Some of the
changes reported included a reduced batch size which was not welcome by the
employees as they saw the extra setups as waste – each setup occupied 6 man hours.
Also some FIFO lanes had been introduced to ensure a fixed processing order in the
department. This setup also introduced a simple planning rule in the forging department
where two orders for the same receiving machine-center were not supposed to be run in
parallel. These changes were still debated at the time of interview because occasionally
some centers were starved when intermediate processes for deburring were not manned
or when the sequencing of batches changed due to different routes through the surface
treatment department. According to the supervisor in area A the employees in this
department had not changed their attitudes and thinking to the same degree as he and
his people had. It appeared that issues brought up in this department were generally
being categorized as bickering or resistance. The project had attempted to introduce new
roles for the skilled staff. It was thought that the output and productivity of the department
could be raised if the skilled staff also undertook “production work” when no set-ups were
due. But this was met with resistance from the unskilled staff and union representative in
the area. They wanted the exclusive right to perform that kind of work. The factory
manager had chosen not to intervene in this debate and the change agent and the
supervisor had chosen to drop the issue. The change agent involved in the project
thought that 8 months had been too long a duration and that momentum had faded away.

Pilot project C
Approximately 6 months after the first corporate project in the factory had finished, a
second corporate project took place in part of the assembly area C – the project crossed
the span of control of two supervisors. Most of the assembly processes in this area were
automated with primarily feeding and surveillance tasks mixed with some manual work.
During the project, the layout was changed for multi machine handling. Machinery from a
small department was brought into two surrounding departments along with some of the operators. FIFO was implemented between equipment and machines were stabilized. At this stage of the programme, a set of commonly applied lean practices had been made a mandatory part of each pilot project.

Multi machine handling resulted in a pressed work situation when the different pieces of equipment needed attention at the same time. The workload was described as 30% higher – one factor contributing to this perception could be the entrance into the high season, another could be the fact that the new setup required a change in mindset. As the supervisor pointed out, the new setup required a different logic for operators. The operators had been used to aim at high utilization of the individual equipment but the new setup instead required an orientation towards the flow through the set of interdependent equipment. After the project finished, many of the initiatives were “trained” again – this tool training primarily consisted of a presentation of a lean tool, the reasons to use it, and discussions of questions or concerns. Several adjustments had been made to the systems, e.g. more relevant items had been added to an audit sheet used to evaluate the sustainability of new processes and the hourly targets had been reduced to have fewer occurrences of “red numbers” during the day. The change agent in the area described this process as “picking them up”, “they were lost on the floor”. The process involved weekly meetings between change agent, supervisor, shop steward and an invitation to some operators on a rotating basis as an opportunity to air frustrations. Not until a couple of months after the layout had been changed and the project finished did the employees begin to settle down with a new confidence in the setup.

Even though the first pilot project, A, created severe frustration among operators and supervisor it did not create so much attention in the organization. This was locally explained by the fact that area A was located furthest away from the office area whereas the second corporate project C took place right outside the office area. Furthermore some suggested that since project C involved women who may be more open in their reactions, frustrations were more evident. Thus the voice of resistance had increased while also the amount of staff becoming involved in the pilot projects and witnessing the resistance had increased. Although the operators primarily perceived the changes as rationalization, it appeared that the output had also begun to increase. The area was in a process of developing the team coordinator role and competencies in order to free up the supervisor for more developmental work. The problem solving process had experienced the first challenges as several suggestions stated by the employees required considerable resources. This had slowed down the implementation rate.
Additional initiatives and developments
Project C was led by a corporate project leader and it had been used as the final training ground for the local change agent (A) and a newly hired change agent (B). After this project these two change agents had been put in charge of two new, locally managed projects. The factory management did not foresee using corporate change agents for any remaining part of the road map implementation. Several new initiatives supporting the transformation were mentioned by the local human resource manager. E.g. together with the liaison committee she had arranged some basic lean training for employees as preparation for pilot projects. This was a reaction to the experience of the pilot period as very dense not leaving enough time to educate employees in the new thinking. Some debates on local values versus lean principles had also been planned for the management meetings. Many of the attempts to soften up tensions were engaged in by supervisors, the human resource manager, and change agents who all had direct contact to employees and witnessed the struggles they faced in coming to terms with the new approaches. Within the factory there was a shared perception that the production was well run and efficient. This perception of success was part of a line of resistance taking its departure in the constraints of the technical system and arguing that the system held no or only a small improvement potential. Also other lines of resistance were present, especially some bound in traditional union interests. Generally the shift that had begun to occur from job designs with a large portion of surveillance tasks towards an increased amount of manual labor was resisted. This shift was driven by two interests – one was to establish flow which required more change-overs, one was to increase productivity which required multi-machine handling. Neither of these interests was considered legitimate by the employees. These lines of resistance clashed with the plan for a speedy roll out of projects. This clash was described with a vocabulary referring to battles and power.

Transformation orientations
Factory manager
The projects and the approach taken within the projects had met considerable resistance in the organization. In spite of this, the factory manager had dedicated himself to the implementation process and the goal of establishing the future organizational principles. Some criticized the strong road map focus of the factory manager and thought that he was “too inspired by lean”. The factory manager experienced the organization as “heavy” to turn around and his role had been to stand firm regarding the new changes, even though he felt that he had been taken captive by the programme and had had to adopt an approach he did not agree with completely. "[the programme] is managed top down ... so we had to comply and have also started this top down approach [of pilot implementation]"
and put this TPM structure [based on employee initiatives] in the background”. It appears that during the first period of the implementation, the factory manager did not engage in dealing with resistance among employees, rather it was somewhat ignored. There was a discourse in the factory concerning this approach “you will just do it [end of discussion]”. The factory manager expressed dedication to the lean principles but had come to the realization that the principles did not have the same convincing effect on employees. E.g. he had introduced the employees to the roadmap in a canteen meeting but it appeared that he was not aware how little positive effect this had had among employees. Employees interviewed said that they had not been informed of anything. The factory manager had changed his perception of the goal of the programme as primarily productivity enhancement. The fact that the recent projects did not show any large productivity potential contributed towards this understanding. Instead, the aim of the roadmap would be to gradually exchange the MRP scheduling with FIFO control through the list of pilot projects lined out. The factory manager spoke of the “mental transformation” as only 25% finished and thought that once a pull-flow system was established, the new working mode would face much less resistance.

The local human resource manager thought that the factory manager was becoming more open to input and that supervisors were becoming less scared of giving input. Thus, it appeared that the factory manager had engaged in a more varied approach towards the management of the lean initiatives and was developing a broader understanding of levers to use in the transformation. This was reflected in his management approach towards supervisors. For instance review meetings with supervisors who had been engaged in pilot projects were on the one hand described as a simple lever to maintain behavior: “Just half a year ago – if I had stopped those meetings we would have landed back where we started within two days” but it appeared that the role of these meetings was changing: “We challenge each other and question the goals we have and try to to create a forum where we can exchange ideas”. The factory manager acknowledged the resistance among operators and some groups of staff and thought that new initiatives entailing more dialogue would provide “some glue” by aligning and clarifying views. A new initiative entailed discussions of how to merge local values with the ten organizational principles outlined by the programme.

**Change agent A**

At the time of the interview the change agent’s main focus was the pilot projects and the follow up performed to ensure that new practices were maintained. However, he acknowledged that the transition to lean entailed more than the tools implementation and that the process was highly dependent on work done by others than him: “If the
supervisor does not rise up and say this is what he wants ... we can just forget about it because he pays their salaries and he evaluates them”. He thought that employees in area A had been through a long mental journey – mainly driven by the supervisor but also supported by the follow ups in terms of audits and other reviews performed by the change agent and the factory manager. The changes in area A were characterized as: "we have gotten another attitude that, yes, we try to keep the area tidy, we fix the machines, I can hear something is wearing down let us react now ... so from being a place where no one wanted to work ... now they are more proud and they don’t just beat the stuff with a hammer as they did before"

Up to the point of interview the implementation process had faced a substantial amount of resistance and the change agent had found himself in several intense arguments where he had had to defend the lean principles and goals of the projects. “We performed audits, really kept them to the rules ...audits is just as much a way of showing an interest in the practices". The change agent expressed faith in the lean tools and faithfulness towards the pilot project concept: “We don’t discuss the time plan and whether it is a four or five months it is four months. We don’t debate over the use of the ten organizational principles”, “We performed audits, really kept them to the rules ... and the first four or five times there were tools missing and so on”

However, the change agent did question the approach he was introduced to in the corporate projects and had managed to create room for a more involving approach in the locally driven projects as a way of negotiating some of the driving principles. The change agent engaged actively in the change processes by trying to role model new behaviors and by showing interest and openness towards criticism and input. "People will willingly change but if you just disregard all that matters to them you don’t get far."

As a project manager he adopted the type of goal operationalization strived for within the programme in terms of gap analysis, action planning, and follow up. He expected that new lean challenges would follow the initial round of projects, among other things the challenge of engaging the support staff more in driving continuous improvement and problem solving.

Supervisor A

During the pilot project the supervisor had found himself torn between two roles – on the one hand he had to support the project and on the other hand he had to support and protect the employees. In the early phases of the implementation his colleagues made fun of him and the fact that his department had to put up with all the “young engineers running around” but the supervisor managed to make the best of the project.
It appears that he was good at reading the needs of the employees and showed faith in them by taking a more relaxed approach to the changes and standards introduced. He enjoyed delegating tasks to employees where possible and engaged them in a more fun improvement race as a way of translating and not only transferring the pressures he was subjected to for results and stable delivery. "it is not only the people who have to be completely overturned it is also me ... if I cannot change myself then you can't teach others to do it", "only they can make it [the productivity] increase I can't do it". The supervisor was proud of the improvements, the state of the area, and the competencies and dedication of his employees. He acknowledged that this state would not have been reached without the project, the attention it brought along, the weight of the analyses performed, and the investments undertaken. He also conveyed that area B needed to go a long way before they reached the level of dedication and improvement orientation present in his department.

The supervisor had not continued the project practice of using analyses to identify improvement potentials but he set concrete targets and followed up on them as he thought this was a motivating approach. Meanwhile frustrations about some problems with the FIFO system between departments were regularly aired but appeared not to be a topic for the problem solving processes. He talked of the phase the area was in as “now we just have improvements”. He shared this view with change agent A and the factory manager; they all talked of the transition as finished in area A. The supervisor did not have any vision of a differently looking area or added capabilities but he was open to new suggestions such as e.g. merging departments along the value stream. Preventive maintenance was on the agenda next.

**Team coordinator A:**

The team coordinator did not consider the role to entail any authority or control, he did not interfere in the jobs of his colleagues but trusted them to know what to do, and all equipment issues were discussed in the team. He saw his main role as that of filling out the paperwork, keeping track of various information, and taking initiative to deal with equipment issues. As no one else had been willing to take care of all this paperwork he had volunteered to the role even though he was one of the less experienced in the department.

The team coordinator avoided expressing any critique of the change process – it had been a tough period, and employees did not think highly of the changes, the time studies and the complex papers they had to fill. But they managed to get through the period without the stress they saw in the subsequent projects. "well, we chose not to take notice of all of it ... let them mind their businesses we said".
The improved change-over time was mainly seen as a matter of employees running a bit faster admittedly combined with an improved work sequence. Recently another information board had been added in the department to display the scheduled change-overs and the planned durations. The team coordinator expressed that this board had not been installed to help them; it was unnecessary, mainly helping those passing through the department to read the status. However, they had gotten quite an amount of repair out of the whole project participation and had also worked with a number of equipment improvements themselves afterwards. He found it more rewarding to work in the department after it had been realized that the forging processes constituted the bottleneck of the production.

The team coordinator expressed that little by little the various things fell into place and some things had also been taken off the agenda again. He described the phase the area was in as "pure maintenance [off machines?]" and some repairs and equipment updates were on the agenda. The problem solving board had gotten the status of a "repair board" displaying all the necessary repairs and was not used for other kinds of problems such e.g. problems in the FIFO system between departments or suggestions for more efficient paperwork – "we don’t concentrate on that, those things that are running". Ideally though, they would skip some of the paperwork and registrations. They would also like to see investments in a new forging machine with higher capacity and some robots for deburring rather than the present instable deburring equipment that took up a lot of their time for frequent adjustments. Employing more people for the area was also mentioned as a potential improvement.

**Supervisor C**

The supervisor of one of the assembly areas involved in the second corporate pilot project (C) thought that the area had been too efficient to allow for any radical improvements. Financially he did not see the benefits from the project. The number of employees in the area was reduced by 1½ men out of 13. Compared to the cost of running the project the project was estimated to have a pay back time of three to four years which was not seen to be in concordance with the strain the change process put on the people in the area. He sincerely hoped that the choice of project area was grounded on some strategic motives. He resented the approach taken to carry out the changes and regretted the consequences the project had had for his staff. He described the layout change as a “slaughter”, “the ripping apart of a department” and at the time of the interview the supervisor’s goal was to establish “peace and quiet” in the department. Generally he acted according to the expected principles and tried to practice the new approaches. “earlier ... we would also stab a bit in the dark [in regards to problem solving]"
and there we now take greater care, that now there has to be data to back it up to be absolutely sure”. He acknowledged that both he and the employees had learned from the project; the employees had become better at dealing with issues occurring during operations, and the employees had a bigger role in problem solving in terms of bringing up problems and receiving information on the implementation process. The new layout and flow processing was demanding for the employees as they had to develop a new understanding of how best to operate: “they had to be reprogrammed from being used to operate with a high output on some machines to operate a flow”, “rather than feeling safe close to a pile [of products] they had to see the interrelationships in the flow”.

Together with the local change agent B, he had initiated that some of the implemented elements were softened up or adjusted after the project had finished. The area had reached a state where the supervisor could leave more responsibility to the team coordinators. But the area had also run into a deadlock where tough-to-solve problems blocked the flow in the problem solving process. The supervisor hoped that these problems would be solved soon and thereby clear the way for more throughput in the process again. He hoped that this would eventually have effects such that “everybody can feel the effect that when suggestions are put forward it is taken care of ... the tough message though is that it has to be things we can handle ourselves ... so it is still the low hanging fruits that we actually have picked a couple of times”.

Except for these improvements, the supervisor did not foresee any larger changes or improvements and expressed that the area mainly needed peace and quiet to settle with the new systems.

Change agent B
Change agent B was mainly looking ahead to the next projects and challenges. The challenge in project area C was to keep building up the team coordinator role. But the main challenge of the transformation process was to spread out the tools and techniques to more staff and operators, this diffusion should facilitate acceptance of the new ways. Furthermore the role of the pilot projects was to stabilize processes which should make the FIFO system feasible.

Operator C
An operator from area C expressed that the area had taken part in several three letter initiatives during her employment but the latest initiative was not the most welcome. The employees had played a different role in the TPM project that had run in the past. Now the area was settling in and the changes were no longer felt as unfair. But the change process was seen as very unfortunate – partly because experiences were not used to
alter the sequence of the overall project. The operators had, without effect, pointed out that the equipment needed to be stabilized before it was brought together in a cell to minimize operator stress. The problem solving process was perceived to concern technical issues only and the department had no influence on the amount of resources they would get for the problem solving. The auditing had become a ritual with routine answers and did not help the employees in any way. New production targets would be set for their department but they had no influence on the target setting and no levers to use to improve performance. The operator did show some excitement about the possibility to engage in changing the work procedures and learn new skills. Together with the change agent she had come up with a suggestion of how to improve the refilling of all the stations on the automated equipment so that they would only have to go one complete round every hour rather than having to run every time a station was running out of parts. But her colleagues thought that approach was ridiculous. She was interested in learning new skills e.g. small repairs that would make her more autonomous in her work but again she was not sure this would be possible due to the attitudes of her colleagues.

Supervisor D
The supervisor of the machining area taking part in the next pilot project run by change agent A. He said that he wanted to stay in control over the project even though he thought that it was hard to make objections within this organization as one risked being criticized and labeled as negative.

He said that it had been unbearable to see so many get ill from the projects. He agreed with employees that all the manual registrations the projects established would interfere with their production work and thought that registrations should be performed electronically.

He thought that due to the high volumes they had always run lean and optimized every bit possible. The area performed with an average OEE of 83%. The only option he saw for cutting costs in his area was through further investments in new machinery. The department operated cam controlled mills and according to the supervisor it was difficult to find skilled personnel interested in this kind of machinery – as he said the younger generations were only interested in CNC and not in the mechanical controls that would get you oil and chips on your fingers. In spite of this difficulty he would like to exchange the unskilled operators with skilled personnel to reduce down time on machines.

He thought that the area had gone as far with work standardization as they could – all details regarding the tools to use and the settings to apply had been laid out but he was against formalization: “it is crazy we are not standard people”. The employees could perform the change-over in any sequence they thought fit and some would manage within
three hours while others could not manage in less than 24 hours. Setting up the machines was a matter of craft skills that could not be codified and not be trained for those who did not possess the right sensitivity.

**Operator D**
An operator from the machining area expressed that the aim of the projects was mainly rationalization. He felt that the projects did not care about employees’ wellbeing or safety. Neither was he convinced that the improvements they saw reported in the company newspaper were true. He was unaware that they had managed to reduce the change over time in the forging department by almost 50% but when this was confirmed by a colleague from the tool shop taking part in the interview, he was impressed. He did not see the benefit of more frequent change overs. He thought that the type of planning where he had to spend several hours setting up for another product only to reverse the setup a couple of days later was a waste of his efforts. “*then they say – but you are here anyways, it is as if you are not allowed to have 5 minutes to sit down and think if you are an employee*”

**HR manager**
The local human resource manager was not impressed with the approach to teaching taken within the projects. She had tried to offer her assistance for developing better training material but this had been declined - it appeared that the project managers did not have any time or focus to spare on this suggestion. Together with the liaison committee she had suggested to hire some external trainers to perform some basic lean training as preparation for the pilot projects. Furthermore self management and cooperation had been prioritized as important employee competences to strengthen. Lately she had experienced a more open attitude towards discussing transformation goals and means in the organization. She saw the new initiatives as a response to the resistance and thought that the approach was undergoing a form of continuous improvement that would eventually result in more buy-in from operators.

**Reflections based on the Beta case**

**The transformation challenge**
The implementation plan identified the future state of the factory shop floor as a factory that had been covered by pilot projects and that had exchanged the MRP scheduling approach with a pull system. As explained by change agent B, the purpose of the pilot projects was to establish reliable processes which would facilitate the introduction of FIFO or other pull systems throughout the plant.
Contrary to the factory manager in the Gamma case, the factory manager in the Beta case engaged in many activities directed at implementing these new systems. The factory manager’s initial experience with the pilot projects was that of resistance. He had had to stand firm to ensure that new practices were adhered to. It had taken a lot of time and effort to embed the new behaviors. Along with the supervisor and the change agent he shared the perception that area A had been through a transformation. In the words of the change agent, the employees in area A had eventually developed a new attitude towards their work and had taken more pride in it.

The factory manager’s hope was that once the pull system had been established the visibility in the production planning and control would facilitate the final mental transformation. As explained by the factory manager this mental transformation had not occurred at the time of the interviews and this was the cause of the resistance felt in the factory. So the lean transformation was envisioned as a transformation that would lead operators to accept working with lean practices and facilitate supportive behaviors and attitudes. As such, no new employee competences or organizational capabilities were evident in the factory manager’s vision of the transformation.

In Factory Gamma, proactivity among supervisors and team skills among operators were identified as relevant competences to establish in order to drive the development of a continuous improvement environment forward. In Factory Beta, only the human resource manager had identified new operator competencies relevant for the transformation process. Specifically she focused on self management and cooperation. It appeared that these competences would re-establish some degree of autonomy and independence that the new tools invading the operators’ work-sphere had taken from them. The first initiatives she had engaged in however, focused on lean tools training for employees.

The supervisor in area C mentioned that the new systems required employees to eventually adopt a different systems perspective; they could no longer maximize the output of just one machine but had to take the interconnectedness of several machines into account. He also hoped that the area would develop capabilities to deal with more problems.

From these different accounts, it appears that some thoughts about the transformation goal were shared within some parts of the organization while other objectives were mentioned as private considerations.

Dilution and transformation
The changes in the factory were gaining momentum in several aspects – more resources were being employed to drive change, more projects were being run, more people were
being involved in the changes. For each new project being run, yet another supervisor was being included in a weekly performance review meeting with the factory manager, change agents and on occasion also the logistics and the production technique department heads. The road map lined out some of this and was used as a reporting tool between factory manager and the operations manager of the business unit. As such the road map worked as a driver of the implementation process and the expansion of the transformation process.

At the same time, some aspects worked to slow down, dilute, or transform the transformation process. There was a shared perception among the local change agents and management that the locally driven projects should follow the time schedule for corporate pilot projects but be less intense by aiming at fewer changes and allocate more time for involvement and commitment. Only few resources were being put into the continued transformation process in area A where the supervisor was left on his own to address the issue of planned or preventive maintenance. In area C the problem solving process also experienced the consequences of lacking resources. These issues illustrate that while the implementation via pilot projects was accelerating, the depth of the transformation and the continuation from the pilot projects may have been suffering.

Another aspect working against the accelerated momentum was employee resistance. While the implementation process involved an increasing amount of the organization, the image of the pilot projects may have suffered from the increased visibility of employee reactions and frustration. According to the supervisor from area C, the recent pilot project may have signaled that employees were expected to work harder rather than being leveraged with new investments and clever systems. Also employees from other departments expressed that they did not perceive the projects to show consideration for employees’ wellbeing.

It appears that some of the aspects working against the implementation had resulted in a spur of new communicative and interpretive initiatives stemming from staff in close contact with operators. These new initiatives that popped up to support the change process were especially aimed at reducing frustrations and some concerned the approach taken in the implementation process. The human resource manager described it as an example of continuous improvements of the process. This revision of the process and the added communicative initiatives may have been just as important as the plans outlined in the road map.
Developing new visions

Also the transformation vision was undergoing some changes; the factory manager had changed his perception of productivity as the main goal and thought that the establishment of a flow environment was an objective that carried a more convincing argument. However, the transformation vision did not entail added manufacturing capabilities, strategic advantages, organizational capabilities, or employee competences. Some of these aspects would perhaps emerge through the new communicative initiatives engaged in.

Several issues mentioned during the interviews pointed out that the visions mainly related to practice adherence and technical problem solving. Such narrowly defined vision may limit the scope of the transformation process and cause engineering resources to be a bottleneck. For instance, the continuous improvement phase following the project periods used to reestablish motivation and reduce frustration were either allowed to have or restricted to have a narrow focus on technical improvements which among other things excluded competences from the spotlight.

In area C the problem solving process had been slowed down by some initiatives that required engineering resources. This was de-motivating for operators and supervisors. They felt that they had already worked with most of the smaller initiatives that they could implement on their own. Yet it was paradoxial that a suggestion brought up by a colleague for a new refilling procedure was ridiculed by other colleagues in the area. This attitude to learning and development was not identified as a transformation target. It appears however, that changing this attitude could provide a way to broaden and speed up the continuous improvement process and make it less dependent on engineering resource availability.

In area A the skilled employees were able to manage several of the improvement suggestions on their own. As such engineering resources did not appear to constrain the problem solving process. But preventive maintenance had been identified as the next challenge for the area and it appeared that without engineering resources the area would not go very far with this improvement initiative. Regardless the extent to which engineering resource availability constrained the improvement process, a broader focus exceeding the technical repair issues might facilitate a broader transformation process.

The narrow focus left the area with some unresolved issues. Registration routines that were felt to be time consuming and also some reoccurring issues with a FIFO system resulting in bickering between departments could potentially be addressed as issues in a continuous improvement process – not only improving the technical system but also improving the organization’s ability to improve on a wider set of aspects.
However, from the interviews it appeared that some of the systems implemented by the programme were perceived as "no gos" – employees did not experience that they were allowed to alter them. It may be sensible to stick to new procedures even when they clash with old values and norms but it could be argued that in this case, the approach supported the narrow technical focus as it only left the production processes for the employees to work with. This approach would be in line with the traditional mass production perspective and fail to support a shift towards variability reduction in a flow perspective.

An extension of the transformation vision might facilitate the supervisors in addressing some issues frustrating their employees; help the organization develop new capabilities; and lead to more focus on employee competences. Such developments might lead to a more smooth transformation process. But it appears that more than smoothing could be needed. Several interviewees expressed a view, that only investments and more resources could improve the output. In the presentation here, this line is exemplified by the supervisor of one of the machining areas. For his area with cam controlled mills, he denied that codification and increased focus on sharing knowledge could reduce the huge variation in change-over time from employee to employee. It appears that such line of reasoning took its starting point in local experiences – an inwards orientation that does not appear to build on benchmark studies of other companies’ practices. If strategic considerations were included in the transformation vision, perhaps this could be the driver towards a more external orientation.

All in all it may be argued that not only the transformation approach but also the transformation vision could be extended beyond the implementation plan outlined by the programme in order to support the establishment of lean production and continuous improvement capabilities. That is, the vision could be extended to also incorporate future state goals for competences, organizational capabilities, manufacturing capabilities and strategic advantages.
**Factory Alfa (V2)**

The factory Alfa factory produces mechanical flow devices in the small range as well as in the medium-large range with two separate operations teams managing the two areas. The production contains a machining area, mainly producing components for the small range, an assembly area for the small range devices consisting of an assembly line as well as independent assembly tasks, a smaller machining area, and a bulk assembly area.

The factory had participated in the corporate programme early in programme life. The project had primarily taken place in the machining area feeding assembly of the small devices. During the corporately driven pilot project, A, the project team had performed some analyses of the machining area as well as the assembly line. Based on these analyses, the scope of project A had been limited to the machining area. The local organization then took charge of designing and implementing a new future state in the assembly area, B. A young change agent reporting to the factory manager had participated in the first pilot project and later he had driven a pilot project, C, in the bulk assembly area.

Since the first project, the factory had experienced many organizational changes and also many quality and delivery problems. The factory had only recently begun to recover from these problems at the time of the interview. It was not apparent what had initiated the quality problems. The moving of the old equipment in the machining department, employee resistance, new material handling etc. were all seen as drivers of the problems. These quality issues were mentioned as the main focus of the factory and SPC and inspection initiatives were being investigated. Recently worker flexibility between departments had come into focus. It appeared that the corporate productivity measure based on finished goods rather than produced parts were one of the drivers behind this.

The factory manager did not foresee that the factory would need anymore pilot projects but he would like to engage the central programme in some kaizen events as this was seen as a way of creating focus and energy. Recently the change agent had quit for another job – his implementation experience was in demand at the time. A new change agent had been hired into the factory and was participating in a pilot project in a sister organization to learn about the tools and implementation approach. Eventually the factory would become less dependent on the programme for local kaizen events.

**Project A**

The area was producing machined parts for the two assembly areas. 27 employees worked in the area distributed over three shifts. There were many dedicated machines with no change-overs and most equipment was fully depreciated. Before the pilot project,
the area had used large batch sizes and MRP scheduling of individual machines. Daily planning of operations had taken up a considerable amount of supervisor attention and yet the period was characterized by several interviewees as always behind – always missing one component and yet having 15000 on stock of other components. The operators had an average seniority of somewhere between 15 and 20 years. Since each operator only used to work at one or two machines, they had acquired considerable knowledge about these machines and operated them quite autonomously, e.g. they performed change-overs and minor repair work by themselves.

During the project, the layout was changed for multi machine handling and shortened material flow. This required that all machines were relocated. Kanban and water spiders were introduced to control material flow. Order sizes were reduced. Operator roles were changed from specialized to flexible by installing multi machine handling and by incorporating production work into jobs formerly consisting of machine monitoring. At the same time the operator role was stripped of peripheral tasks such as material handling, set ups, and collaboration with repair crew. To accommodate for the reduced output rate per machine due to multi machine handling, the shift structure was changed from two large and one small shift into three equally sized shifts. The pilot project team was manned with 1-2 external consultants, four candidates training to become the first corporate pilot project leaders, and also local staff participated in the project either as team members or as suppliers of data. Therefore the project managed to complete these changes within two weeks after the new future state had been proposed and the design finalized.

The team coordinator role was introduced even though the positions were open for months as no one wanted to take on the new role. Some employees had had a proactive role in the department before when a lot of daily scheduling was required but the team coordinator role was eventually taken on by some other employees - one similar proactive and another less visible, as described by the supervisor. Hourly registrations were introduced late in the project period and it required a lot of attention from the supervisor to ensure that output was actually registered. New performance reports between supervisor and operations manager were introduced and gave much more detailed information about the weekly performance and activities than had been reported earlier. The support staff in the factory adopted an 8 week action plan format to keep track of larger development tasks.

The changes in the operator role along with the physical changes created a lot of frustration among operators. There were no longer room for personal items in the layout and operators had become tied to the area with no reason to leave their machines except for breaks. Team autonomy over the daily planning had been substituted with more
standardized and formalized procedures. The changes in shift structure required that people who had chosen to work on the night shift had to enter the day/evening shift rotation scheme. For two operators, this brought back some mental problems and resulted in long term sick leave. Other substitutions in the organization were introduced: Some employees were shifted around in the factory, a new supervisor was hired ½ a year after project finish, and a new operations manager for the area was hired from outside the company after App. 1½ years. The factory had expected to enter the low season after the project but instead sales boomed which may have resulted in extra run-in problems for the multi machine handling routines that had been introduced. The group that had been instructed to incorporate some manual work in their jobs was arguing hard that there was no room for this manual content if machines were to be attended to properly. The work was designed to consist of 15 minutes of manual work, then a tour of half an hour to monitor machines, and then back to the manual work. But as some employees put it: “machines can break down two minutes after you attended to them, they don’t wait ... or when you come back you have to sort scrap from 45 minutes worth of parts”. At the time of the interview, two years from project finish, there were still different opinions on this in the factory. Some felt that things had settled in after a run-in period of 3-4 months following the project period. The new operations manager thought that only after he had lowered the targets to something achievable had the productivity reached a stable level and begun to steadily increase. And some operators were still trying to show how a different work mode would yield a higher throughput. In spite of some negative attitudes among employees, some aspects were welcomed: The area was more clean and organized, the right parts were almost always at hand, and there was no bickering about which parts or machines should take priority. The former supervisor in the area stated that operators had become more critical regarding machine stability – they did not accept to operate machines that were too unstable. Productivity had increased and daily planning took up much less time.

**Project B**

The analyses conducted during pilot project A resulted in a second project. Initially the project team on pilot project A had analyzed both the machining department and the automated assembly line. The potentials identified had been presented at the business unit level and it had been decided that the pilot project should focus on the machining area since this area fed the assembly area and it was thought that improvements in that area would benefit both areas. Furthermore it was decided that the local organization would implement the changes suggested in the assembly area.
Some weeks after the analyses had been presented by the pilot project staff, the supervisor of the assembly area, a production technology engineer, and a project manager met privately during some holidays to start the design of the future state assembly line. The idea was to break up a semi automated assembly line that was very long and contained 9 workplaces with highly repetitive tasks. According to the interviewees, project B was organized as a technology project rather than a typical pilot project. The technological changes were implemented within three weeks of closure during the summer. The winter and spring was spent on planning the changes and on fine-tuning the design by inviting selected employees to take part in simulating the new design with a table-setup in a meeting room. This simulation was also used to get the design approved by the company’s occupational health service. Preparation also included incorporating advice from the external consultancy company that was supervising the pilot project. The result was a cell layout that allowed for a one piece flow. This was achieved by breaking up the line into smaller lines each of which had a manual station placed in the same cell. Operators would walk the cell in a rabbit chase carrying a product from station to station. Later in the process the performance management system used in other pilot projects were also introduced to this area along with the team coordinator role. The team coordinator role had lifted a lot of coordination from the supervisor who no longer received calls in the middle of the night from the night shift.

Initially the occupational health service did not welcome the idea of the setup but eventually the prolonged work cycle and the change from sitting to walking were seen as weighing the strain from carrying the ½kg products by hand and the amount of walking included in the new jobs. These latter two aspects were seen as a matter of training. Some employees were not interested in the new job design and were terminated.

For some time, this project was promoted widely within the factory and the company as an example of the achievements a local organization could harvest using lean principles. Even though project B had been driven as a technology project, is was equated to a pilot project in the factory. The project may be considered one of the local variants of the pilot project approach.

Project C

A third project in the factory incorporating parts of the pilot project tool box was run by the local change agent who had participated in pilot project A. The manual assembly area involved was part of a value stream producing more heavy equipment in smaller volumes, with only 9 employees. The area included several different cells – cells for the main assembly, cells for subassemblies, tests, and packaging. It had been important for the change agent to adjust the pilot project approach he had witnessed. Also the employees
in the area had agreed and stated that a different approach should be taken – they wanted more influence on the decisions. Apart from the increased employee participation, the project also distinguished itself from other programme projects by focusing on customer needs and material planning and control. Customer expectations had been moving towards shorter lead time and this was taken as the starting point for the project.

Parts storage had been moved into the production area and set up so that picking for a product could proceed in a straight line along the racks. Picking still took up some time and was conducted for four products at a time. But rather than using batch production with four similar products, picking was conducted for four different products in the same go. Similar to the project in area B, this project also only incorporated a select set of the standard tools and formalization approaches used in the corporate programme. The set included written SOPs, an orderliness audit, team boards, the team coordinator role, skill matrices, and weekly performance measurements and reports. The area did not use hourly registrations, problem solving boards, or action plans.

During the past ½ year, the area had been consumed by quality and delivery problems. It was not clear exactly why these quality problems had arisen. But all staff was involved in fighting them – the supervisor thought that later that spring, they would get a rest and be able to dig deeper into the underlying causes. The area had some minor improvement tasks to complete such as getting written SOPs for all workplaces, shifting from having a label stock to label printing per order, cross training more employees, achieving a higher score on the local orderliness audit. The goal was to eventually reduce the promised lead time from 5 to 3 days but no specific plans had been laid out for this.

Additional initiatives and developments

Even though the area was old, with old equipment, high seniority, and products in the mature part of the life cycle the area came across as dynamic. Especially in area AB, the support team with a seniority between 2 and 5 years talked of themselves as dynamic, solution oriented, and busy. But even on the shop floor in the machining area where average seniority was somewhere between 15 and 20 years, stagnation had not settled in. The support team was in a learning process developing interactions and processes and improving a bit here and there. But in the middle of all this learning the support staff was swamped in firefighting and many different improvement initiatives. It appeared that in spite of the use of 8 weeks action plans in team AB, it was difficult for the staff to leverage performance and stability. Problems were popping up many places in the production and initiatives and learning took place many places in the organization. It appeared that many of these learnings and initiatives were attempted diffused to all parts of the factory. E.g. increased focus on cross training and reduced frequency of follow up
meetings was seen in all areas. This diffusion put extra strain on the staff to continuously change work procedures. The organization had managed to escape backlogs and low productivity but was still busy, struggling with the remaining problems and it appeared that only small steps of progress were felt.

**Individual orientations**

**Factory manager**

The factory manager as well as the former supervisor of area A told amusing stories about the operation approach before the pilot projects where they had been buried in piles of work in progress. It appeared that the factory manager had accepted many of the ideas laid out by the programme. He used the audit system provided by the programme and also invited the programme managers to perform audits in his area as a way to steer the direction of new initiatives. He mentioned several improvement areas – they had focused on material planning and control and on reducing the lead times so that production could be driven by need rather than parts availability. He thought that since only smaller production areas had been left untouched by pilot-like projects the factory did not need more pilot projects but rather kaizen events. In the future some departments could be linked in a flow but presently machine reliability and quality did not allow for this. In fact inspection between departments was being planned as a means of isolating the semi automated assembly cell from disturbances and quality problems. He felt that the organization lacked some analytical competences. Their knowledge was still too shallow and therefore he would also postpone potential outsourcing. He thought that moving towards continuous improvements – away from firefighting was the biggest challenge for the area. But the use of action plans was an attempt to work more structured and focused.

**Operations manager, area A+B:**

The operations manager for the value stream in which project areas A and B were located had only recently been hired. Even though his product line was subject to low margins, he felt that the threat of competitors and the motivation to become lean was not so high in the company. Yet, he acknowledged that there was an improvement potential. E.g. he thought that project A had caused considerable turbulence in the factory and created some conflicts that the supervisors tended to cover rather than solve.

He had worked with lean in another company before and thought that top-down programmes were not necessary to develop operations – this was a task of the local management. He would like supervisors to become more active in continuous improvements and take on a new role – therefore he did not want to run more projects in
the area at the time even though he assessed that the area lacked knowledge to go much further. He felt that more employees could be involved much more in the improvement work and found it problematic that area B had become so trimmed that operators were not participating in continuous improvements of the area. He had been the driving force behind lowering production targets following 1½ year of “red numbers” on the hourly registration board. Similarly he had prioritized to take out one hour of production time for scheduled weekly maintenance.

The operations manager had engaged in a range of initiatives to establish a smoother production and to ensure development. He wanted to improve the lean performance of the area but not necessarily following the programme recipe.

Supervisor A1:

The supervisor who had taken part in the pilot project A had changed position within the factory half a year after the project had finished. At the time of the interview, he was managing the maintenance department. He was interviewed due to his extensive knowledge of the pilot project. His commitment to lean principles illustrates how lean had diffused into the surrounding organization.

During the time as supervisor for the pilot area he had been focused on sustaining new practices and implementing corrective actions and bring about change on several levels. He had taken time to explain the principles over and over to help employees transform. In the new job as manager of the maintenance department he was focused on creating lasting improvements in terms of machine up time and reliability. He still worked along lean principles and appears to have adopted parts of the philosophy. New initiatives in the maintenance department were based on pareto analyses of breakdowns. More extensive initiatives were operationalized into 8 week action plans that formed the basis of managerial reviews upwards in the organization. The results of daily activities were reviewed in daily meetings between team coordinators and supervisors in the various areas drawing on the maintenance department.

"there is always going to be a bar on the graph that is the biggest one and that is the one we will pursue - for the next ten years - and for some of them we come to realize that there is no way around changing the machine layout".

Supervisor A2:

A new supervisor had been employed for pilot area A half a year after the pilot project had finished. When the new operations manager arrived a year or so later, the supervisor had not participated in any lean training but at the time of the interview there were plans for him to follow another pilot project in a neighboring factory as a mean of gaining some
insight in the principles behind the practices implemented in area A. During the interview the interviewer’s impression was resistance – the supervisor appeared quite aggressive and was reverting some of the implemented changes. Revisiting the interview later it appeared that the supervisor had been highly concerned about the impact the project had had on his employees and it appeared that their experiences was his main input for the job. Some of the changes the supervisor had conducted included: Making sure that the planner did not short-cut the kanban system with rush orders, agreeing with operators that hourly registrations were not useful and throwing the hourly registrations in the trash can every morning, cancelling the daily follow up meetings in the area, and changing the productivity measure back from piece per man-hour to some previously used measure (most likely an efficiency measure in terms of produced labor hour per actual labor hour). Except for the measures taken ensure adherence to the kanban system, it is not clear that such changes were constructive and would add to the performance and continuous improvement in the area. But the supervisor was concerned with creating trust and showing the operators that he had faith in them and their competences. He hoped that by creating room for them, they would take relevant initiatives on their own. The area had gone through an organizational development initiative called “welfare seminar” organized by the company psychologist to improve the climate in the area. The supervisor thought that these initiatives were beginning to pay off; employees were more committed to their work, the area implemented two improvements per week, and improvements had begun to last in the sense that the same problems no longer reoccurred as previously. The operator initiative mentioned during the interview included technical improvements, cleaning, and design of check sheets. The supervisor was not against lean as such and thought initiatives would continue but the pilot project had resulted in some unfortunate conditions that needed to be adjusted. Also problems with repetitive work were in focus. The type of resistance displayed by the supervisor is seen as unconstructive even though he thought that it had some positive effects on the operators’ attitudes. It took its starting point in the statements by operators and did not try to lift the perspective to a level where more constructive adjustments could be made. That is, attempts to revert the negative impact of the pilot project implied reversion of the systems and the development of new, internal subsystems rather than improving implemented systems and employees’ interaction with these systems.
**Team coordinator A:**

Similar to the supervisor (A2) in the area, the team coordinator interviewed gave a first hand impression to the interviewer of resistance. She worked in the part of the machining area where manual work had been incorporated into the machine monitoring work. Supervisor A1 characterized this sub-area as the most problematic since operators were still trying to prove that the new work structure was not feasible.

She had taken part in reverting some changes. E.g. for some parts they ran larger batches than what was specified by the kanban. The operators in the area had taken out the manual work from the monitoring role and took care of this in a separate time slot. In a run-in period of three months they had proven that this was a feasible way of operating while still meeting productivity targets. These changes to the planning and scheduling system implied that they needed more information than what was provided to them by the kanban system, they needed an overview of the orders for the entire week in order to prioritize their work. The team coordinator had introduced some other registrations that displayed the progress according to the weekly targets for various products rather than only according to the hourly targets. It appeared that this was a better input for their internal coordination than the hourly issues. This appears to have been the kind of information and planning challenge they had been used to before the pilot project.

The team coordinator mentioned several reasons for these changes. First of all the operators were concerned with managing operations in the way they perceived best, with lowest operator stress, lowest amount of scrap, and best machine up time. The new set up where multi machine handling incorporated three rather than two machines was criticized for the resulting straining repetitive work. With the new levels of repetitive work, operators had to rotate every two hours rather than every four hours as previously to avoid injuries. Also the new flexible operator role was seen as taking away dedication and feelings of ownership among colleagues resulting in poor machine reliability and larger drift before corrective actions were undertaken.

The hourly production targets were seen as unrealistic as only the best operators could meet them – and only by working very focused for the entire 60 minutes of the hour. The operators thought that the targets should be feasible for less productive workers too and that personal time should be allowed for in the targets. The hourly registrations were seen as pointless and time-consuming – the team coordinator felt that there would always be a sound reason for being behind schedule, e.g. change over, lack of materials, or no
orders. She felt that it should be feasible to collect output registrations electronically and would like to see them displayed on screens at the machines.

The team coordinator said that they had now gotten used to the smaller order sizes and some of the other changes even though this had caused considerable frustration during the pilot project. Also the kanban system was seen as providing a good overview and control of part of the production tasks. And the grouping of CNC machines in one area was welcomed. In fact, the team coordinator emphasized that several of the operator initiatives and improvements belonged to the CNC team – a way of setting them apart from other groups in the machining area.

The team felt that they had been taken as hostages in the change process. They had thought that if the new layout did not work out, things would be reverted. They felt that the changes had been proven not to work and were disappointed that the system remained. It appears that they felt they had no voice. Without such voice and perhaps also lacking competences, the surrounding organization and systems could not be engaged in a constructive way. It appeared that the team coordinator was lashing out after anything associated with the project without eyes for positive effects of the introduced systems. On the other hand, she and the team felt quite competent in their dealing with machine issues – their system. It appears that the team coordinator was not against the use of productivity targets, ongoing measurement of production outcome and follow up, or operator driven continuous improvements. But she thought that the changes should have followed their logic and taken their values and work conditions more into account and she was working against the changes for the same reasons. That is, this line of apparent resistance contained some positive aspects and the team coordinator expressed great concern for colleagues as well as production outcome.

**Supervisor B:**

The supervisor of the area involved in the locally driven technology project was proud of the approach taken in and the results of this project. He felt that the project demonstrated that the local organization could avoid some of the weak points he had identified in the pilot project approach in area A. He felt that the project had become much better from spending ½ a year on planning and integrating operator ideas. Participation was used by the supervisor as a sales strategy – "*you participated in the design [process] your selves [now you have to accept the result]*". But the technological changes were primarily designed by him and some colleagues without any initial input from employees.
Serious delivery issues and too many questions from management had almost resulted in long term sickness but he had managed to change his circumstances. His main focus was the development of the team coordinator role. His visions for the next years included more autonomy and more engaged employees. He had recently participated in an auditing session where a senior consultant from the programme had visited the area and given some advice for improvements of the performance management system. He felt that such input would be sufficient to drive the development forward. The supervisor was proud to announce that the area followed the design laid out by the programme and told an anecdote to illustrate how transparent the area had become: A member of the executive committee and some of his guests had been given a tour in the factory by the factory manager and when they reached the team boards the executive had taken over and explained the system and the status to the guests.

The projects were seen as the main step towards lean. Further challenges primarily lay in creating more autonomy and commitment. But the supervisor did not see the need or pressure for new changes of the same order. While initiatives were taken to develop the autonomy of the area and especially the team coordinators’ competencies it appeared that other opportunities for development were not engaged in. Problem solving was mainly focused on reaching or maintaining output levels and in fact other interviewees stated that the area was run so tight that the employees had no time to think about and participate in problem solving.

Team coordinator B:
The team coordinator of the day shift had worked in the area for 30 years. Initially she had objected to the idea of changing from sitting to walking but it had turned out that her back pain had diminished following the change. She was quite enthusiastic about the change – it was the best system she had worked under, the supervisor was the best she had seen so far, and the new layout had brought the work team closer together physically as well as socially. She thought that following the changes the support organization had put bigger emphasis on dealing quickly with technical problems. Earlier, problems and improvement ideas had piled up. In her job as team coordinator she was very concerned with meeting production targets. A few of her colleagues thought that they did not have to have “green numbers” all the time, but she felt that red numbers were disturbing and unsatisfying. It appeared that she was quite confident about her role, she had no problems coordinating the work and telling others what to do – it was necessary that
someone took charge and she had more experience and a good overview. She took great care to make sure that new employees were well trained. At the time of the interview the team had been allowed to screen candidates by observing them for a couple of rounds inside the cell to see how they used their hands and if they could follow a fixed work rhythm. She was in the process of teaching her colleagues one by one how to do setups on a machine. Such increased autonomy was welcome as it enabled the area to go ahead with the tasks without having to wait for other resources. She had not been informed about any upcoming changes and did not know if any changes were going to happen in the area within the next years. She could not identify any learnings from the change and did not appear interested in any further development. She had asked the supervisor to be given leave from participation in daily problem solving meetings as the discussions focused on machines and things she had no input to. She preferred to work in the cell to get the job done.

**Supervisor C:**
The supervisor in area C had shifted job within the factory and started as a supervisor shortly after the project in area C had finished. At the time of the interview he had worked in the area for ½ a year.

The supervisor showed high trust in the operators and gave them considerable latitude. E.g. the SOPs did not include a time standard – he thought that perhaps they would in the future but he did not expect everyone to work in the same speed or sequence. The operators organized overtime on their own – their responsibility was to produce quality products and meet the deadlines. The operators were working to standardize their work benches but were not expected to switch to a floating setup without individual work areas. Operators could look some days ahead on the order list to see if they could combine orders to complete more of the same kind in the same go as long as it did not jeopardize delivery service. The supervisor was not aware of any requirements or goals regarding the use of hourly registrations but referred the interviewer to the operations team manager regarding such issues. The supervisor did not expect the employees to play a big role in continuous improvements – if they had any suggestions they would bring them forward but most improvements would be dependent on the mechanical engineers that had to alter the design of the products.

He had a pragmatic approach to lean – the practices adopted had to make sense according to the set of values they worked by in the area. Some goals had been setup
for the area including the use of some lean tools and principles. But the supervisor did not appear to perceive these goals as something that would change the area or the performance substantially.

**Team coordinator C**
The team coordinator in the area felt that they as operators had been quite involved in shaping the new systems. Some ideas had met resistance – e.g. the switch from batch production to order production. But according to the team coordinator the opposition had faded once people had gotten used to the idea – it had just been a matter of being too focused on the existing solutions. He felt that the area had coped better with the changes and acted more as a team than what he witnessed in the other value stream. Even though the supervisor had taken part in the project, the operators had had the main dialogues with the change agent of the project. The new layout provided a better overview and had streamlined the material routing. The work had not necessarily become easier but new challenges were in focus now as the short lead time demanded quick coordination. He was not sure that productivity had risen but delivery performance had improved. The team coordinator appeared to take ownership for the development goals of the area, e.g. "we wanted to reduce the delivery time – we knew it was a request from the customer". He was interested in continuing the work rather than viewing the change as a one time project. He felt that the area should work more with team building in order to engage better in problem solving. He also thought that they ought to start prioritizing and allocate time for improvements but the area had been busy for the past couple of months. In the long run however he thought that "it is a question whether we can afford not to do this [taking time out for improvements]". Even though the team coordinator may not have had knowledge of other lean tools and practices to draw on he was one of the few interviewees who foresaw global effects of improving / not improving fast enough.

**Input form other staff:**
The planner for area A and B felt that the pilot project in area A had been very time consuming. The support team had experienced a tough time but managed to support each other and had come out on the other side in a good manner and functioned good as a team. The planner felt she had learned a lot from the pilot project and the work they had done afterwards. In the beginning she had had difficulties adjusting to the idea of smaller orders. She thought that more improvements towards lean would be implemented
as the project participation had shown the team new ways of thinking. For her own work she foresaw that all material flow would become controlled by kanban. At the time of the interview she had a challenge of trying to adjust the kanban system to match changes in product mix but she missed some of the knowledge and inputs that the former change agent could give. And she thought that it was difficult to set aside time for improvements in a busy daily schedule. To free up some time she was trying to hand over some work to the water spiders.

**Reflections based on the Alfa case**

The factory hosted some approaches to the new systems quite different from what was found in the other factories visited: Operators in area A who were trying to prove the programme wrong by redesigning the planning and scheduling system; A supervisor in area A who was working against implemented changes; A team coordinator in area C who was more dedicated to continuous improvements than the supervisor in the area and who had visions of increased employee involvement in improvements; A team coordinator in area B who had no vision of future improvements and who prioritized manual work over problem solving meetings; A supervisor in area B who had had a large role in designing future state layout of a line; and A factory manager applying goal operationalization and used action plans in his interaction with direct reports.

The factory manager displayed an extensive knowledge of lean tools and described future improvements in lean terms. Kaizen projects and the establishment of deeper analytical skills along with the use of SPC were stated to be present and future challenges to address. The factory manager consulted senior consultants of the programme for input on ways to strengthen the lean systems. This approach is seen as more analytical than the use of the traditional 5% annual improvement rate applied in Factory Beta after the project period.

The factory had finished its first major round of lean tools implementation but several things were not diffused beyond area A. Hourly registrations were not used in area C, operator involvement in problem solving was not diffused to area B nor C, the coercive approach from project A was softened or abandoned for project B and C, use of tact time was not diffused to area C. This selective diffusion may be seen as the result of local learnings about what worked and what did not which resulted in the more pragmatic approach to lean implementation. But several of the principles that were not diffused might also be seen as part of the continuous improvements engine in a lean setting. The employees in area A did not see any value in registering problems on an hourly basis.
This is one indicator that the tools implemented in the pilot were not seen as templates for improvements. As such, the first round of implementation did not provide a full platform of formalization, performance measurement and feedback, and problem solving.

The projects did trigger a lot of quality problems leading to a series of technical improvements. It appears that the changes may have pushed the production processes out of a fragile balance. And it appears that the area was struggling to establish the organizational capabilities that eventually would lift the daily operations out of the fire fighting mode. These organizational capabilities were, unlike the approach taken in Factory Gamma, targeted through the use of lean tools and practices: Using action plans, engaging in SPC, preventive maintenance and problem solving. But perhaps the organization was in need of some complementary resources that could help the organization move forward.

The staff in the support team felt that with the new organization that had resulted, they were ready to move forward. The staff struggled to find time for development tasks and felt they needed the input from the former change agent. Meanwhile, a new change agent was in the process of getting acquainted with the pilot project approach and tools. With the managerial attention on adding new lean tools, it appeared likely that the organization would continue working with lean techniques.

Like Factory Beta, Factory Alfa had been marked by employee resistance. Waves had risen so high that several organizational changes had been triggered. However, in area A a negative attitude towards the implemented practices had also been adopted by the new supervisor. Such issues may be just as important to address as it appears that this resistance affected the entire organization.

The local organization had adopted other approaches to the locally driven projects. This may be a constructive development of the transformation approach, but the more pragmatic line adopted may also signal that the organization is reluctant to engage in a transformation of some core beliefs. E.g. it is paradoxical that both in area C as well as in area A, employees (as well as the supervisor of area C) did not believe in standardized cycle times – they thought that production speed was individual. In area B in contrast, employees were given the chance to screen candidates to test if they could work at the right speed and maintain a steady rhythm.

**Summary**

Within this summary, research questions No. 2 and 3 will be addressed:

2. **What are the local unit’s challenges in receiving, operating and developing the lean systems implemented?**
3. **How do local activities and initiatives contribute to establishing a transformation towards lean and continuous improvements based on pilot projects and related programme activities?**

The interview round included some pilot projects that had been completed recently. Within these areas some of the challenges the local units face in receiving the pilot projects are particular evident and many of the initiatives engaged in by the local units relate to these challenges.

In Factory Gamma, the supervisor in area B was heavily involved in finishing the last changes, in making the new systems work, and in creating an orientation towards quick action that was needed in order to deal with the employee suggestions and problems that continuously arose. Also in Factory Beta the recent project C had resulted in a spur of initiatives and such increased activity was also evident in the stories from projects A in Factory Beta and Alfa.

The local organizations’ challenges related to receiving and operating new lean systems are reflected in the number of activities engaged in locally as a response to the pilot projects. Some of the initiatives are related to system maintenance but a considerable share of the initiatives appears to be aimed at making daily operations work under the new systems. Many of the initiatives were aimed at softening the effects of the pilot projects and cleanse the air for residual strain and frustration. It is clear that high levels of frustration or tension are not sustainable for the organization. Within the three factories, the initial spur of initiatives following a pilot project mainly fell in three different categories:

- Initiatives aimed at explaining the new procedures and making sure that new practices were adhered to / adopted.
- Initiatives aimed at recreating a balance in the area:
  - Either by adjusting procedures, e.g. relaxing the hourly targets (e.g. project C in Factory Beta and project A in Factory Alfa)
  - And/Or by releasing internal tensions through e.g. team building (e.g. project A and B in Factory Alfa)
  - And/Or by building new team capabilities such as conflict handling (project A in Factory Gamma) and employee competences such as self management and interpersonal skills (potential issues identified by the HRM manager for project C in Factory Beta).
Struggles to maintain a flow in the problem solving process when new employee suggestions and problems raised were hard to solve or overloaded the same resources.

It is clear from these examples, that the local experiences with the pilot projects and programme tools convinced local management of the need for additional initiatives beyond the pilot project implementation and the audit tools used for practice maintenance. Local initiatives and activities engaged in, as reactions to pilot projects, affect the transformation process by normalizing and restoring the organization so that the implementation process can continue in other parts of the organization. Activities engaged in to this end supplement the programme activities by being different from programme activities, by not being programmed but in stead primarily origin from staff in close contact with the pilot area – as responses to the area’s response.

Projects that do not lead to considerable amounts of frustration do not take up the same amount of attention and after a run-in period it appears that the systems become a part of the status quo and no longer foster increased awareness or require new capabilities. This normalization also appears to happen in most of the pilot areas where projects were followed by intense periods of activities pertaining to operator issues with the new systems. These periods with increased activity were described in past tense which indicates that the operation of the new systems could become part of a normal daily practice aimed at smooth operation rather than being aimed at continued transformation. Activities aimed at normalizing a pilot area make the operation of new systems digestible to the area and it appears that this may eventually be adopted as the goal of the transformation process.

At the time of the interview, several projects had been finished for more than 1½ years. In Factory Beta, project A had required considerably attention from the local change agent and the factory manager to ensure practice maintenance, and it had required considerable effort from the supervisor to motivate the employees to make the systems work and reach the output targets. These efforts were described in past tense – the transformation had occurred. The area was ready to take on new challenges, but only few resources was dedicated to this. It appeared that as long as there were new pilot projects to undertake, these projects would attract considerable attention and resources and to some degree starve the continuous improvement processes in the former pilot areas. In Factory Gamma, project A had required relatively less attention due to operator frustration. But project maturity did not appear to foster increased capabilities for
continuous improvements; on the contrary, the newly finished projects spurred much more activity and adjustments to new practices.

These two examples indicate that pilot project areas attract less and less attention as they mature, so over time, the challenges involved in receiving and operating the new lean systems may diminish. It also illustrates that the issue of further developing the lean systems implemented is in conflict with the issue of hosting new pilot projects and receiving and operating new systems as these latter aspects attract more attention and resources.

In Factory Gamma however, it appeared that the managers had come to the realization that more changes were required in area A in order to result in a transformation and foster additional continuous improvement capabilities.

In Factory Alfa, project area A was still marked by frustration directed against the implemented systems. These issues however, were no longer paid the same amount of attention as new pilot projects received. It that sense, the area was not ready to take on new challenges and the operators were not ready to accommodate any more change. The two other project areas in Factory Alfa were not marked by the same problems. These projects had been undertaken by local staff and had been engaged in from a pragmatic stance. The organization was continuously adding more of the tools and practices that had not been implemented in the first round of projects. As long as there were still tools to add, this process of adding might be considered to extend the transformation process.

In Factory Beta the transformation process had undergone a development as more communicative initiatives were being added to supplement the implementation projects.

All three organizations adopted and developed ideas for further transformation goals that differed from programme goals and ideas about the effective and transformed organization. The local visions included different, select parts of the programme vision and also exceeded the ideas addressed within the programme. Factory managers may take initiatives to drive the transformation further – through the establishment of local change agent resources, through additional implementation efforts or through communicative initiatives and dialogues. These initiatives may, in part, be shaped by diverse local interpretations of the transformation process and goal. It appeared that the local visions had not been developed to an extent where active transformation
management could be engaged in and many different opportunities for strengthening the organizations’ capabilities for reducing variability and undertaking continuous improvements were not addressed.

In the next chapter it will be explored how local interpretations play a vital role in shaping the effects of the programme and pilot projects.

In Chapter 6 the issue of normalizing will be explored. This will further elaborate how the local approach to dealing with the challenge of receiving a pilot project can affect the continued transformation process.
5. Models driving change

Individual transformation attitudes and orientations
This section focuses on individual perceptions of the transformation content and goal. In the section, some dimensions for an evaluation of the local impact of the programme and the pilot projects are presented. These dimensions were initially developed in order to assess the transformation success within different units interviewed. They are presented here to further elaborate on models of the transformation content, process and goal towards lean – both models held by interviewees as well as models held by the researcher.

Expected transformation mechanisms
Based on the programme approach to lean implementation some mechanisms through which the pilot projects could operate to drive continuous improvements forward were evident.

The implementation approach utilized by the case company relied on trained project managers and meticulously designed projects to establish a set of tools and practices focusing on increased stability and productivity, especially through the application of formalization such as work procedures and hourly registration of outputs. A whole package of interdependent practices is implemented within a time span so short that it could be considered as one discrete implementation of a whole system. Adler (Adler 1999a) finds that formalization may drive the hypothesis testing described by (Spear & Bowen 1999) by stating planned production output targets based on expected cycle times and registering any deviations from plan along with the drivers for this deviation. Thus supporting practices with practices it appears that the project should ensure the bean sprout effect described by (Shah & Ward 2003) such that the practice density may ensure better results.

During the projects, team coordinators were appointed to a role designed, in part, to monitor the compliance with these standards so as to minimize operator driven deviations. The team coordinator role may furthermore facilitate quick coordination and
problem registration. Shift meetings and shop floor problem solving practices may work to facilitate the soliciting of employee input.

In combination, the implemented systems should ensure that tight specification and measurements should reveal problems. The new team structure should facilitate actions to solve these problems, to improve processes, and to embed these improvements in updated standards. The application of lean tools and techniques such as cell layout, balancing, standard operating procedures, hourly targets and output registrations should ensure that data on the problems could be captured and analyzed.

These systems are local or internal to the pilot area and may drive continuous improvements primarily within the project areas but perhaps also reveal problem areas outside the pilot area. This would be one way through which lean could diffuse and develop by driving lean analysis and application in problem areas outside as well as inside the pilot area.

Other, perhaps secondary effects of the pilot projects could be expected. The knowledge on lean tools and the current state analyses brought to the factories by the project managers could create awareness of improvement potentials and methods. Such awareness could convert into actions to pursue this potential. The roadmaps outline such potentials on a high level based on input from the corporate senior consultants, but additional potentials may be identified for more discrete interventions.

Initially the interviews were engaged in with such ideas of potential, quite mechanical pilot effects. During the interviews however, these ideas clashed with the ideas presented by the interviewees. In the previous chapter it is outlined how the three case factories invest substantial amounts of effort in the three challenges of establishing lean tools, lean principles, and complementary resources needed for the transformation process. The chapter also outlines that less effort is put into achieving competitive manufacturing capabilities through the lean transformation, and the achievement of strategic advantages through lean are hardly strived for at all within the three case factories. An analysis of the initiatives engaged in within each case factory is presented in Appendix A to substantiate this further.

Based on this experience, expectations concerning the continuous transformation process towards lean and continuous improvements were further developed. As such, the following section presents some of the researcher’s expectations to the mechanisms that the pilot project should trigger in order to establish a continuous transformation process.
Testing these expectations against interview data has been a means for exploring the issue of transformation efforts stopping short of strategic benefits and competitive manufacturing capabilities.

**Transformation orientation**

A transformation process that is initiated by but also stretches beyond basic lean tools implementation could be expected to be dependent upon a notion among organizational members of being involved in a transformation process. Such shared notion should facilitate the establishment of development processes to support and drive such transformation. During the initial interview round however, such shared notion of a transformation process was not present in all interviews. Comparing literature on lean with interview data, it appears that an orientation towards a lean transformation process should in particular entail the perception that:

— pilot projects were only one step in a series of steps towards lean.
— all parts of the daily operation of production could be addressed in such a wider transformation process.

These two aspects are further detailed in the following.

**Project thinking versus lean development**

One overall distinction that appeared relevant in the analysis of individual perceptions of the transformation process was the distinction between expressions describing the transformation process as having finished along with the implementation efforts and expressions describing the transformation process as an envisioned journey. These two classes are further outlined as:

— There were some who expressed that as the pilot project had been completed, lean had been implemented. Therefore the organization should just continue its daily business within the new frames. This is termed “project thinking”. Some interviewees expressed a view that other things were on the agenda now. They did not express that the project was a step on a journey or anticipate that they would be responsible for or participate in significant changes – except for maybe copying the project to other areas or revisiting their area some time in the future. Among those who expressed that the lean transitioning had been completed, some focused more on dealing with technical problems in the production system and some focused more on dealing with skills issues among their subordinates on an ongoing basis.

— There were some who expressed, that the transformation towards lean should continue and eventually also result in different mindsets, skills, and interaction among people. Some were focused on the dynamics of the entire organization while others
were more focused on individual competencies. Some transformation ideas were expressed as visions while others were outlined as goals of current activities. This forms the basis for a scale between two extremes: *Project thinking* versus *lean development*. If the lean transitioning is perceived as finished at the time of the project completion, the motivation to engage in further change and learning activities aimed at establishing higher levels of lean performance, practice, or tool usage may be low. Inspiration for further elaboration of this aspect has been drawn from Silvester et al (Silvester, Anderson, & Patterson 1999) who analyze the effects of a culture change program through the attributions employees make regarding the cause and outcomes of change initiatives. These attributions are categorized along four dimensions:

- Stable and enduring or unstable and temporary cause or pressure for change
- Global and company wide or local and specific effects of change
- Internal or external causes or reasons for change
- Controllable on the level of own/group influence or uncontrollable outcomes.

*Project thinking* is thought to reflect a perception of the pressure and need for change as temporary and unstable and the effects as primarily local. In addition, the cause or need for change may be seen as external to the pilot area but internal to the company which allows for it to be considered temporary – lasting only during the project period.

The *lean development* perspective, on the other hand, is thought to reflect a perception that there is a large potential in working more with lean. It is thought that the need for further development of lean capabilities is motivated by a perception of the pressure as enduring, effects as global, causes as external e.g. market driven, and outcomes as controllable and within reach.

The positions in-between these extremes may differ along these attributions as outlined in the following 4 positions:

0. No new goals, no need for change. New working conditions and frames have been setup, the area needs peace after project termination. The pressure for change was semi external – external to the pilot area but internal to the company.

1. Temporary needs for change and improvements of the production system arise during normal operations occur in terms of problems and deviations from status quo. Specific/local effects. Internal causes.

2. A stable need for gradual development of competences and skills. E.g. the need to engage further with some smaller set of lean tools and practices. Other projects in other areas are prioritized in terms of improvement resources and seen as drivers of change.
3. Some vision of and initiatives towards an improved future state incorporating and strengthening lean tools, practices, performance, or manufacturing capabilities. The need is arising out of external factors such as market requirements and developments among peers. The potential effects are global and affecting the interaction with customers and suppliers.

These attributions may be formed through many different channels. For the individual pilot project there may be a trade off between establishing an orientation towards a wider transformation and maintaining the focus on the specific project.

**System-individual interaction**

In the attempt to characterize the challenges of the transformation process a cognitive aspect thought to be equally relevant although also entangled with the project thinking vs. lean development orientation is the individual’s perception of the system they work in/with. Some interviewees expressed to feel subjected to a system they could not influence while others saw the technical and/or human system as within their control and yet others saw the organization as a complex, dynamic system which may not be directly controllable but which holds many levers and many options.

Expressions that contain a lot of frustration and attempts to lash out on and fight the new conditions in a more random manner are thought to stem from the lack of a system perspective. The reactions appear to reflect a sense of being submerged into / surrounded by a system which one cannot analyze or control. Without some model of the organization it is difficult to react in a constructive way either within the new conditions or in the constructive creation of alternative conditions. With such limited level of system-control, only the personal response to new conditions can be controlled.

The individual level of direct control over the system may also be limited for individuals perceiving the system, which they are part of, as complex and dynamic. However, such perspective allows for a more constructive interaction with a dynamic system rather than the static iteration of action-reaction with a system one is opposing. In Social Cognitive Theory (Wood & Bandura 1989), an induced perception of the environment as uncontrollable is associated with low managerial performance while complexity is not associated with any managerial performance differences. It appeared from the interviews that a perception of the system as complex and dynamic also allowed for the feeling or perception of challenge, opportunities, and vision.

In between these opposing system perspectives were perspectives characterizing the organization or the production system as relatively simple and stable. These perspectives
were combined with the perception of mastery over this stable system. It appeared that this perspective was based on a distinction between a system under control and the control system which the interviewee was part of. This perspective appeared to restrict any visionary outlook such that envisioned future changes would not entail changes to the control system. Such perception of control over a relatively simple system may interact with a perception of the effects of the pilot projects as localized: Pilot projects concern the system mastered but do not concern the control system / the individual himself. This is considered to represent a form of externalization that constructs the transformation as localized and finished. Such position may challenge the development of lean capabilities as far as also individual and group behaviors, perceptions, and interactions would need to undergo qualitative transforming.

Inspired by a system of systems (Boulding 1956), the system perspectives are ordered based on increased levels of complexity and capacity for information handling as:

1. Zero perspective, being surrounded by systems with no option for constructive interaction
2. Competency – mastering a relatively stable technical or structural system
3. Competency – slowly developing the human system
4. Fluency – interacting with a dynamic system with multiple levers

Within the framework of transformational leadership, attraction and transformation is related to the ability to “exchange figure with ground” such that what was previously perceived as the ground becomes the center of attention. This implies that the scrutiny of underlying assumptions and embedded behaviors may form the basis for development in new areas. (Avolio, Bass, & Jung 1999; Avolio & Bass 2004)

It is thought that also the pilot projects could have a role in shifting individual system perspectives. If pilot projects have shaped or confirmed a perception that employees do not have any voice in the shaping of the circumstances of their work, the project is thought to have had a demobilizing effect. A cognitive mobilization, on the contrary, should raise the awareness of improvement potentials and levers to work with.

It appeared, that the mastery perspective of slowly developing a simple and stable system was quite common among staff. It is thought that when such perspective is combined with project thinking, the pilot project has not resulted in a mobilization. If the pilot projects or other programme activities have not led to any questions pertaining to the effects of the behaviors, thoughts, and values present within the organization and the individual, the basis for a transformation of these aspects may not have been established. There is no need for the individual or the organization to address underlying assumptions and behaviors if the transformation is perceived mainly to concern the structural aspects.
of a technical system. It is thought that without such awareness, an improvement culture which differentiates itself from the existing culture will not be established. The outlined scales therefore form the basis of a normative evaluation of the factory transformation challenges on the level of its members.

**Managerial action orientation and control systems**

To categorize different managerial approaches to planned action, two dimensions are suggested: *Initiative competency* and *goal operationalization*.

**Goal operationalization**

Operationalization of goals relates to the planning and managing for some specific outcome. Levels of goal operationalization are outlined based on the tendency to form hypotheses of how to realize a vision possibly by operationalizing the vision into concrete targets and action plans and follow up to ensure the realization of the vision. In cybernetics these principles form the core of control systems (Flamholtz, Das, & Tsui 1985). The application of formalized control systems reflect a principle applied in the change programme: Identification of “current states” and “future states” and the operationalization of the transitioning between states in detailed action plans and the managerial reviews of actions, plans, and results. This principle is applied in the pilot project approach and is promoted as one of ten organizational principles outlining the future characteristics and principles of the manufacturing organization. Also the principle is related to an integrated part of lean: The rigorous challenging and quest for learning described by (Spear & Bowen 1999) and (Liker & Morgan 2006) as the application of the plan-do-check-act cycle which requires codification via process description, standardization, and adherence. So while the tendency to not link visions with concrete action plans could perhaps be related to a more advanced organizational ontology, it appears not to reflect the highest level of transformation drive towards lean within the programme settings. The following scale is setup to characterize managerial approaches along these lines:

1. **No targets and visions**
2. **Operationalization of vision into targets**
3. **Targets based on analysis of improvement potential, operationalization of transition into action plan**
4. **Managerial review and follow up on action plan and results**
**Initiative competency**

Initiative competency relates to a slightly different aspect of action and improvement orientation. The operationalization of visions into concrete targets and action steps describes the cogency of the pursuit of goals, but such degree of operationalization may only be relevant for some organizational initiatives. Other initiatives of a more sporadic nature could supplement or feed into such stringent pursuit of identified targets. According to Sitkin et al. (Sitkin, Sutcliffe, & Schroeder 1994) the cybernetic control approach may only bring about first order learning and not engage the organization in search and second order learning. Within the programme, goal operationalization is applied to goals that have been identified through expert analyses of current states and application of known techniques for the design of a future state. Not all initiatives may be initiated and directly translated into future states and transitioning plans. The transformation process should entail considerable learning and search for new possibilities.

Among the different organizations interviewed some appeared to have a higher capacity for identifying potential improvement areas and engaging in actions to bring about change while some appeared to engage in a joint blindness or passiveness towards certain kinds of improvement potentials – either ignoring certain potentials or ignoring options for action. Not all improvement potentials may be readily achievable for the organization but this characterization focuses on areas where options for action appeared to be within the range of the organization. Such initiative competency could bring about improvements on its own or it could be needed to feed visions into the goal operationalization process. The positions outlined for this scale are:

0. Problems and potentials overlooked
1. Options for action overlooked or deferred due to perceived lack of needed resources, Options for action postponed due to other priorities
2. Actions engaged in for reestablishment of status quo
3. Actions engaged in to ensure learning and development

**Mapping**

Based on interview data, a set of individual interviewees from each pilot project area have been attempted mapped according to dimensions described in the previous sections. This mapping is presented in Appendix A. It was mainly achieved by listening to the audio files or reading transcriptions from the interviews, taking notes for parts that conveyed attitudes, ideas, and actions related to development of operations. These mappings are summarized in radar diagrams depicted in Figure 13.
As described in the previous section, each dimension in the diagram is tentatively ordered in a way perceived to reflect an increasing transformation drive or competence. In this ordering inspiration is taken from the working principles of the change programme which is a normative approach.

![Figure 13 Transformation orientations found among interviewees from the three case factories](image)

As shown in the diagram depicted in Figure 13, the interview data indicated that while the programme is somewhat successful in establishing a transformation orientation, it is less successful in establishing new behaviors directed against creating continuous improvements through adoption of the lean principle of goal operationalization and initiative competency to address opportunities for variability reduction.

Grouping respondents according to the positions they occupy, as seen in Figure 14, some differences among the group of factory managers, supervisors, and employees are evident. Factory managers are more oriented towards discussing a wider transformation while supervisors are more prone to position the pilot projects as finished implementation projects and distinguish between development projects and daily operations. The group of team coordinators and operators is the most diverse. The factory managers do not stand
out as distinct from other respondents in regards to adopting the programme ideal of goal operationalization and displaying broad initiative competencies.

Factory managers represent the link between the factory and the surrounding organization; as such they are responsible for demonstrating change readiness and being alert to trends in the organization. Supervisors on the contrary primarily have responsibilities in regards to daily operations, meeting budgets and ensuring delivery and the wellbeing of employees. These different interests and responsibilities manifest themselves in the top part of Figure 14 which demonstrates a schism between higher ranking managers’ orientation towards development and lower ranking managers’ orientation towards making daily operations work. Although the perspectives represented by the interviewed supervisors do not appear to support a transformation orientation, these different voices and perspectives may be important to solicit in a transformation process designed by consultants and corporate change experts. It may be that by being concerned with daily operations, supervisors play an important role in the sustained transformation. Yet, as outlined in the previous chapter, the approaches adopted to
normalizing project areas for daily operations tend to reduce activity levels and narrow the
continued development into the narrowed focus of technical problems only.

Cross case comparison of transformation process models

Structural differences and similarities
The sampling of factories and pilot project areas to include in the exploratory case studies
evolved based on the interviews performed in Factory Beta. Certain structural differences
were expected to affect the local approach and experiences and some of these structural
differences will be revisited in the following. The purpose of this is to illustrate how
diverse settings and experiences influence local interpretations of the lean transformation
challenge.

Coverage
At the time of the interview, Factory Beta was engaged in several projects and still had
some ahead. A large part of the organization had not been involved yet, as the
organization was not structured in operations teams that could be involved in the projects.
In stead, different members from the various functions were being involved for the
different projects. The main focus was on finishing the projects as a way to facilitate and
realize the transition towards pull. Some efforts were put into preparing employees for the
dense project period by means of some up front lean tools training. Also the projects
were attempted made more digestible. The focus on continuation of the transformation
was smaller. The narrow scope of the continuous improvements was not challenged and
the areas experienced a lack of engineering resources.
Factory Gamma had only been involved in two projects and considerable parts of the
production area had not been involved yet. This lay in the future. Some initiatives were
engaged in to prepare other areas for future pilots. And perhaps because of the small
coverage it was felt that the projects should be supplemented by other initiatives to
constitute a transformation.
Factory Alfa had undertaken three lean projects, involved both operations teams, and
covered most of the production. To the factory manager, the transitioning was more or
less complete. The continuation would entail diffusion of more programme tools and more
lean techniques, possibly organized as kaizen events.
It appears, that the attention shifts as a function of the coverage / state of
implementation. But the various structural differences affect the transformation approach
in combination. This will be further elaborated in the following sections.
Experiences with employee frustration

Factory Alfa and Beta had both experienced high levels of employee frustration as reactions to the pilot projects and the implemented systems. In Factory Alfa, this appears to have led to a more pragmatic and holistic approach adopted for the locally organized projects. The local diffusion of programme tools was selective and neither the local project approach nor the implemented systems appeared to have clashed with common operator interests. In area B, employees had been given the opportunity to give suggestions for the design of the new system and subsequently they were given the choice to either quit or adopt the new practices. In area C the team coordinator explained the initial hesitations among some of his colleagues as a matter of being used to one system and getting used to another. To him, customer needs were more important than old habits. Within the factory, organizational restructuring was a means for creating unified operational teams. It appeared that the selective diffusion would continue – programme input and needs arising during operations would be the driver of this. The continued transformation was not directed against key beliefs held in the organization; it was directed against discrete improvements. Experiences with frustration or resistance could perhaps lie behind this approach. This selective approach may have been adopted so as to avoid further clashes with existing values. Furthermore, the continued experience of resistance and frustration aired among a group of operators and former colleagues in area A may have formed a perception of the transformation as completed within the remaining organization; they were not complaining. Within the operations teams and among some operators, a reorientation towards smaller order sizes, TPM, and SPC had taken place and this may have been perceived as the objective of the transformation.

In Factory Beta, experiences with employee frustration appeared to affect the further approach in a range of ways. The locally organized projects were designed to be smaller in scope, they were aimed at creating less drastic changes and thereby allow for more attention to be dedicated to each element of the change. Regarding the content of the transformation however, critique and neglect was met with a firm and persistent line laid out by the factory manager and the change agent. These firm lines may have delayed dialogues and any adjustments based on feedback from the supervisors. However, the resulting tension may eventually have led to a much more open atmosphere when it was realized that such tension would not be sustainable.

In Factory Gamma the project had been received in a different atmosphere and not resulted in the same experiences with employee frustration. The organization had successfully supplemented pilot projects with communicative initiatives. It appeared that
the managers remained convinced that the pilot projects were good tools for restructuring and improving processes on top of which additional development work could be built.

**Table 7** Different experiences with employee reactions and frustrations may lead to different views of the transformation process.

<table>
<thead>
<tr>
<th>Case:</th>
<th>Alfa</th>
<th>Beta</th>
<th>Gamma</th>
</tr>
</thead>
</table>
| Experiences of frustration among employees: | Pilot A: Considerable frustration, continued years after the project.  
Pilot B and C: Insignificant level of frustration directed against project and systems | Pilot A: Considerable frustration, overcome  
Pilot B and C: Considerable frustration, being addressed | Pilot A: Insignificant level of frustration directed against project  
Pilot B: Some frustration especially directed against the organization of the layout changes |
| Envisioned transformation process: | Continuously implement some new techniques, avoid upsetting employees | Implement new systems through pilot projects, upset employees, overcome frustration | Engage in the transformation through pilot projects and find new ways of adding capabilities |

In Table 7 it is outlined how different experiences with operator resistance or frustration could lie behind the different visions of the transformation process adopted within the three factories. Frustration and resistance may be very strongly felt in organizations and it appears that this resistance may be interpreted as a lacking accept/ transformation: When employees accept new work modes and systems, their frustration will diminish. In Factory Beta, the goal of the lean implementation process was to establish a new system that was accepted; therefore the turn from resistance to accept was seen as the core of the transformation. In Factory Alfa, new systems were attempted implemented without upsetting employees such that accept and system change can occur at the same time which was important because gradual system change was at the core of this transformation model. In Factory Gamma, only little frustration was experienced and the transformation process was envisioned as something over and above structural changes.

**The use of locally organized pilot projects**

In contrast to the two other factories, Factory Gamma had not engaged in locally driven pilot projects at the time of the interview. The organization was awaiting the return of their former change agent from a trainee period within the programme and it was awaiting the programme for additional pilot projects. The managers did engage in the diffusion of
the team structure but they were reluctant to engage in diffusion and implementation of
 techniques requiring significant amounts of analyses. The initiatives were more
 communicative and the vision related more to individual competences than visions
 described in other factories. Without engineering analysis and implementation as main
 driver of change, it appeared that change was more difficult to engage in and many
 aspects were identified as stumbling stones or hindrances for further change.
 Factory Beta had increased its capacity to undertake locally organized pilot projects and
 the main objective stated, was that of completing the implementation, engaging all parts
 of the organization in the new practices, stabilizing processes, and implementing a flow
 system with reduced lead times. The recent openness and engagement in dialogues was
 merged with the implementation orientation as both dialogues and pilot projects were
 seen as levers directed against obtaining acceptance for new, flow-oriented practices.
 Factory Alfa had undertaken two locally organized projects emulating parts of the
 programme toolbox. At the time of the interview, the organization was lacking resources
 for additional implementation. Given the relative success of the local projects building on
 a more selective approach and allowing more time for local considerations in the project
 schedules, it appeared that additional initiatives would build on that model. New tools and
 analyses would be engaged in when relevant in relation to operational problems.
 Implementation would take place as kaizen projects that would not interrupt practices to
 the same extent as pilot projects.

In Table 8 it is outlined how different approaches to roadmap implementation may affect
 how closely the organization’s lean model mirrors that of the programme. In Factory Beta,
 local change agents who had experienced corporately driven pilot projects were put in
 charge of mirroring this format in locally driven projects. Thereby action and
 implementation attracted considerable attention and the change agents may have played
 a central role in shaping the implementation in close correspondence with the programme
 model. In Factory Gamma in contrast, managers were envisioning a transformation that
 was not only driven through implementation. It appears that they were forced to search
 for other transformation models since they did not have the change agent resources to
 emulate the programme model and drive implementation. In Factory Alfa, local projects
 were initiated before the term was invented as part of the roadmap concept in the
 programme. The first local project was engaged in as a technology project aimed at
 changing the layout rather than the information and management system. The local
 projects in Factory Alfa were aimed at leveraging manufacturing capabilities and in part
 had a strategic aim. So although the factory did possess change agent resources to
 undertake implementation, this did not result in close emulation of the programme model.
Table 8 Different mix of local and corporately managed projects and change agents may affect lead to different views of the lean transformation challenges.

<table>
<thead>
<tr>
<th>Case:</th>
<th>Alfa</th>
<th>Beta</th>
<th>Gamma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of centrally and locally organized projects</td>
<td>Pilot A: Corporate Pilot B: Local Pilot C: Local</td>
<td>Pilot A: Corporate Pilot B: Local Pilot C: Corporate Pilot D: Local</td>
<td>Pilot A: Corporate Pilot B: Corporate No local change agent involved</td>
</tr>
<tr>
<td>Lean transformation model:</td>
<td>Lean model exceeding that of the programme. Striving for closer correspondence w programme model.</td>
<td>Close correspondence with lean model promoted by programme</td>
<td>Inspired by but not in close correspondence with programme model</td>
</tr>
</tbody>
</table>

Lean transformation models in use

In Figure 15 the lean models found to be in use in the three case factories are depicted. It appears from the interviews that in Factory Alfa, lean was primarily seen as techniques and practices which could add manufacturing capabilities and leverage strategic benefits. In contrary to some of the perspectives held in Factory Beta, adopting the new systems was a matter of "getting used to" rather than transforming. A lean mindset was therefore not seen as a prerequisite for added manufacturing capabilities, but a supplement to the benefits achieved through lean tools adoption. At the time of the interview, the factory was engaged in adopting more of the programme tools as a way to engage more with lean organizational principles and capabilities. This perspective does not promote lean mindset as a catalyst, yet it allows for more elements in the lean model than traditional technique models.

In Factory Beta, the acceptance of lean principles was seen as the precondition for the lean tools to function. In addition there was a growing awareness that this accept was not automatically achieved through tools implementation, more communicative initiatives and dialogues were required. This is depicted as a dotted line around complementary resources – the organization was trying to establish the glue that would hold the elements of the transformation together. The initial strong focus on tools implementation appears to exemplify the warning found in literature on lean, that means such as tools implementation and practice maintenance may be mistaken for goals and it appears that
employees react very strongly to this approach as they do not see the value in these tools. In Factory Gamma, the main focus was not on establishing manufacturing capabilities. Instead, the programme was seen as an opportunity to develop a more well-functioning organization. Without change agents to drive implementation, and with a growing awareness (a suggested aspect of project age and low lean-activity levels) that the platform implemented during the pilot project had to be supplemented with individual competencies and organizational capabilities, the main focus was on the lack of complementary resources needed to engage the organization in the pursuit of these aspects. This model does not resemble any of the lean perspectives presented in the amalgam of lean models developed based on the review of lean literature presented in Chapter 1. These models were all concerned with how to establish increased manufacturing capabilities and not with organizational development inspired by lean. This exemplifies how the local adaptation of lean can manifest itself at the conceptual level.

Table 7, Table 8, and Figure 15 demonstrate that the lean models and transformation models in use within the various factories differ considerably. It is clear from these different models in use, that the programme had not established a common transformation vision shared across all units. There appears to be a certain consensus that the programme tools must be implemented across all manufacturing units, but the perception of these tools and the role they play differ between different factories.

The past section should illustrate how different approaches to and experiences with the programme may have a role in affecting how the factories perceive and construe the lean transformation.
Figure 15 Lean transformation models adopted in Factories Alfa, Beta, and Gamma
These different models of the lean transformation shape the factories’ approach to transformation and as such, these models may affect the establishment of continuous transformation processes and also affect the direction of such transformation processes. Reflecting back on research question No. 3, this substantiates that not only local activities and initiatives affect the transformation process, the local construal of this process is just as important a unit of analysis. This could be formulated as research questions:

4. How do local experiences in the implementation phase affect the local construal of the transformation process and content? How do local construals of the transformation process affect local approaches to transformation management?

**Using transformation models**

To the extent that local models of the transformation process and content shape the local approach towards transformation, these local variations may be important to address in the corporately directed transformation process aiming at establishing a shared production and management template across a wide set of production units. However, revealing these models in use is not unproblematic. Pettersen (Pettersen 2009) suggests that it may be beneficial to position specific models of e.g. lean within a wider reference frame encompassing multiple lean models so as to facilitate communication between actors with different perspectives. For the present research an amalgam of lean transformation challenges was developed and presented in Chapter 1 as a set of contiguous perspectives or models. This amalgam has been applied in the attempt to describe different models in use within three different factories, see Figure 15, p135. The model is built on a wide range of literature spanning multiple models of lean and related transformation challenges. Still the local models in use within the case company each encompassed some aspects that were not in complete alignment with models found in literature.

**Establishing new behaviors through modeling**

The extensive changes taking place during the pilot projects is by some interviewees seen as the main element in the transitioning to lean. Within organizations experiencing operator resistance directed against the new systems, also the need for a mental transformation is discussed by managers and staff. This mental transformation is associated with the acceptance of the new work modes. This demonstrates how the physical changes and the operation of the new systems attract considerable attention and implies that less attention is put on other types of contributions towards a transformation.
The pilot project is run by experienced and skilled project managers; they draw on expert knowledge and a standardized approach to lean implementation. In this setup, the focus of the projects is not on establishing new capabilities within the organization through collective discussions and development. Instead, the organization, design, and management of implementation is left to experts. For the host organization, these experts’ behaviors and activities may be perceived as unrelated to their own behaviors and activities. The experts conduct a project while the role of the host organization is daily operations. As one supervisor stated: He preferred to get the input for his work from daily operations, he did not see the need for any goals set from above.

Seeing experts engage in goal operationalization therefore may not influence and inspire the host organization to try to adopt similar practices. The pilot projects demonstrate a work mode that is efficient in establishing extensive changes and this project work mode is adopted in some factories in local projects but not in daily operations.

According to Munduate et al (Munduate & Bennebroek Gravenhorst 2003) the risk of carrying over existing values is especially relevant in the transactional change approach applying strong influence tactics. Based on Weick & Quinn, Munduate et al (Munduate & Bennebroek Gravenhorst 2003) relate attraction to transformational leadership and continuous change while replacement is related to transactional leadership and episodic change. While transformational leadership impact employees’ value systems and ambition levels, transactional leadership “attempt to bring about coworkers’ attitudinal compliance with change by showing them that change is for their own good [... by] modell[ing] the contents of influence attempts in such a way that those contents come to fit the existing values of the coworkers” (Munduate & Bennebroek Gravenhorst 2003), p4.

Such modeling problems illustrate a mechanism that facilitates the construal of goal operationalization as a project tool rather than a new behavior to engage in during daily operations. When changes towards lean at the same time primarily are associated with pilot project content, the pilot projects create a solid basis for externalization.

Based on Latour 1992, 1998, Pettersen (Pettersen 2009) discusses how artifacts contribute to stabilizing and supporting certain behaviors. Based on Sarker et al 2006 he furthermore describes how top down change projects announce obligatory passage points through which the organization has to pass. In the case company, the pilot project presents itself as a concrete artifact contributing towards a shared model of the transformation process as that of implementation. The roadmap and full diffusion of pilot
project tools becomes the obligatory passage point which is easily identifiable to all organizational members.

These aspects exemplify how not only the receiving local units but the entire organization can influence the transformation process by adopting transformation models positioning pilot projects as the primary transformation driver. This model could have spurred additional transformation if the more mechanical effects described in the beginning of this chapter were not affected by local interpretations of transformation goals. In that case, the pilot projects would have installed an engine that could automatically generate continuous improvements. However, several aspects indicate that local enactments and interpretations hinder this engine from driving a wider transformation addressing other aspects of the range of transformation challenges found in literature on lean.

In the next chapter the issues the local organizations face in recreating a balance in the area is further addressed.
6. Consumption of room for change in ongoing change processes

As indicated in the previous sections, factories involved in pilot projects appear to engage in activities aimed at recreating some former balance within the involved areas. The approaches taken to this restoration influences the further transformation process. It appears that in some cases this balance is attempted restored by externalizing the need for further transformation and presenting the process as finished. In some areas this restoration was obtained by relieving employees from some of the strict rules implemented. In these approaches to recreating balance, the mechanisms that should provide an engine for the continuous improvements of the production system may be undermined. The question is whether more constructive ways of restoring balance exist.

Being out of room - a hindrance for further development

Within some groups of interviewees there were views that appeared overwhelmingly unconstructive and aggressive or hopeless and passive. People were troubled either by the way the project had been carried out, by the focus of the project, and/or by the outcome of the project. Some felt that the new working conditions were very demanding due to the increased output rate. Some saw the new degree of formalization as signaling new times with less trust in employees. Even though the groups of employees expressing such perceptions were small, it appears that the experience of these reactions seriously affected the remaining organization and emphasized the need to restore balances.

Certain views expressed among a few of the operators conveyed a serious disillusionment – they were not sure for how long they would be able to cope with the new situation, nor did they express any hope for the future. It had become clear to them that in the past employees had been given too much slack and therefore they now had to be subjected to the increased control and speed resulting from the implemented systems. They felt subjected to changes that were not in their interest. These views, expressed by a few interviewees, along with the views of a larger group of interviewees could also be described by an apparent lack of confidence. They lacked confidence in their position to change things for the better, in the surrounding’s view of their worth, and in anybody’s interest in listening.
On the other hand, the views of especially the change agents and the managerial interviewees expressed considerable confidence in their own abilities and opportunities for affecting and driving change. It was clear to them, that they would be driving additional change initiatives on the shop floor within the following years.

In between these two groups there were employees, shop stewards, and supervisors who were cautious about the stress produced by the project period which they had experienced as very intense. Several interviewees were troubled by the consequences the change approach had had for a few of their colleagues.

In the section p129 on different experiences with employee frustration across the three cases, it is outlined how employee resistance may affect local models of the transformation process. The approach to dealing with this frustration therefore has implications not only for the frustrated group of employees and their immediate colleagues but also for the entire transformation process.

**Periods of tranquility for restitution**

In several areas there was a shared understanding that following the pilot projects, the organization needed tranquility – a period during which the employees were left to themselves for a while. It appeared that such a period would help employees fill up depleted reserves somehow, but the mechanisms behind this result were not quite clear.

A supervisor stated that his area now needed “room” to deal with all the new changes. The notion of **room for change** arose out of this expressed need for tranquility. The intense period of change had depleted reserves and thus produced a need for restitution which was associated with peace and tranquility. Tranquility was perhaps not directly a countermeasure but it was the only measure identified in a situation where staff experienced to be depleted and lacking room for further change.

Even though the fastest way to move forward may sometimes be to slow down, a period of tranquility may not be the most beneficial way to further a transformation process. If the use of periods of tranquility involves the freezing of activities, this may support the organizational members in their “project view”. “The project view” was found in several interviews. It expresses the perception, that the transitioning towards lean is fully achieved through the pilot projects such that no further development activity is needed to complete the transformation. Slowing down activity after an intense project period may also mean that the “window of opportunity” that may arise following implementation of new technology is missed. Purser, Bluedorn and Petranker (Purser, Bluedorn, &
Petranker 2005) refer to research by Orlikowski which showed that following the introduction of new technology, a short period arose with many activities to adjust technology and work procedures. Following this period, activity levels fell and it became difficult to implement additional changes to correct and improve the technology. Purser et al suggest that such periods of increased change receptiveness could be exploited in a dynamic change management approach. In relation to a lean transformation initiated through pilot projects, such a window of opportunity could be used to adjust implemented systems and to avoid that the new systems acquire a frozen status. As described in Chapter 4, several of the interviewees in the present research stated that they did not change the implemented lean systems after the projects had finished. They either saw no reason to do so as the systems worked fine, or they found it difficult to obtain the authorization to address the ideas they had. However, in the lean literature, standards are regarded as fluid; standards should facilitate development rather than freeze initiatives. Therefore it appears, that if periods of tranquility instill a sense of “end of journey” and render the system untouchable, such effects will hinder the transformation towards lean.

**Different types of change processes and effects**

Within the case company, several organizations had hired organizational development consultants to engage employees in teambuilding or other processes during the periods allocated for restoring reserves and recreating balances. For some reason these initiatives were not perceived as change initiatives, perhaps because, in contrast to some of the other lean implementation activities, the OD activities were not aimed at speeding up the production process but instead aimed at helping employees to cope. The fact that these organizational development initiatives were positioned as part of an “us” period may have helped create a sense of standing still or at least not being pushed around, while in fact the organization was moving and developing.

The organizational development initiatives engaged in during these periods of tranquility are also forms of change processes. So it appears that while one change process generated a need – room had been consumed and needed to be restored – this need could be addressed through other forms of change processes. Rather than putting the transformation process on hold for a while, organizational development or other initiatives could be positioned as planned elements of the transformation process aimed at facilitating an experience of tranquility and restore room. This outlines a dynamic and perhaps emergent change process in which room is used as a parameter to navigate the sequencing of different change initiatives.
Huy (Huy 2001), (Huy & Mintzberg 2003) introduce the idea that various types of change processes will affect the experience of employees and the organization differently and that different types of initiatives could be combined longitudinally in an intelligent manner so as to control the level of stress experienced. Juxtaposing more abrupt with more quiet approaches could even create a sense of rhythm in the change. In (Huy 2001), Huy argues that change agents should possess “temporal capabilities” in order to succeed in this combining and juxtaposing. However, which indicators to look for in this process or how to acquire temporal capability was not addressed in the paper.

In the following, the notion of room for change as a form of resource or buffer that can become consumed but also restored through various processes is investigated further.

**Exploring the concept of room for change**

**Related concepts: Openness, readiness, willingness**

A stream of research has been concerned with employee attitudes such as commitment, readiness, or openness towards planned, discrete change events. Based on research by Miller et al 1994, Wanberg & Banas (Wanberg & Banas 2000) and Jones, Jimmieson, and Griffiths (Jones, Jimmieson, & Griffiths 2005) use the concepts openness and readiness which both relate to willingness to accommodate or accept a specific change and positive evaluation of the possible outcomes of the change. Affective commitment to change is related to the positive evaluation of the need for change and of the possible outcomes of change (Herscovitch & Meyer 2002). Armenakis et al (Armenakis, Harris, & Mossholder 1993) consider readiness as a cognitive precursor to resistance – a precursor formed by the change target’s understanding of the need for change (the change message) as well as confidence in his/her capabilities to overcome the discrepancy outlined by the need for change (efficacy). In the following these concepts of cognitive, intentional, and affective states determining willingness or commitment to participation are treated as overlapping and the umbrella term openness is used.

Openness research has been concerned with antecedents to openness as well as outcomes of openness – especially employee outcomes in terms of job related attitudes, behaviors, and psychological strain. E.g. Wanberg and Banas (2000) found that personal resilience (self esteem, optimistic life orientation, and perceived individual control over life events) positively affects openness to change. They also found openness to change to be affected by the perceived organization of the change in terms of information received and participation options. Openness in turn was found to affect work related outcomes such
as job satisfaction, turnover, or irritation. In Figure 16, a small set of research models on antecedents and outcomes of openness to change is depicted.

In combination the models in Figure 16 show a positive spiral in which openness produces better results and thus contribute to a history of good results, and such history facilitates openness. Good results may strengthen the perception of organizational reshaping capabilities which creates openness. And good results in terms of user friendly systems and less employee irritation may also work to emphasize humane values which may create openness through trust in management. But management is not only dependent on a good track record of change; also the organization of the specific change process affects openness. Participation and information sharing are two widely recommended influencing strategies for ensuring acceptance and openness, see e.g. (Wanberg & Banas 2000) and (Jones, Jimmieson, & Griffiths 2005).

**Attitudes and resources**

The models depicted in Figure 16 position openness as the dependant variable and a list of circumstances and resources as factors influencing this attitude or perception. The openness research focuses on discrete change events with a specific change content which employees can relate to. In the reviewed sources, openness is researched as an attitude adopted by the individual and this attitude is to some extent positioned as accessible through some of the normal sales channels such as communication and participation.

The concept of room for change must deviate from the concept of openness on several points. The lack of room for change appeared to be a socially constructed perception shared within departments and not an individual attitude. It was based on the department’s current situation rather than the vision of an announced change process and content. With regard to ongoing, cumulative change, Kiefer (Kiefer 2005) suggests that the research focus should shift to the consequences of change in terms of everyday experiences. In ongoing change, employees will associate their emotional reactions with their job, colleagues, management, or the organization rather than with specific change incidents (Kiefer 2005). This underlines that the present conditions which had been established through recent changes were at the core of the perception of lacking room. The areas had not always been lacking room – this lack had arisen as a consequence of the pilot projects. In ongoing change there is no “normal” condition which may potentially be jeopardized by an announced change process. This normal condition has already been jeopardized and the present conditions may be compared to an array of former conditions the cumulative change process has created and recreated through its course.
Figure 16 Models on antecedents and outcomes of openness to specific change events. Based on (Wanberg & Banas, 2000), (Cunningham, 2006), (Devos, Buelens, & Bouckenooghe, 2007), and (Jones, Jimmieson, & Griffiths, 2005).
Regardless the content of the change, interviewees thought that room for change was needed for any further development, it was needed to avoid potential, advert effects of further change. The need for “room” was not only a personal concern; it extended to colleagues as well. Several departments had seen colleagues go on sick leave due to the recent changes. It burdened the entire department to see colleagues struggle with psychological strain. Even the big, calm blacksmith was affected and troubled by seeing his female colleagues break out in tears at work. On top of such effects, the changes to work procedures made production unstable, and workers had to adjust to the new systems while also enduring performance pressures to make up for lost production. These were some of the stressors reported from the projects. Being depleted meant that minds could not cope with more topics, that employees could not tackle anymore instability and increased demands, that the organization could not support more stress. Further initiatives would not necessarily have any advert effects, but these were the anticipated effects of change. The perception of lacking room for change may therefore have been concerned with the fear of escalating an unwanted condition through any further change. As such, lacking room for change is associated with risks. Times of tranquility could possibly work to reduce some of these stressors by ensuring less steep learning rates, and allowing staff to catch up on delivery, develop new habits, and deal with emotional reactions. Apparently, the interviewees wanted to make sure that there would be enough room to buffer or absorb new events and new stressors. The need to reduce the strain experienced within the departments before new change could be taken on implied that strain consumed important resources needed to accommodate for additional change processes. Lacking such resources was associated with lacking room for change. There may not have been a common threshold of strain below which all departments would experience to have room for further change. Yet, the interviewees may have had clear opinions about the thresholds beyond which additional change could lead to adverse effects such as cynicism, exhaustion, or stress. The considerations may have been based on the perceived discrepancy compared to some idealized “normal” state for the department as well as the direction of recent developments; an experience of increasing stress may consume room and experience of decreasing stress levels may establish room and resources for further change and positive aspirations for the future.

**Resource buffers and debts**

**Frustration and problems as occupants of room for change**

During the interviews several issues related to the change process and to perceived imbalances (injustice) were identified areas that could be addressed. The list of perceived
imbalances was long, a few examples of such imbalances mentioned were: The need for more physical space as shop floor got more packed and cluttered, the need to share the revenue from increased productivity somehow, the need for good raw materials to reduce rework in the more demanding setups, the need for more investments in equipment to leverage employees rather than merely strain employees further. Some unresolved conflicts or poorly resolved conflicts were also mentioned as points of frustration. Such issues diverted potential energy from more constructive relationships / patterns of engagement.

Conflicts, imbalances, and exhaustion acted as barriers or problems consuming room for further change. Information on many points of frustration was readily available for managers to tap into. Yet, judging from the volume of reported concerns it also appeared that imbalances and some conflicts were either not addressed by management, or they continued to emerge. Such points of frustration may be seen as symptoms of more fundamental issues. It may be that removal of imbalance issues may diminish the consumption of room for change but not generate new room as long as more fundamental issues continue to consume resources.

In Figure 17 it is outlined how different levers may have different potentials for generating room. Some levers may address symptoms of resource removing processes, others may reduce resource removal, and yet others may directly work to generate room for change.

Johnson & O'Leary-Kelly (Johnson & O'Leary-Kelly 2003) find that experiences of psychological contract breach in a normal situation spur behavioral reactions but if respondents experience organizational cynicism at the same time, contract breach will
more likely lead to affective reactions and emotional exhaustion. This is an example of a buffer mechanism. In the absence of cynicism the contract breach can be absorbed and dealt with through action. In the presence of cynicism there is no buffer to absorb contract breaches; in fact the presence of cynicism carries a high interest as the experience of imbalances leads to additional cynicism and exhaustion.

In the interviewed shop floor environments, imbalances were perceived as points of frustration and thus perhaps resource removing by themselves, but they may also have been symptoms of more fundamental issues. If resource removing processes can generate frustration that in itself is resource removing, management should not consider resources needed to establish room for change as deposits that can be overdrawn - this would lead to high and unpredictable costs.

**Resource consumption at the workplace**

**Individual resources for change**

While room for change may be an exhaustible resource, tranquility was identified by the interviewees as a means for restoring it. However, resources could possibly be regenerated through other measures or alternatively, change processes could be organized to be less resource consuming.

It appears that some employees felt “subjected to” the changes occurring during the pilot projects and this was part of the reason why the changes had depleted the reserves. Possibly one issue in building room for change could be the aspect of overcoming the victim role. If “change” could be transformed from something one was subjected to into something that naturally arose from ones’ actions, this would imply a more stable condition in which the involved parties would be changing something without being changed themselves. Such mechanism exemplify how individual resources may be invested against advert effects of change.

The notion of sustainable resource consumption and regenerating processes is inspired by Kira (Kira 2003). Kira reviews the literature on stress, job design, and optimal experiences and finds ways of linking theories from these different fields. She discusses the following issues:

--- Hobfoll’s (1988) theory of stress as a matter of resource loss or of the threat of resource loss.
Hobfoll’s (1998) notion that individual appraisal of events at work is connected to the socio-historical context; and to the extent that people share socio-historical contexts, appraisal models will also be shared, i.e. appraisal is positioned as far less individual than it is in other appraisal theories.

Hobfoll’s (1998) suggestion that stressful conditions are dealt with through resource investment but that this is a complex process. The complexities arise because alternative resources may not necessarily fully match the resources lost and because the investment of alternative resources may be restricted by prevailing norms.

Maslach & Leiters’ (1997) operationalization of burnout as physical and emotional exhaustion, cynicism, and ineffectiveness.

Maslach & Leiters’ (1997) list of types of imbalance between person and job that contribute to burnout – not necessarily through the size of the imbalances but also through the number of imbalances experienced.

Antonovsky (1979, 1987) and Csikszentmihalyi’s (1990) notion that optimal experiences of manageability, comprehensibility and meaningfulness contribute to a sense of coherence and provide the individual with resources to cope.

Kira suggests that regenerative work should not only feel good but should also continuously build resources to be invested against the challenges emerging at work and in life. This cannot be achieved simply by changing what the work looks like. What work feels like and how it affects organizational members must also be addressed. This is a task that stretches beyond work design and involves social processes. She furthermore suggests that prevention of stress needs to be dealt with in a participative manner, continuously, since workplaces are in continuous flux. Both for the individual and for the organization stress prevention is important because “stress becomes an organizational problem due to the “stressed” individuals and their social behavior” (Kira 2003).

In the present research some of the more reflective informants reported some individual needs and resources for further change. E.g. one informant found that she had developed through the changes and found ways to further her development. As an example she was in the process of getting acquainted with upstream processes which gave her a better understanding of the quality issues faced in her down stream job but also gave her some freedom or latitude which functioned as a personal resource for her. She was quite aware that not all of her colleagues would feel the same way but thought that “it would do them good” to learn more about the production.
Another issue related to personal resources was that of reduced job enrichment. To some of the employees, the new setups implied reduced roles; they had become “manual labor”. In former setups they had taken responsibility for dealing with problems on their own which had many benefits for them. Some of the interviewed managers expressed little understanding for employees need for job enrichment; they considered job rotation as an adequate substitute for the multiple tasks and roles employees had undertaken before the pilot projects.

**Social capital as resource for change**

Within some of the areas, employees had been engaged in team building as an approach to establishing organizational development. Such efforts may solve collaboration problems and more fundamentally they may help the organization obtain a sense of coherence and achievement by demonstrating that problems can and should be dealt with and eliminated.

In a Danish work environment context, social capital is positioned as an organizational resource that facilitates collaboration towards a greater common good. It captures the organization’s ability and willingness to collaborate based on the experience of trust, justice, and reciprocal commitment among organizational members. These experiences are embedded in the social relations and reproduced in the daily interaction. (Olesen et al. 2008)

Within the case company, the focus on imbalances may indicate a lack of social capital. When mutual commitment to collaboration does not exist, suboptimal considerations of diverse interests may result (Olesen, Thoft, Hasle, & Kristensen 2008). Olesen et al find that high social capital implies that problems are addressed in a proper and decent way. Therefore this resource is particular relevant to change processes that surface many new questions, points of frustration, and problems.

Within the case company, two informants both found that the operations teams, they each were part of, had the resources to go through a period of change. They both felt confident that although there were new members in the team, members trusted and liked each other – to them this was a resource that would help the team identify good solutions and reach agreements regardless the issue.

**Stability as employee value and resource generator at the workplace**

For the present research, a third resource generator / consumer is suggested.
Aspects of stability, continuity, rhythm, and control appeared to be highly valued among many employees. Process stability was emphasized in most shop floor interviews and deterioration of process stability following the transition to lean systems was mentioned as a cause of frustration. Most shop floor interviewees experienced that stability was very vulnerable and could be upset by, for example, the moving of machines, introduction of new employees, transition to multi-machine handling, or bad raw materials. Working under instability was experienced as exhausting and the experience of lacking control and former levels of mastery contributed to irritation. Continuity appeared as a mechanism that could contribute to feelings of stability. For instance, knowledge about upstream processes could contribute towards experiencing more continuity and in turn stability, because with such knowledge, the errors that occurred downstream could be associated with a cause rather than appear as random nuisances.

This is a parallel to Huy’s (2001) notion that cyclical patterns project continuity which may work to stabilize experiences of time. Rather than focusing on resource consumption and generation, Huy (Huy 2001) is interested in different aspects of time in relation to change. For example, he suggests that teaching approaches which result in retrospective sensemaking will upset the individual’s sense of stability formed by the person’s deep beliefs about the linkages of past events in time and space. Socializing interventions, on the other hand, may work to stabilize perceptions of time, as ongoing processes of social bonding create cyclical patterns (traditions) which project continuity and predictability. According to Huy, the value put on qualitative time and good social relations is an individual preference (Huy 2001). This is yet another reason why the consequences of change may vary from employee to employee.

However, as Kira’s review suggests, people who have similar socio-historical contexts may appraise events at work similarly. This may heighten the ability of colleagues to empathize with each other and understand which events will be felt as removing valuable resources and as stressing. In contrast, several managers appeared relatively more ignorant regarding the effects of change on employees. For example, one production manager thought that after one month, new employees would be able to perform at the same level as more senior employees. The employees in the same factory, however, felt that they were very dependent on the skills and knowledge of their colleagues in the new cell setup and therefore felt the use of many temporary workers quite stressful. They estimated that it took around two years for new employees to gain enough experience to deal with the uncertainties embedded in the setup. Such uncertainties would constantly...
interrupt new colleagues with less experience in their work and this would affect the experience of a good work flow within the cells.

**Interplay between stability, social capital and individual resources**

Ideally the parties involved in an ongoing change process would be aware of and alert to the possible outcomes of and reactions to change and possibly they would be able to navigate and adjust the process while reactions were occurring. However, managers of change who are concerned with the consequences of change on employees may not find much guidance in literature as this is an area that is not well explored (Wadel 2005). However, understanding the consequences of new work conditions may be important in the attempt to navigate in a long-lasting, cumulative change process.

Wadel (Wadel 2005) investigates the consequences of the transition to self-governing teams in an engineering department. He finds that employees experience a dilemma between the increased demands and a lack of authority. The team organization requires that they govern their own work as well as the work of their colleagues, but without the authority of management. Therefore, they try to legitimate their attempts to influence colleagues by deploying a communicative management style which Wadel finds is a subtle and difficult art placing great demands on the individual. Visholm (Visholm 2005) finds that employees can no longer project all negative issues onto management when self-governance is implemented. Such polarized conceptions of good employees and bad management cannot be sustained when dealing with the different behaviors and preferences of group members, e.g. fast or slow members becomes a group concern. Group members may experience insecurity when the bad/good-jargon is no longer a safe, common denominator, and the group may need to find a new source of security.

To people who value qualitative time, the upsetting of inner time may be felt as resource depriving, while a strong sense of continuity or stability may work as a buffer against minor effects on time perception. This may be one reason why it is important for a group that is transitioning to self-governing teams to find new sources of security that will accommodate good social interaction. If the group does not succeed, if differences cannot be overcome or if the group engages in some unfortunate dynamics, the group members will lose social capital as well as a source of stability and continuity. Consequently, it is not only the resource consumption related to the transition period that may affect room for change but also the lack of resource generation in everyday work life.
Based on the present research, three different types of resources or conditions are proposed as constituents of room for change: Individual resources needed to cope with stressors; Social capital needed to engage in fruitful collaboration; and Stability, continuity, rhythm, and control as aspects of the work environment. In Figure 18 these three resources or conditions are depicted as spanning a room – room for change. The example listed above illustrate how change may affect room for change by affecting any of the constituents of room for change and these effects can interact with and mitigate to the other constituents.

Olesen et al (2008) uses a quote from Rousseau et al 1998 to characterize trust – one of the elements of social capital: “Trust is a psychological state comprising the intention to accept vulnerability based on positive expectations of the intentions or behaviors of another.”

Based on the present research, it is suggested that room for change is similarly related to willingness to accept the risks entailed in further change based on the perception of having sufficient resources, or access to resources through management, to accommodate for and cope with problems that will naturally arise during change.

**Empirical investigations of consequences of change**

**Lean practices and resource consumption / generation**

Some concerns mentioned in the interviews could be seen as direct consequences of specific lean practices. Examples of such practice-related concerns are given in the following. Identification of such concerns may help shed light on the mechanisms through
which the lean production system can affect the way employees experience their work conditions and their perception of having or lacking room for change.

A review of literature on stress and “lean”, “TQM” and “JIT” by Landsbergis, Chahill, and Schnall (Landsbergis, Cahill, & Schnall 1999) shows that especially physiological consequences of these systems were investigated in the automotive sector during the 90’es. A follow up review by Hasle et al (Hasle, Bojesen, & Langaa-Jensen 2010) found that also outside the automotive industry, certain lean elements tend to lead to increased work speed and reduced job autonomy, which the increased control and support from kaizen and teamwork cannot compensate sufficiently to avoid advert effects. Conti et al (Conti et al. 2006) applied a survey study to examine the relation between specific lean practices and employee outcomes, e.g. "rotation can increase control by expanding job knowledge and experience. It can also increase social support through interaction with more co-workers. Therefore: H20. Job stress is negatively related to the frequency of job rotation." The survey shows that the frequency of job rotation has mixed effects for the respondents. One explanation may be that individuals value different needs differently (Ciulla in Kira, 2003). One of the interviewees referred to above, for instance, found that rotation worked as a resource for her since it supported her needs to learn new things and have some personal latitude. But she was well aware that her colleagues did not all feel the same way. She valued having the opportunity to choose and to learn while the frequency of rotation may have been less important to her. Also Vidal (Vidal 2007) finds that "Individual orientations toward work play an important role in mediating the effects of objective characteristics of job design – such as participatory work arrangements – on job satisfaction." These examples show that it may be difficult to predict any clear relations between the use of lean practices, change in work conditions, and resulting employee outcomes.

Use of hourly performance registration, example I
A fixed element in the pilot project toolbox is the hourly registrations of production output. Hourly output registration is performed by employees. Every hour the output of goods from a specified area, e.g. a cell, is counted and written on a board. The actual output number is compared against the planned capacity of the area based on cycle times and number of employees manning the area. Negative deviations are highlighted in red while positive or zero deviations are highlighted in green or black. The boards may display additional information such as accumulated deviation for the shift and hourly productivity levels based on actual manning. Furthermore deviations should be explained by brief comments and also problems that have occurred may be registered in text on the boards.
None of the factories visited for this research had used similar procedures before the pilot projects. In most areas, the new practice had resulted in some frustration and discussion. The use of red colors was by some perceived as unnecessarily stressful as red is associated with something wrong – several employees felt that the color indicated they should be scorned for insufficient output. Most interviewees reported to feel a sense of satisfaction when they could leave the shift with “green numbers”. Red numbers however deprived them of this satisfaction – even when they had done their share to meet targets. In several areas interviewees reported that they or some of their colleagues were keen on trying to catch up in case of “red numbers”. In some areas this was accepted as a general practice but in other areas this urge was ill-received by other team members. So to fit into the teams some employees had to mute their urge to perform well. This shows how differences in individual preferences, which may not have mattered when output was not registered, can become highlighted by a lean practice.

In some areas employees had troubles identifying problems embedded in the equipment or materials as reasons for insufficient output, instead they made sure that most deviations were explained by “meetings”. This note indicated that some employees had been absent such that the area had been insufficiently manned to meet targets. Operators may have felt that work was interrupted by the many meetings especially team coordinators were pulled into. But it seemed unlikely that equipment or material failure did not occur during normal work days. To investigate this further, some observations of the work in such areas were carried out. These observations showed that errors did indeed occur, but these were often remedied on the spot. Perhaps employees engaged in these procedures unconsciously or they perceived such small errors to be normal. Pointing to meetings as the main reason for deviations therefore may signal that the operators felt that blame had to be located somewhere and when possible blame would be directed outside the team.

In one area, the teams used a double accounting system. They would avoid writing on the boards for some hours, then the supervisor would remind them to fill in the information on the boards and any deviations that occurred in between would be hidden. Sometimes they would work ahead and just fill in numbers matching the targets which meant that they had a buffer in case problems would occur later. In this area production output was always exactly on target. This may have been important to the workers especially since upper management often visited the area with outside guests to show them how the information boards worked. On one occasion observed by the researcher,
one of the teams managed to cover up a mistake made by an elderly colleague by using this double accounting system. Some products had been assembled with the wrong parts and had to be reassembled. The team picked up speed for some time and due to the buffer and by skipping one registration they managed to catch up without revealing the mistake before they were reminded by the supervisor to fill in the output on the board. At that time the skipped registration could be filled out as if the team had been on track for the entire day.

One area reported that the first implementation of hourly registrations had followed clock hours such that some periods were pure production time while other periods spanned across breaks. Each period would therefore have a different target, but since the teams in the area was very focused on fulfilling productivity targets hour by hour, employees had to orient themselves towards new numbers every hour. This to them was disrupting and it was a big relief to them when registration was aligned to breaks so that breaks would fall outside registration periods. In the new setting, registration would thus start at different minutes of the hour but all span 55 minutes of pure production time which to the employees in the area created a sense of rhythm and stability. This practice was only invented and adopted in one factory.

Several of the identified issues continued to surface more than one year after the pilot project implementation. Therefore the concerns may not only be associated with a change but also with the resulting working conditions. The disagreements arising from differences highlighted from the new performance registration practice were reported to diminish over time. However, to the extent that the disagreements were rooted in different personal preferences, the diminished open conflict may not necessarily reflect that new shared values had been formed. Instead it may have been a result of a minority subordinating to the majority voice. This model could lead to feelings of loss of social support and coherence on behalf of the subordinating team members; feelings which would be associated with the new conditions. Lean practices highlighted some differences in individual preferences that had not been so obvious or important in the former settings. Therefore these conflicts were not just change related; they were more profound.

Use of cells or multi-machine handling and standards, example II
In several areas, the pilot projects had implemented the use of production cells with balanced work stations with either “cell in motion” (rabbit chase) or “hands off” work patterns. In some areas this was achieved by breaking up flow lines, in other areas cells were created by bringing together work stations that had previously been spread out and operated individually. Similar to the implementation of hourly registrations, the transition to
cells, the use of standards, and multi-machine handling had several implications for the involved employees.

The cell layout implied that workers had to work very close to each other in a small area. It appeared that especially in cells with the rabbit chase work pattern this was a big transition for employees. On the tour round the cell they had to overtake the workspace from their colleagues. Timing was very important in this “dance”, but also other less recognized issues were brought up. One interviewee gave some relevant input about issues related to this work pattern. The interviewee felt that the new setup was demanding on the personal level because the employees were so dependent on mutual respect and collaboration. Compared to the conditions in the former flow lines, any sneering or bad moods would have a much larger impact on the climate and would affect smooth operations and coordination in such cells. She felt, that she had to perform everyday and leave troubles at the front door when she came to work. This could be categorized as higher emotional demands.

The transition from one employee per work station to flexible manning or multi-machine handling implied that the deep knowledge build up through many years of operating the same machine deteriorated. Employees in one area reported to produce more scrap and having to call maintenance personnel for far more issues than before. The process had become more unstable and in a sense, employees had lost some control and expertise in their work.

Shared responsibility and flexible manning put more emphasis on standard operating procedures and to a larger extent than before, employees had to be able to reach agreement on how to work. This highlighted some differences among employees. Some employees were interested in experimenting and finding more optimal ways of working, but in some areas this was not welcomed by the majority of employees who wanted to work with fixed standards. A couple of interviewees reported that they had chosen to implement new procedures in their own work, without addressing the common standards.

The interviews indicate that the transition to lean systems may affect workers on a number of psycho-social factors such as: Conflicts, and loss of social support, loss of expertise, control, latitude, and networks, higher emotional demands, quantitative demands, “double accounting” and cognitive inconsistencies.
From the number of different concerns raised regarding these new practices, it appears, that sensemaking had not converged towards the understanding of these same practices found among corporate project leaders. Interviewed project leaders stated that the teams should only be concerned with red numbers when the lacking output could be related to team performance. The array of feelings, meanings, and concerns attached to the use of hourly registrations were not foreseen, understood, or communicated by neither the interviewed corporate project leaders nor the local factory managers. To the employees, the neglect of such effects may illustrate that management is unable to consider the consequences of change they may experience, this may make them wary of further change and less susceptible to believe in rosary images of change portrayed by management.

The list of consequences of the new work conditions could be extended further. It is well-known that changes to work will produce a lot of questions and consequences. However, the mechanisms through which employees are affected by changes on shop floor in the transition to lean are less explored. The interviews point out numerable ways through which personal resources, process stability, and social capital may be affected in the pilot project. Understanding individual employee as well as shared shop floor values is important in the ongoing change process because it is through these values that changes affect resource consumption and generation.

**Summary**

The question of how to sustain long periods of change towards some envisioned or perhaps meticulously planned future state is central to the lean transformation process for several reasons: Some intense months of change is not sufficient to establish a lean production system, lean mindset, lean behaviors, and lean performance; The lean literature suggests that continuous change should eventually become the norm rather than something we consider doing after we have rested; Periods of tranquility engaged in to remedy the lack of room may work to establish the lean standards as fixed rather than tools for continuous development.

An ongoing change process cannot be planned to the same extent as discrete change events and will have to evolve dynamically, possibly by drawing on a number of different types of change approaches. In such juxtapositioning of different change processes Huy (2001) suggests to employ temporal capability as different processes affects the experiences of time differently. Kiefer (2005) points out that in ongoing change, employee
reactions will be associated with everyday work experiences rather than with the specific change process.

In the present chapter, the notion of **room for change** has been proposed as a conceptualization of the complex assessments employees perform in relation to ongoing change. The concept is not unrelated to openness or readiness for change, but it entails issues not traditionally researched under that umbrella since openness and readiness is usually associated with specific, discrete events and individual attitudes. Room for change on the other hand is associated with perceived risks regarding stress, injustice, frustration, and uncertainty involved in further change, and is based on experiences with work conditions and recent changes to them. Furthermore the assessments regarding room for change stretches beyond individual concerns and also includes concerns for the welfare of colleagues.

In the interviews conducted for this research, the notion of room for change appeared to be helpful in conceptualizing and identifying input for dynamic navigation in an ongoing change process. Through this notion, a long range of consequences in terms of affected psycho-social factors was identified as sources of resource generation / consumption in the lean transitioning.

The many different issues reported by interviewees show how sensemaking diverges in many different directions. Previously, surveys of relations between lean practices and employee outcomes have produced mixed results. The interviews show how individual preferences and localized nuances may affect the resulting resource generation / consumption of specific lean practices.

**Implications**

The pilot projects abruptly alter the work conditions, any such alteration risks removing sources for resource generation from employees and lead to lack of room for change. The projects may also have positive effects, e.g. they may address issues that have been resource consuming in the former settings and they may establish work conditions containing new potential sources for resource generation. However, the projects bring about such comprehensive changes that the sheer volume of change may require some processing time before potential sources for resource generation embedded in the new work conditions are appreciated. In the present research it appeared that the many, varied concerns brought up by employees were not easy to accommodate for in a dense
project period. For a period of time following the projects the net effects of the change process and content may be a loss of resources.

In a lean transformation effort, a temporary net loss of resources should be prevented or remedied in order to accommodate for a dynamic, ongoing, and cumulative change process.

The pilot projects mainly address employee preparation through communication and participation: Employees are informed of upcoming changes before the projects start by local or business unit management; local company magazines print information about the projects and experiences from other factories; employees take part in a lean game; corporate change agents communicate what is going to happen, how the lean tools work, what the expected employee roles are, and invite employees to participate as data suppliers as well as idea generators; seminars on stress and reading stress signals are provided to employees. All these initiatives could be categorized as strategies for creating openness, they may prevent some types of resource consumption, but they are not strategies for ensuring room for change by building resources that can buffer against risks involved in change. Nor are they strategies for soliciting employee concerns and remedying lack of resources.

The remedying of resource consumption and lack of room for further change was primarily handled by the local units. This was addressed differently in different areas. Local units visited for the present research primarily resolved to the use of periods of tranquility to restore room. During these periods, some of the areas had adopted traditional organizational development methods to resolve some of the strain built through the transition to the lean systems. Other areas addressed some of the imbalance issues upsetting employees by for instance the use of additional breaks, massage, or new work tables and other equipment purchases. Some areas addressed imbalance issues through process improvements by making sure that problems and suggestions brought up by employees were attended to by technical staff regardless the contribution of these efforts in terms of output. Addressing imbalances is a reactive approach to the issue of lack of room for change. Collinson (Collinson 2000) find that focus on injustice and compensation may work to reproduce the image of workers as commodities at the bottom of company hierarchy. Therefore this approach may not generate new resources but merely reduce advert effects of resource deficiency. In some areas, this approach led to technical staff being swamped with minor tasks that may have smoothed out some imbalance issues but did not contributed considerably to process improvement. Organizational development
issues on the other hand may work to facilitate improved social relations and sensemaking which in turn may lead to improved resource generation. The interviewees reported that such initiatives had helped them – some stress had been removed, but in these initiatives, the issues of sustained transformation and room for change were not considered and addressed conjointly.

While the local units engaged in different activities to ensure room for further change and address resource consumption, the programme maintained a singular approach to transformation through implementation and sensegiving efforts. This strategy may have been adopted to avoid opening up for new interpretations, mutations, and divergence. Yet, the interviews show that a number of different interpretations and divergent sensemaking is at play, also long after the projects have finished. The divergent interpretations may play a central role in the consumption of room for change. For various reasons, some of the changes were perceived as unjust and gave rise to a range of different questions, thoughts and debates or conflicts among employees. Several changes were perceived to prey on employees and deprive them of status or other valuable resources, this consumes room for change.

Stensaker et al (Stensaker, Falkenberg, & Grønhaug 2008) find that sensemaking achieved through cognitive understanding arising from involvement in planning activities is not enough to fully shape members’ sensemaking of change implementation. Drawing on Weick (1995) they suggest that action is needed to facilitate learning and sensemaking in retrospect. The present case shows that also action and learning by doing is not enough to shape sensemaking uniformly across units and certainly not enough to shape sensemaking in line with programme ideas.

Change agents’ employed by the programme showed little awareness of the many divergent interpretations and resulting issues related to the practices they implemented. While experiences with restoration of room for change were created locally in areas that had been engaged in pilot projects, corporate change agents were ill-equipped to guide local management and supervisors responsible of carrying the transformation beyond the initial practice implementation. This points back to the gap in knowledge transfer identified previously. While the programme design ensures transfer of tacit knowledge on project management to new project managers and of tacit knowledge on how to use the lean systems to local management through extensive co-location, transfer of knowledge on how to manage and navigate the further transformation from local units to corporate staff or between local units is not addressed in the programme design.
7.

Discussion, conclusion and reflections

Discussion

The sustainable transformation process

Many of the issues investigated during the present research may be characterized as examples of how potential generative mechanisms may be restricted in their field of operation.

Generative mechanisms are needed in a sustained transformation process to propel change onwards but implemented change generators are subject to subjective interpretations. Local interpretations and engagements with change generators may restrict the field in which these mechanisms can operate and generate change such that they do not obtain the planned or idealized effects. Examples of such restriction occurring to generative mechanisms include: The need to engage in new behaviors such as goal operationalization may be externalized by managers and staff who consider the object of change to be shop floor practices only; Standards that should capture process improvements may be perceived as “no go” areas and new ideas may be perceived as work arounds; Continuous improvement processes may become routinized and establish a narrow focus on technical issues inside the project area only.

Such restrictions to the field of operation of generative mechanisms could perhaps be counteracted through active and encompassing transformation management. However, also local transformation management occurred in a restricted field of operation as projects that should establish a platform for further change in some areas were seen as artifacts crystallizing the transformation. New pilot projects attracted considerable attention such that local transformation management primarily focused on the challenge of receiving and hosting projects while the challenge of further developing mature pilots received less attention.

This restriction of operating fields appeared to occur to generative mechanisms at many different levels of the transformation initiative. This may in part be the result of a dichotomy between implementation and maintenance/operation which will be further explored in the following.
The programme management challenge
2½ years into programme life senior advisors within the programme were interviewed about local units’ transformation orientation, goal operationalization and efforts to develop knowledge about lean tools locally. They stated that in their experience, focus disappeared from former pilot areas after a run in period. The implemented systems continued to function but did not spur new initiatives or new targets. Although many local change agents had undertaken locally driven pilot projects, the experience within the programme was that “lonely preachers” were not enough to maintain the transformation process. Meanwhile, at the time of the interview, the senior advisors were oriented towards the next phase of programme life which would entail the establishment of change offices within every business unit. The pilot projects were positioned as a tool for establishing a platform on top of which additional lean initiatives could be implemented by such change offices, and the programme was positioned as training ground for project leaders who would eventually populate the future organization. Therefore they did not consider the level of local focus on lean knowledge and capability building an issue, it did not jeopardize the transformation as the programme would continue with other controllable initiatives.

This transformation model of a change process, that can be controlled and executed by the programme and which is constituted by implementation efforts, is not in line with the model adopted for this research in which the development/adoption of new behaviors, practices, and guiding principles is thought to be the main ingredients of the transformation. To some extent, the validity of the search for signs of such transformation within the case company should be questioned, if this form of transformation was never the goal of the programme. Alternatively the promotion of these ideas by the programme may be read as illustrations of mechanisms that are relevant to consider in the design of programme organized change.

During the first years of programme life, programme execution shared some characteristics with the typical project management. In project management, deliverables take the form of work packages (Pellegrinelli 1997) and project management should be concerned with the establishment of safe implementation processes (Thiry 2002). Programme management on the other hand is by some characterized as delivering strategic benefits which cannot be encapsulated in work packages (Pellegrinelli 1997). Programme management must take into account the dynamically evolving needs of the organization (Pellegrinelli 2002). To accomplish this, Thiry (Thiry 2002) suggests that
programmes must address other aspects of strategy management than strategy implementation. Aspects of strategy management suggested by Thiry have to do with sensemaking for ambiguity reduction during formulation of programme aims, and ongoing re-evaluations concerning the programme objectives and benefits through a continuous opening for feedback and reflections and through formal evaluation processes. Winter et al (Winter & Szczepanek 2008) borrow from Normann and Ramirez in suggesting that rather than delivering a product to a customer, programmes should be concerned with enabling the customer of the programme to create value for the next tier customers by using the offerings of the programme as input. Standard programme management literature has been criticized for being “based on a project-level view of change-control rather than a strategic view of change”. In practice this may occur due to the traditional linear hierarchy with direct reporting from project managers to programme management (Lycett, Rassau, & Danson 2004) which draws considerable attention to the project agenda.

It appears that the programme organization risks drawing too much attention to the role as project host. The present case illustrates that also programme roles emerge through processes taking place within the organization rather than by design. In the present case, the emphasis on project success may have been established through the demand for deliverables. The programme may have drawn considerably legitimacy from the vast improvement potential it was set out to harvest. Business units on the contrary may have been wary of the large sums invested in the programme. The road map process demonstrates a firm boundary drawing taking place early in programme life. The programme is being made responsible for rolling out projects that can harvest a certain potential, the local units on the other hand are being made responsible for maintaining the gains from each project and for facilitating the rolling out of projects.

This dichotomy between implementation and maintenance is also established in other aspects. Interviewed supervisors demonstrated a clear orientation towards daily operations and gradual development. They very clearly pronounced a concern for daily operations by adapting new systems to employee needs in order to reduce or counterbalance the resource removal lying behind the perception of being out of room. Also production and some factory managers demonstrated how goal operationalization was perceived as a project work form rather than a model for their continued maintenance of the transformation process.
Based on this, a question for future research into the programme organized transformation process is suggested:

5. Which types of transformation effects may be related to dynamics at the programme and company level?

The adoption of project management approaches such as risk externalization at the programme level illustrates one approach to dealing with a transformation dilemma. Implementation is a means for establishing new processes and structures in a controlled manner but behavioral changes are difficult to direct through implementation. New structures may influence daily operations, but structures are subject to a diverse range of local interpretations and subjective meanings (Adler 1999b). Boundary drawing between implementation and maintenance responsibilities may be one approach to overcoming the vulnerable position of implemented practices in daily operations. However, in this approach, different needs clash and the negotiation between these needs risks jeopardizing the sustainable transformation: Pilot projects consume room for continued transformation on behalf of the implementation agenda; adaptations occurring during daily operations in order to normalize project areas restrict the field of operation of potential change generators that could have propelled the transformation forwards.

The pilot project approach results in parallelism and enables the organization to create a broad frontline of development (Gustavsen, Hofmaier, Wikman, & Philips 1996) But there may be a dilemma between establishing a broad frontline and speed versus a broad transformation concept. The volume of the programme and the investments required to establish a solid implementation approach may be a hindrance for exploring ways to achieve strategic benefits from lean activities outside the scope of implementation initiatives. The operation of an expensive pilot project concept may make the organization reluctant to engage in ongoing re-evaluations concerning the programme objectives as suggested by Thiry (2002).
Conclusion

The present research has demonstrated that local reactions to the establishment of new work systems through pilot projects are diverse and unpredictable. The relevance of these diverse reactions has been demonstrated through the notion of room for change. Room for change represents the combined effects of individual, social and operations related consequences of the establishment of new work conditions in terms of a socially constructed experience of either having or lacking resources for engaging with further change and volatility. Local reactions to lacking room for change play a role in restricting the field of operation of change generators embedded in the lean system. This is one reason why a sustained transformation process cannot be approached as an operation producing similar output across the organization.

The research demonstrates that the field of operation of a change initiative is shaped and restricted by interpretations in use such that an established change generator may not achieve the planned or idealized effects. Restrictions to the field of operation may occur to a range of different change generators spanning from tools and shop floor practices to projects and strategic programmes. Therefore the sustainable transformation must entail planned as well as emerging initiatives to support the transformation process. The sustainable transformation process must be able to continuously establish further room for change without jeopardizing the continued transformation generation and vice versa. In order to accomplish this, the sustained transformation must continuously solicit different needs and evaluate how change generation as well as digestion can be supported in light of diverse needs.

A dichotomy between implementation and maintenance may establish itself at many levels in the project driven implementation approach. Firm boundary drawing between project execution and operation responsibilities is one manifestation of this dichotomy.

In relation to the programme organized and project driven transformation process towards lean, the research questions for this project are addressed with some propositions:

2. What are the local unit’s challenges in receiving, operating and developing the lean systems implemented?

Each local unit faces the challenge of identifying and establishing local initiatives to support implementation projects in order to increase the benefits and reduce drawbacks of such projects.

Local units hosting several months of intense changes face the challenge of maintaining daily operations in light of increased volatility and consumed resources. In this regards,
local units face the challenge of adapting systems implemented by experts to needs arising in regards to daily operations.

4. How do local experiences in the implementation phase affect the local construal of the transformation process and content? How do local construals of the transformation process affect local approaches to transformation management?

Proposition 4a: Individual and shared perceptions of and reactions to the transformation initiatives affect local units’ room for change.

Proposition 4b: Individual and shared perceptions of and engagement with change initiatives determine the field of operation of potential change generators.

3. How do local activities and initiatives contribute to establishing a transformation towards lean and continuous improvements based on pilot projects and related programme activities?

Local initiatives may imitate programme initiatives and supplement the programme by increasing the implementation frontline. Perhaps more importantly, local initiatives countering the experience of lacking room for change following intense periods of change work to normalize the levels of volatility and facilitate the continued engagement with pilot projects in other areas of the organization.

Proposition 3b: Local initiatives may supplement programme initiatives by addressing highly localized needs and reactions and by drawing on other types of change initiatives.

5. Which types of transformation effects may be related to dynamics at the programme and company level?

Proposition 5a: Boundary drawing may establish a dichotomy between implementation and maintenance of new work systems that renders the conjoint consideration of implementation, room for change, and sustained transformation difficult.

Proposition 5b: Expert driven implementation projects present themselves as concrete artifacts contributing towards a shared model of the transformation process as that of implementation.

1. What are the characteristics of a sustainable transformation process?

Proposition 1a: The sustainable transformation process must be able to continuously generate as well as digest change.

Proposition 1b: In order to maintain capacity for change generation and digestion, the sustainable transformation process must continuously explore individual and shared perceptions of and reactions to the transformation initiatives.
Reflections

This research has been concerned with the lean production paradigm, organizational transformations and programme management.

As pointed out by Koskela, production paradigms are different from scientific paradigms as "... the criterion of an idea is its potential for inducing action ... rather than its ability to explain and predict"

As a management concept lean is widely disseminated and discussed in books, interest fora, and companies (Arlbjørn et al. 2008). It functions as a sales window promoting a series of practices, the use of change agents, and action oriented leaders. As a management concept, the lean paradigm therefore appears to be able to induce considerable action.
In the research presented here however, the implemented lean practices do not demonstrate the same potential for inducing action after the first run-in period. On shop floor, the use of implemented practices are subordinated the goal of a wellfunctioning daily operations and the operation of these practices do not lead to shared visions of a transformed operations.

In this thesis, the distinction between a technical core and an infrastructure facilitating the operation of lean or JIT was criticized based on the notion that these aspects were equally important for the lean company. However, also the idea of a unified concept should be criticized. Lean is many things at once: It is a management concept that seduces, among others, managers to action; it is an outlet for lean practices; it is a philosophy about how variability reduction and knowledge generation can be obtained and provide benefits for the production company; and it is a concept that lends itself to many different interpretations and enactments. These varied faces and properties of lean must not be neglected. The present research goes hand in hand with other research demonstrating that a management concept such as lean is more than what management in charge of its implementation defines it to be.

Although less recognized as such, also “organizational transformation” is a management concept with many of the same properties as lean. The present research has been engaged in with an underlying ideal model of encompassing transformation management and organizational transformation leading employees and organizations to develop in new areas and at new rates. Although a range of literature promotes this ideal model, it may
not exist in practice or be a realistic model for organizational change. Yet, hopefully the ideas presented here may have some relevancy even with such ideal model positioned as unrealistic.

The case company for the present research engaged in a lean transformation in accordance with much of the advice found in change, project, and programme management literature. In fact, the programme/pilot model is a strong vehicle for securing productivity gains, practice implementation, and shared standards and the model has gained recognition among Danish organizations.

I set out to identify advice relevant for the programme organization of transformational change as well as the project driven change process against lean and continuous improvements. I believe the most fundamental advice is to reject the notion of a unified transformation and mechanical effects as transformations are established through organizational members affected by local experiences and values. Different practice enactments and transformation construals will emerge in different parts of the organization, and the announced transformation vision and content as well as the organization of the transformation also play a role in shaping diverse construals. In an organizational transformation effort, the uncovering of assumptions underlying a transformation theory adopted among colleagues and discussing the implications of these assumptions is not straight forward. How can different transformation theories in use be described, how can the translation space be uncovered, how can differences and overlaps be identified? The advice should therefore include an encouragement to ask many questions related to why, what, and how the transformation may unfold and an encouragement to thoroughly engage in subjecting these ideas to criticism by engaging multiple parties and perspectives and creating room for soliciting such criticism throughout all phases of the process. To the extent that programmes may transform into projects, the programme client should be aware that this organization of transformation may not be best equipped to establish such room for exploration and criticism. However, by recognizing that a transformation is neither directed nor carried by practice implementation alone, room may be created for discussing aspects that cannot be addressed through implementation projects. It is not a matter of discussing project failure (an issue typically perceived “as a pathology to be eradicated” (Lindahl & Rehn 2007)) but a matter of positioning project contributions and limitations in wider transformation theorizing within the organization. Meanwhile, large sums invested in establishing strong vehicles for implementation may render the programme client less inclined to consider the need for additional and very different types of transformation drivers. The investments
made in such vehicle may be far more visible than the costs carried by the individual factories trying to operate implemented systems and to engage in local transformation management.

Not all issues of the transformation towards lean are necessarily socially constructed. Future research could perhaps contribute to better theories about variability reduction and knowledge generation as a production paradigm directing and restricting the development of production methods, tools, and knowledge. In the present research, WIP reduction and productivity enhancements do not appear as goals that attract the local, receiving end towards further transformation. Sustainable transformation towards these goals therefore may be difficult. Based on previous research, variability reduction and knowledge generation appear to have been fundamental principles pursued within TPS (Spear & Bowen 1999; Spear 2002; Towill 2007). Based on the performance demonstrated by Toyota, productivity enhancements and other manufacturing capabilities could be proposed as potential derivatives of these principles. Ferdows (Ferdows 1990) has suggested that a sequencing with global relevance to the pursuit of cumulative manufacturing capabilities may exist. This ideas by has been disputed by e.g. Flynn (Flynn & Flynn 2004). However, variability reduction and knowledge generation are not manufacturing capabilities but production theories and while capabilities may be achieved in any number of ways, some principles may be better suited to establish a broad set of manufacturing capabilities.
Appendix A: Applying the transformation framework to case studies Alfa, Beta, and Gamma

In the following, additional data for the three case studies presented in Chapter 4 is presented. For each factory the following is depicted/reviewed:

— Diagrams highlighting the structure of the manufacturing organizations. Structures affect the rate at which sequential pilot projects lead to managerial coverage.

— Productivity results reported from each corporately managed pilot project show the identified improvement potential targeted through the project next to actual results and the further development in productivity following the pilot projects.

— Lean initiatives engaged in and

— Individual transformation and action orientation for a set of interviewees for each pilot.

**Figure 19** A set of lean transformation challenges used to characterize the local units approach to sustain and further develop the pilot project areas

*Lean challenges addressed*

Many of the initiatives engaged in by the factories following the pilot project did not appear to have a direct effect in terms of added leanness and performance. Therefore a list of activities engaged in in relation to the pilot projects is listed and reviewed for each
Appendix Structured case and interviewee analyses

factory. Based on these lists, the amount of effort put into the different lean transformation challenges identified in Chapter 1, see Figure 19, is evaluated. The lean model depicted in Chapter 1 lists types of elements in a lean transformation identified through literature studies. Characterizing the initiatives according to these types should reveal which challenges within the model the factories focus on.

The elements include: Lean tools and practices, Complementary resources, Lean principles and organizational capabilities, Lean performance and manufacturing capabilities, Strategic direction and advantage.

Struggles to implement tools may be more basic than efforts to achieve strategic advantage using lean levers but all elements may need to be addressed even in the more advanced lean companies. To assess the breadth of challenges addressed each element used as a scale and evaluated as:

0. Not in focus
1. Some attention
2. Considerable attention
3. Main focus.

Individual transformation and action orientation

The transformation orientation dimensions developed in Chapter 5 is applied to a set of interviewees from each pilot area within the three case factories used for the initial exploratory study. The framework consisted of four dimensions listed below.

Project thinking versus lean development

The tendency to perceive the pilot project as part of a wider lean transformation versus the tendency to perceive the pilot project as a discrete event not leading to any further developments (project thinking). This tendency is outlined along the following four positions:

0. No new goals, no need for change. New working conditions and frames have been setup, the area needs peace after project termination. The pressure for change was semi external – external to the pilot area but internal to the company.

1. Temporary needs for change and improvements of the production system arise during normal operations occur in terms of problems and deviations from status quo. Specific/local effects. Internal causes.

2. A stable need for gradual development of competences and skills. E.g. the need to engage further with some smaller set of lean tools and
practices. Other projects in other areas are prioritized in terms of improvement resources and seen as drivers of change.

3. Some vision of and initiatives towards an improved future state incorporating and strengthening lean tools, practices, performance, or manufacturing capabilities. The need is arising out of external factors such as market requirements and developments among peers. The potential effects are global and affecting the interaction with customers and suppliers.

**System-individual interaction**
The tendency to describe the surrounding system as rigid and un-influencable versus the tendency to perceive of many different levers to engage the system through. The tendency to differentiate between a static control system and a more flexible production system to be changed – as a means for excluding own actions from consideration versus the tendency to talk of improvement potentials also related to own behaviors and perceptions.

0. Zero perspective, being surrounded by systems with no option for constructive interaction
1. Competency – mastering a relatively stable technical or structural system
2. Competency – slowly developing the human system
3. Fluency – interacting with a dynamic system with multiple levers

**Goal operationalization**
The tendency to translate new ideas and goals into action plans and adopt a cybernetic control system to manage the realization of these goals versus the tendency to work with different levers and goals without operationalization or the tendency to not form goals.

0. No targets and visions
1. Operationalization of vision into targets
2. Targets based on analysis of improvement potential, operationalization of transition into action plan
3. Managerial review and follow up on action plan and results

**Initiative competency**
The tendency to identify a broad set of potential improvement areas and engage in actions to bring about change along these versus the tendency to engage in a joint blindness or passiveness towards certain kinds of improvement potentials. These tendencies are outlined as:
0. Problems and potentials overlooked
1. Options for action overlooked or deferred due to perceived lack of needed resources, Options for action postponed due to other priorities
2. Actions engaged in for reestablishment of status quo
3. Actions engaged in to ensure learning and development
Appendix Structured case and interviewee analyses, Factory Gamma

**Factory Gamma (V4)**

Figure 20 Factory organization in Factory Gamma - a hybrid between a functional and a team structure with logistic coordinators working in the operation teams but technical engineers working in functional departments reporting to the factory manager.
Individual orientations within Factory Gamma

Factory manager:

*Lean development orientation - level 3:*

To the factory manager the changes in area B demonstrated the future shop floor setup and work mode. The factory manager was oriented towards further lean development and had taken initiatives in several areas to further the transformation. However, it appears that he saw the pilot projects as the main drivers of change towards lean as several of the initiatives were aimed at preparing the ground for the pilot projects.

*System-individual interaction – level 3:*

The initiatives focused on culture, attitudes, and competences.

*Goal operationalization – level 1:*

Some goals were concrete – e.g. implementing information systems – but not thoroughly followed up on. Some goals were less concrete but could be considered to lead to more concrete transformation plans – e.g. the discussion and concretizing of the future organizational principles.

*Initiative competency – level 1, (3):*

Some ideas and visions were awaiting help from the programme – e.g. education of supervisors for a more proactive role in which they would engage more in involving
operators in problem solving and continuous improvement tasks, the building of competencies for setup reduction and carrying out further lean tools implementation. The initiative to implement information boards in the production teams was not followed up and as such it exemplifies a tendency not to operationalize goals. However, it appears that the initiative was engaged in to initiate the learning processes normally brought about by the pilot projects. Therefore the initiative competency may be evaluated higher than level 1 – deferment of action.

Area manager A:

*Lean development orientation – level 3:*

The area manager in area A was aware that he had “to keep stirring the pot” to keep a development process moving. He was challenging his staff to apply more of the lean principles introduced in the pilot area. For instance he engaged the staff in the task of standardizing change over procedures, in coordinating activities among different staff groups and shop floor on a daily basis, and in discussing local opportunities for improving performance rather than focusing on excuses for lacking performance.

*System-individual interaction – level 3:*

The many and varied initiatives engaged in by the area manager illustrate competency in the interaction with a complex system.

*Goal operationalization – level 1, (3):*

The area manager reviewed weekly output targets with his direct reports and discussed the outcomes of the initiatives or countermeasures agreed on in previous meetings. These discussions addressed targets, actions, and experiences. It appeared however, that several development initiatives had no clear target, and analysis was not used to identify potentials. It appears that to the area manager the development process was more important than the actual achievements and potentials.

*Initiative competency – level 3:*

Even though the staff in the area may not have had the resources to perform thorough analysis and skilled application of lean tools, the area manager did not hold back from working with lean tools to encourage learning and further performance development. The width of initiatives engaged in, indicates that the organization and the manager managed to identify and take into consideration many different types of problems. The process of challenging the organization to identify solutions to problems rather than excuses seemed to be more important than the achievements. That is, the challenge centered on creating
awareness of action potentials rather than directly creating action orientation to achieve agreed results.

**Supervisor A:**

*Lean development orientation – level 2:*

The supervisor in area A considered the lean transitioning as finished. He expressed that the current rate of dealing with problems within the team of support staff was satisfactory. He did not see the use of any improvement targets set from above as his focus areas were highlighted by the problems occurring in operations.

*System-individual interaction – level 2:*

Similar to the factory manager and area manager A, the supervisor in pilot area A interacted with the system using several different levers. He worked with ensuring machine stability, and with increasing team autonomy through improved conflict management. He envisioned that he would engage the operators in debates on the local interpretation and operationalization of the ten organizational principles outlined by the programme.

*Goal operationalization – level 1:*

The supervisor had a vision of more autonomous employees. Based on this vision he had some expectations to the staff in the area. The vision was promoted regularly when appropriate situations arose where employees could be challenged to address issues independently. However, the vision was not operationalized into plans or concrete targets.

*Initiative competency – level 1-2:*

In regards to developing the area, the level of initiatives engaged in is assessed as low. The supervisor did not judge the local organization capable of engaging further in 5S or SMED activities. In his perspective, this would require training performed by corporate experts. This is seen as an example of ignored options for action. SMED had been used as a tool during the pilot project in the area, so some awareness and knowledge should linger in the organization. Therefore the application of ideas from the SMED toolbox could not be considered out of reach even though the staff did not feel equipped to engage in such activities.

However, in regards to the daily operations, the initiative competency is assessed much higher. The supervisor was engaged in dealing effectively with problems on a daily basis to ensure smooth operation. Based on his description of these challenges it appeared that he engaged actively in any actions needed in relation to urgent problems.
Team coordinator A:
A couple of excerpts from the team coordinator:
- Interviewer: "This process of getting good ideas is that supported some how or systematized, if time is allocated for this?", TC: "No, it isn’t", Interviewer: "Would it be better if it was?", TC: "I am not sure, ideas they just pop up, you can’t say at this or that point we will have a meeting and then just bring along your ideas, I think we need to deal with them as they pop up”
- Interviewer: "Is there any goal for the things you work with, are there certain things you try to improve?", TC:" Yes, both productivity and efficiency and our quality and everything and then of course our climate out there”
- Interviewer: “Do you use standards”, TC: “yes we do”, Interviewer: “do you then sometimes change them?”, TC: “No, we do not tamper with the things implemented by the project - it works”
- TC: “Well, for this I have been allowed by [the supervisor] to – if there is anybody, any gossiping or rumorizing in the corners to say well, it ends here, drop everything and let us sit down at the table until this is solved” ... “so I have talked to them that well, take the initiative just one of you, and say ‘we are short on this and that and I don’t know how to order, I’ll go to the office’”

These excerpts indicate that the team coordinator was action oriented and dealt with both ideas and problems here and now. Actions were initiated when needed to make sure a rush-order would come through or when something deviated too much from some expected level, for instance when the internal gossiping, the delay in the technician work, or the failure among colleagues to seize responsibility became unacceptable to the team coordinator. In that sense, the team coordinator worked by a vision that was an improvement over the current state, albeit perhaps not big enough to operationalize. However, the team coordinator did not describe any vision of a transformed or leveraged area with increased capabilities or increased use of lean tools – this had already been achieved.

Lean development orientation – level 1-2.
System-individual interaction – level 2.
Goal operationalization – level 1.
Initiative competency – level 2.
**Area manager B:**

*Lean development orientation – level 2:*
The area manager in area B displayed project thinking and mainly focused on fine tuning systems. Lean implementation in other areas would take place in similar pilot projects driven by change agents from the corporate programme as this was seen as the best way to achieve results and ensure new competences.

*System-individual interaction – level 1:*
The area manager primarily appeared to perceive the production system as a stable technical structure as he primarily described interactions with the system based on structural levers such as for instance increasing worker flexibility to enable more precise manning.

*Goal operationalization – level 1:*
According to the area manager, the primary target in the area was improvements of delivery service and improved budgeting. The area manager had some ideas for this and these ideas would be implemented in a natural process of development of daily operations. It appeared that no change management planning would be needed as the changes were expected to be embedded in the structural system.

*Initiative competency – level 2:*
The area manager did not want to address the potential for improvement in neighboring departments; this should be deferred to future pilot projects run by the corporate change programme. However, other improvement potentials would be addressed when deemed reasonable. For instance the next round of budgeting and planning would also incorporate parts of the action plan format used in the pilot project.

**Supervisor B:**

*Lean development orientation – level 2-3:*
The supervisor in the newly finished pilot area was focused on finishing work station design and on maintaining new work modes with increased coordination, efficiency, and problem solving capability. At the time of the interview, the supervisor was heavily occupied with these finishing touches but it appeared that the level of activity would decrease once these things had been run in. Following the intense transition period, the supervisor expected to develop the skills of employees and team coordinators further - to an extent such that he would be able to supervise a larger area. This was a concrete
vision of a future lean organization but it drew on a small part of the lean toolbox. The achievement of the vision was expected to take place as a gradual development process.

**System-individual interaction – level 3:**
The supervisor engaged actively in changing the system, establishing learning and changing his own behaviors. E.g. he had moved his desk out into the production area to be available for quick interaction when problems arose. By this he wanted to demonstrate the kind of action orientation that he wanted to emanate the shop floor.

**Goal operationalization – level 1?:**
At the time of the interview, the supervisor worked against a concrete action plan outlined by the programme but it appeared that the goal was to complete the actions laid out in the plan rather than to continue developing new plans.

**Initiative competency – level 2-3:**
Action oriented. Regarding daily operations the supervisor preferred to focus on daily results rather than weekly performance. He engaged in the prevailing, temporary transformation process in a way so as to encourage learning and adjustments. E.g. the improvement of the problem solving process exemplified a focus on results that led to the engagement in the necessary problem areas.

**Operator B:**
For an operator from area B the challenge had been to digest and get used to the new roles. The interviewee expressed that employees had no role or interest in the problem solving process since technicians and supervisors were expected to deal with operational problems at a satisfactory rate. The hourly registrations of output problems were not seen as a driver for continuous improvements neither were they seen as necessary for ongoing daily coordination.

Employee: “we run [/operate] with three men [in our cell] and we run as many as we can get through and if things act up the others will not be able to do anything about it because we have to take it apart ourselves and find out what is wrong”

If employees saw some improvement potential in the cell layout or in the work balancing, they would voice this to the supervisor. Some employees had been concerned with the attitude displayed by the new team coordinator, these issues were discussed at a team building session aimed at improving conflict handling within the team. It appeared that without this session, the issue might not have been dealt with. The operator stated that among employees there was a general perception that greater notice was paid to the
problems they encountered and brought up. Problems could be aired at a daily meeting between supervisor and employees and it was thought that “the 20 witnesses” had a role in ensuring focus on implementing solutions. However, the operator expressed that the organization had not made a serious commitment to continuous improvements. Two examples of problems with incoming materials were described. In these examples the organization had not wanted to push the problem back to the suppliers nor initiate some corrective work that could have ensured a smooth production flow inside the cells. For some months such issues had taken up an hour of their time on a daily basis and the operator was troubled by the fact that the department was not credited for this work. The operator saw the project as a reestablishment of some former order and working rates and he expected that the area would undergo a similar second updating after an unknown number of years. In his cell they were good at balancing the work on an ongoing basis, shifting work patterns if problems arose at one station. Not all colleagues in other cells were so dynamic or able to think along those lines and therefore the operator did not feel that such approach could be spread or formalized. Even though he and other colleagues did not appreciate the team coordinator role, the operator did not see any way to change the distribution of roles better: OP: “[it was possible to discuss and find solutions within the team] as long as it is not stated in [the programme] because that is difficult, it is difficult to get anything changed that is written in [the programme]”

Lean development orientation – level 0.
System-individual interaction – level 1.
Goal operationalization – NA.
Initiative competency – level 2.

Summary of individual transformation orientation in Factory Gamma
The two pilot projects and possibly also other programme initiatives seem to have inspired or triggered some additional change initiatives in Factory Gamma. The major activities and initiatives identified in the interview data from Factory Gamma are itemized below. In the following section these initiatives are referred to using the correlating number in brackets, e.g. (V) refers to the introduction of electronic data collection in area A.

Factory level:
I. Interpretation process, concretizing future organizational principles
II. Implementation of boards for team coordination in other areas

Pilot A
III. Team building and conflict management (to be copied in pilot B)
IV. Finishing kanban implementation

Area A
V. Electronic system for collecting hourly output rates and operator comments
VI. Initiating daily coordination among support personnel on shop floor

Figure 22 Factory Gamma: Individual transformation orientation in area A and B respectively

Support initiative diversity in Factory Gamma
Appendix: Structured case and interviewee analyses, Factory Gamma

Pilot B

VII. Finishing cell design and stabilizing processes
VIII. Creating rules to ensure a flow in the problem solving process
IX. Creating rules and procedures that prioritize the customer orders rather than production orders

Area B

X. Introducing yearly action plans for the staff in the area similar to the 4 months implementation plans used for the pilot project

Lean challenges addressed in Factory Gamma

*Lean tools and practices – level 1 - some attention.*

The organization was working with establishing some lean tools and practices such as hourly registration. Other tools were identified as relevant but out of reach under the present circumstances. Tools considered out of reach included 5S and SMED for area A and the whole pilot package for area B. Area B would continue to work with cell design, balancing, and cross training but the present activities in pilot B were limited to low budget activities.

*Complementary resources – level 2 – considerable attention.*

Complementary resources are resources necessary to further the lean transformation along any lean measure – capabilities, principles, or performance. That is, the complementary resources are resources that are not usually related to leanness but may be identified as necessary to accomplish the lean transformation. In Factory Gamma the need for such complementary resources may be derived from the list of hindering circumstances and idealized states mentioned during the interviews. These include finances (for cell design), courses, training, competences or skills (for 5S and SMED activities and for increased supervisor proactivity), increased supervisor proactivity (for improved problem solving and involvement of operators in continuous improvement tasks), corporately driven pilot projects (for improvement of other areas), a shared vision built through interpretive processes (to establish lean behaviors). Within the organization, these needs draw attention in relation to the discussion of a lean transformation. However, most of these needs had not yet been addressed at the time of the interview.
All in all, considerably fewer activities aimed at supporting the transformation process were engaged in in factory Gamma in comparison to the two other case factories presented.

**Lean principles and organizational capabilities – level 1 – some attention.**

Within the list of idealized conditions some lean behaviors and principles appear, e.g. proactivity and operator involvement in continuous improvement. Also the introduction of electronic output measurements and team boards drew on the principles of measurement and visual control.

**Lean performance and manufacturing capabilities – level 1 - some attention.**

Cost and delivery were to some extend strived for as improvements of manufacturing capabilities through lean tools. Cost improvements were strived for especially in area B where a large productivity increase had been achieved and where cross training was identified as a further lever. Both area A and area B strived for increased delivery performance, this need was addressed through the newly added communication and coordination but traditional lean and JIT tools such as production leveling and increased supplier interaction were not pursued. However, no benchmarked targets were identified for changes in this direction; that is, performance improvements may be welcomed but lean targets of large improvements were not identified.

**Strategic direction and advantage – level 0 – not in focus in regards to lean efforts**

The vision in the factory was a more well-functioning organization, with larger spans of control, better communication, better interaction, and higher skills. No potential strategic benefit or manufacturing capability was mentioned as goal or outcome.
**Figure 23** Factory organization in Factory Beta - a functional structure without the team structure seen in Factory Alfa, Gamma, and Delta. Supervisors report directly to the factory manager.
Individual orientations within Factory Beta

Factory manager:

*Lean development orientation – level 3:*

The factory manager acknowledged that the transformation process required more than the rolling out of pilot projects. A discussion initiated with the middle management of how to merge local values with the future organizational principles exemplifies this. He spoke of the “mental transformation” as only 25% finished and expected that employees would not understand the vision of the transformation until the entire production has been tied together by FIFO lanes.

*System-individual interaction – level 3:*

It appeared that the factory manager had begun to develop a more varied approach and was developing a broader understanding of levers to use in the transformation. E.g. review meetings initiated with supervisors who had been engaged in pilot projects were on the one hand described as a simple lever to maintain behavior: “Just half a year ago – if I had stopped those meetings we would have landed back where we started within two days” but it appeared that the role of these meetings was changing: “We challenge each
other and question the goals we have and try to to create a forum where we can exchange ideas”.

**Goal operationalization – level 1-2:**
The factory manager followed up on targets and actions but it appears that target setting related to the "continuous improvement" phase following the pilot projects was not based on analysis and not operationalized into action plans.

**Initiative competency – level 0→3:**
It appears that for the first period of the implementation the factory manager ignored resistance among employees. There was a discourse in the factory of this approach “you will just do it [end of discussion]”. Thereby opportunities for improving the anchoring of the new principles and practices were ignored. According to the local human resource manager the factory manager was becoming more open to input and supervisors were becoming less scared of giving input. The discussion of the future organizational principles was one of the new reactions to the resistance and an opportunity to address the resistance in a constructive debate. Adding such dialogue and openness to the action orientation regarding tools implementation is considered to demonstrate increased competency for identifying and reacting to improvement potentials.

**Change agent A:**

**Lean development orientation – level 2-3:**
At the time of the interview the change agent’s main focus was the pilot projects and the follow up performed to ensure that new practices were maintained. But the transition to lean was seen as something more than the tools implementation. E.g. the change agent thought that they had been through a long mental journey with the employees in area A – mainly driven by the supervisor but also supported by the follow ups in terms of audits and other reviews performed by the sailor and the factory manager. And new lean challenges were expected to follow the initial round of projects. The change agent identified some future challenges of engaging the support staff more in driving continuous improvement and problem solving. The changes in area A were characterized as: "we have gotten another attitude that yes, we try to keep the area tidy, we fix the machines, I can hear something is wearing down let us react now ... so from being a place where no one wanted to work ... now they are more proud and they don’t just beat the stuff with a hammer as they did before"

**System-individual interaction – level 2-3:**
The change agent had a complex view of the system and saw the changes as entailing both structural and behavioral changes as well as changes in attitude and interaction patterns. The change agent used himself as a tool in the change process by role modeling and showing interest and openness towards criticism and input.

**Goal operationalization – level 3:**
Goal operationalization based on gap analysis, action planning, and follow up was an integral part of the pilot project approach and as such a condition for the change agent.

**Initiative competency – level 2-3:**
The main focus of initiatives engaged in by the change agent was to make pilot projects function. But it appears that the change agent took an active role in further developing the transformation as adviser or sparring partner for the factory manager.

**Supervisor A:**

**Lean development orientation – level 2:**
The supervisor talked of the phase the area was in as “now we just have improvements”. He shared this view with change agent A and the factory manager; they all talked of the transition as finished in area A even though preventive maintenance had been identified as the next challenge. The supervisor did not have any vision of a differently looking area or added capabilities – it appears that vision creation beyond the pilot implementation phase had not taken place within the organization. But the supervisor was open to new suggestions such as e.g. merging departments along the value stream.

**System-individual interaction – level 3:**
During the pilot project the supervisor had found himself between two parties – on the one hand having to support the project and on the other hand having to support and protect the employees. He engaged actively in this process and the follow up period where he among other things had instituted a competition to reach production targets. It appears that he was good at reading the needs of the employees and showed faith in them by taking a more relaxed approach to the changes and standards introduced.

**Goal operationalization – level ~2:**
The supervisor had not continued the project practice of using analyses to identify improvement potentials but he set concrete targets and followed up on them as he thought this was a motivating approach.

**Initiative competency – level 2:**
The supervisor did not appear to tend to defer identified options for action but his quest for improvements could be described as narrow. The employees in the area denoted the problem solving boards “repair boards” as they were mainly used to track repairs. Meanwhile frustrations about some problems with the FIFO system between departments were regularly aired but appeared not to be a topic for the problem solving processes.

Team coordinator A:
As no one else had been willing to take care of all the paperwork he had been appointed for the job as team coordinator even though he was one of the less experienced in the department. The team coordinator did not see his position as special, he did not interfere in the jobs of his colleagues but trusted them to know what to do, and all equipment issues were discussed in the team – he saw his main role as that of filling out the paperwork, keeping track of various information, and taking initiative to deal with equipment issues. The team coordinator did not express enthusiasm about the changes – e.g. the improved change-over time was mainly seen as a matter of employees running a bit faster admittedly combined with an improved work sequence. Recently another board had been added in the department to display the scheduled change-overs and the planned durations. The team coordinator expressed that this board had not been installed to help them – he saw it as unnecessary, mainly helping those passing through the department to read the status. But they had gotten quite an amount of repair out of the whole project participation and had also worked with a number of equipment improvements themselves afterwards. It was more rewarding to work in the department after it had been realized that the forging processes constituted the bottleneck of the production.

The team coordinator expressed that little by little the various things fell into place and some things had also been taken off the agenda again. He described the phase the area was in as “pure maintenance [off machines]” and some repairs and equipment updates were on the agenda. The problem solving board had gotten the status of a “repair board” displaying all the necessary repairs and was not used for other kinds of problems such e.g. problems in the FIFO system between departments or suggestions for more efficient paperwork – “we don’t concentrate on that, those things that are running”. Ideally though they would skip some of the paperwork and registrations. They would also like to see investments in a new forging machine with higher capacity and some robots for deburring rather than the present instable deburring equipment that took up a lot of their time for
frequent adjustments. Employing more people for the area was also mentioned as a potential improvement.

**Lean development orientation – level 1:** No need to work further with neither the lean systems nor the human system; only the technical system needed updating on occasion / when new equipment was available. Main need identified was to improve their work conditions.

**System-individual interaction – level 1:** Saw a technical system – main interaction: Repairs

**Goal operationalization – NA:**

**Initiative competency – NA:**

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**Supervisor C:**

**Lean development orientation – level 2:**

The supervisor of one of the assembly areas involved in the second corporate pilot project (C) thought that the area had been too efficient to allow for any radical improvements. Financially he did not see the benefits from the project but he hoped that the choice of project area was grounded on some strategic motives. He acknowledged that both he and the employees had learned from the project; the employees had become better at dealing with issues occurring during operations, the flow allowed for a better understanding of the interrelationships between stations, and the employees had a bigger role in problem solving in terms of bringing up problems and receiving information on the implementation process. The area had reached a state where the supervisor could leave more responsibility to the team coordinators. But the area had also run into a deadlock where tough-to-solve problems blocked the flow in the problem solving process. The supervisor hoped that these problems would be solved soon and thereby clear the way for more throughput in the problem solving process again. Except for these improvements the supervisor did not foresee any larger changes or improvements and expressed that the area mainly needed peace and quiet to settle with the new systems.

**System-individual interaction – level 1-2:**

The supervisor was mainly concerned with technical and structural aspects but also hoped that the problem solving process would have behavioral effects such that “everybody can feel the effect that when suggestions are put forward it is taken care of ... the tough message though is that it has to be things we can handle ourselves ... so it is still the low hanging fruits that we actually have picked a couple of times”. Developing skills would mainly be a matter of practicing the new approaches in the group, e.g. regarding
fact based decision making: "earlier ... we would also stab a bit in the dark and there we now take greater care, that now there has to be data to back it up to be absolutely sure".

**Goal operationalization – level 1:**
At the time of the interview the supervisor’s goal was to establish peace in the department. This goal was not operationalized but pursued when occasions arose.

**Initiative competency – level 1-2:**
According to the supervisor, problem solving of the most important problems in the area was dependent on central technician and engineering resources but the limited access to these resources slowed down the improvement process. The area had resources to and was also used to dealing with minor technical issues on its own. But it appears that there could have been other possibilities for improving the area if the focus of the problem solving had been shifted away from the technical issues. E.g. an operator from the area said in her interview that she had come up with a refilling procedure that allowed her to spend more time on her other duties but her colleagues did not show any interest in such an improvement. It appears that this constituted one area that could be dealt with within the department.

**Operator C:**
An operator from area C exemplified the "system-individual interaction view" of being surrounded by systems with no real option for constructive interaction. The area had taken part in several three letter initiatives during her employment and the latest was not the most welcome. The employees had played a different role in the TPM project that had run in the past. The area was settling in and the changes were no longer felt as unfair. But the change process was seen as very unfortunate – partly because experiences from a subproject were not used to alter the sequence of the overall project – the operators had without effect pointed out that the equipment needed to be stabilized before it was brought together in a cell to minimize operator stress. The problem solving process focused only on technical issues and the department had no influence on the amount of resources they would get for the problem solving. The auditing had become a ritual with routine answers and did not help the employees in any way. New production targets would be set for their department but they had no influence on the target setting and no levers to use to improve performance. The operator did show some excitement about the possibility to engage in changing the work procedures and learn new skills. Together with the change agent she had come up with a suggestion of how to improve the refilling of all...
the stations on the automated equipment so that they would only have to go one complete round every hour rather than having to run every time a station was running out of parts. But her colleagues thought that approach was ridiculous. She was interested in learning new skills e.g. small repairs that would make her more autonomous in her work but again she was not sure this would be possible due to the attitudes of her colleagues.

*Lean development orientation – level 3: Would like to learn and develop further.*

*System-individual interaction – level 0.*

*Goal operationalization – level NA.*

*Initiative competency – level NA.*

**Summary of individual transformation orientation in Factory Beta**

![Diagram showing the transformation orientation in Factory Beta](image)

*Figure 25 Factory Beta: Individual transformation orientation in area A and C respectively*

**Support initiative diversity in Factory Beta**

The programme in form of the roadmap was driving the implementation efforts in the shape of projects. In the two pilot areas A and C some adjustments had taken place to make the system better suit the operators. In addition to such local adjustments it appears that the factory manager was in the process of adjusting the overall approach to accommodate for operator needs and also to leverage the pilot areas. The major activities and initiatives identified in the interview data from Factory Beta are itemized...
below. The following section relates to these letters in brackets, e.g. (IV) refers to the initiative of establishing FIFO lanes.

Pilot A
I. Building motivation through internal competition and added autonomy
II. Numerous equipment repairs and investments
III. Preventive maintenance set as next goal for the area

Pilot B
IV. FIFO lanes and planning rules between departments A and B

Pilot C
V. Establishing a calm period by accommodating for operator needs and suggestions
VI. Lowering the ambitions for the problem solving process to avoid deadlocks

Factory level:
VII. Translation process, concretizing future organizing principles
VIII. Attaching steering boards to internal projects
IX. Expanding the exclusive forum of the weekly review meetings

Pilot D
X. Incorporating more involvement and less ambitious targets in local pilot projects

Human resource manager
XI. Preparing future pilot project areas through a lean game
XII. Mapping new competence needs, focusing on self management and cooperation

**Lean challenges addressed:**
*Lean tools and practices – level 3 – main focus.*

The planned roll out of projects would establish a range of lean tools and practices. After the projects some tool orientation remained. In area A the team had worked on continuously reducing change-over times and increasing output. And more than a year
after the project finished preventive maintenance had been identified as the next lean practice to start adopting.

**Lean principles and organizational capabilities – level 2 – considerable attention.**
The factory manager had laid out a firm line insisting on using audits and weekly reviews. This focuses both on insistence on lean tools and practices maintenance as well insistence on the application of lean principles such as fixed review cycles, and solid platforms of standardized procedures. Furthermore the roadmap was designed to establish visibility in the production planning and control system.

**Complementary resources – level 2 – considerable attention.**
Several complementary resources were in focus in the organization. The supervisors engaged in initiatives (such as (I, V, VI) mentioned above) to build motivation and reduce frustration. The human resource manager was taking initiatives such as (XI, XII) to establish employee competencies to engage constructively in the projects and new systems. The change agents were listening to employees and staff and taking a more involving and appreciative approach in order to establish commitment and reduce resistance. The factory manager established steering committees for the projects to ensure political backup for the projects and he engaged the organization in discussions of the future organizational principles to create a shared vision that could facilitate commitment and involvement.

**Lean performance and manufacturing capabilities – level 1 – some attention.**
As explained by change agent B the purpose of the pilot projects was to establish reliable processes which would facilitate the introduction of FIFO or other pull systems throughout the plant. But the pull system will not bring about any increased manufacturing capability. The vision of the future state was a factory that was well run (which was also the image of the current operation) and which incorporated the lean principles of visibility, cycle timing, more workplace organization, and visual management. Goals were set up for reduced change-over times and increased output in area A but the targets were the traditional 5% yearly improvement rates that had also been used in the past. No strategic outcome of the transformation process was mentioned.

**Strategic direction and advantage – level 0 – not in focus.**
Appendix Structured case and interviewee analyses, Factory Alfa

**Factory Alfa (V2)**

Figure 26 Factory organization in Factory Alfa - a team structure with both planning and engineering staff in the teams.

Figure 27 Productivity numbers from area A+B and C in Factory Alfa
Individual orientations within Factory Alfa

Factory manager:
Both the supervisor A1 and the factory manager told amusing stories about the operation approach before the pilot projects where they had been buried in piles of work in progress. It appeared that the factory manager had bought into many of the ideas laid out by the programme. He used the audit system provided by the programme and also invited the programme managers to perform audits in his area as a way to steer the direction of new initiatives. He mentioned several improvement areas – they had focused on material planning and control and on reducing the lead times so that production could be driven by need rather than parts availability. He thought that since only smaller production areas had been left untouched by pilot-like projects the factory did not need more pilot projects but rather kaizen events. In the future some departments could be linked in a flow but presently machine reliability and quality did not allow for this. In fact inspection between departments were being planned as a means of sealing in the semi automated assembly cell. He felt that the organization lacked some analytical competences – their knowledge was still too shallow and therefore he would also postpone potential outsourcing to China. He thought that moving towards continuous improvements – away from firefighting was the biggest challenge for the area. But the use of action plans was an attempt to work more structured and focused. The factory manager engages in any initiatives but they are not as diverse as in other factories. It could be argued that the frustration in pilot area A signaled the need to engage in other types of initiatives.

*Lean development orientation – level 3.*

*System-individual interaction – level 3.*

*Goal operationalization – level 3.*

*Initiative competency – level 1-2.*

Operations manager, area A+B:
The operations manager for the value stream in which project areas A and B were part had only recently been hired. He had worked with lean in another company before and thought that top-down programmes were not necessary to develop operations – this was a task of the local management. Even though his product line was subject to low margins he felt that the threat of competitors and the motivation to become more lean was not so high in the company. Yet he acknowledged that there was an improvement potential. E.g.
he thought that project A had caused considerable turbulence in the factory and created some conflicts that the supervisors tended to cover rather than solve. He thought that supervisors should become more active in continuous improvements and take on a new role – therefore he did not want to run more projects in the area at the time even though he assessed that the area lacked knowledge to go much further. He felt that more employees could be involved in the improvement work of the production technicians. He had been the driving force behind lowering production targets following 1½ year of “red numbers” on the hourly registration board. He thought that area B had become too trimmed and thought it was problematic that the operators were not dragged into continuous improvements in the area. Similarly he had prioritized to take out one hour of production time for scheduled weekly maintenance.

**Lean development orientation – level 3:**
The operations manager gave an impression of having many goals and ideas and many initiatives.

**System-individual interaction – level 3.**

**Goal operationalization – level 2:**
He had many ideas and initiatives that were brought into life. It is not clear that these were based on thorough analysis it appears that they were rather taken as countermeasures to the poor development witnessed in the organization when compared to previous workplaces.

**Initiative competency – level 3:**
The operations manager had engaged in a range of initiatives to establish a smoother production and to ensure development.

**Supervisor A1:**
The area supervisor who had taken part in the pilot project had changed position within the factory half a year after the project had finished. At the time of the interview he was managing the maintenance department. He was interviewed due to his extensive knowledge of the pilot project. His statements are analyzed here as his commitment to lean principles illustrates how lean diffused into the surrounding organization.

**Lean development orientation – level 2:**
During the time as supervisor for the pilot area he had been focused on sustaining new practices and implementing corrective actions to bring up the productivity level. In the
new job as manager of the maintenance department he was focused on creating lasting improvements in terms of machine up time and reliability.

"there is always going to be a bar on the graph that is the biggest one and that is the one we will pursue - for the next ten years - and for some of them we come to realize that there is no way around changing the machine layout".

External pressures and global effects were not mentioned.

System-individual interaction – level 3→1:
During the pilot period the supervisor had been actively engaged in bringing about change on several levels. In the job in the maintenance department he was focusing on the technical system as manageable and to a smaller degree perceived mentality or attitudes as potential development areas.

Goal operationalization – level 2-3:
New initiatives in the maintenance department were based on pareto analyses of breakdowns. More extensive initiatives were operationalized into 8 week action plans that formed the basis of managerial reviews upwards in the organization. The results of daily activities were reviewed in daily meetings between team coordinators and supervisors in the various areas drawing on the maintenance department.

Initiative competency – level 2:
Data analysis and actions plans had been incorporated in the maintenance work as improvements of work procedures. Other than that most initiatives were result oriented - focused on improving machine stability rather than focusing on improving maintenance work procedures.

Supervisor A2:
A new supervisor had been employed for pilot area A half a year after the pilot project had finished. When the new operations manager arrived a year or so later the supervisor had not participated in any lean training but at the time of the interview there were plans for him to follow another pilot project in a neighboring factory as a mean of gaining some insight in the principles behind the practices implemented in area A. During the interview the interviewer's impression was resistance – the supervisor appeared quite aggressive and was reverting some of the implemented changes. Revisiting the interview later it appeared that the supervisor had been highly concerned about the impact the project had had on his employees and it appeared that their experiences was his main input for the job. Some of the changes the supervisor had conducted included: Making sure that the
planner did not short-cut the kanban system with rush orders, agreeing with operators that hourly registrations were not useful and throwing the hourly registrations in the trash can every morning, cancelling the daily follow up meetings in the area, and changing the productivity measure back from piece per man-hour to some previously used measure (most likely an efficiency measure in terms of produced labor hour per actual labor hour). Except for the measures to adhere to the kanban system it is not clear that these changes were constructive and would add to the performance and continuous improvement in the area. But the supervisor was concerned with creating trust and showing the operators that he had faith in them and their competences. The area had gone through an organizational development initiative called “welfare seminar” organized by the company psychologist to improve the climate in the area. The supervisor thought that these initiatives were beginning to pay off; employees were more committed to their work and the area implemented two improvements per week. The operator initiative mentioned during the interview included technical improvements, cleaning, and design of check sheets. The supervisor was not against lean as such and thought initiatives would continue but the pilot project had resulted in some unfortunate conditions that needed to be adjusted. Also problems with repetitive work was in focus.

*Lean development orientation – level 2.*  
*System-individual interaction – level 2.*  
*Goal operationalization – level 1:*  
The supervisor had a fuzzy goal of establishing more trust and generally felt that improvements had begun to last in the sense that the same problems no longer reoccurred as previously. That is, neither targets nor goals were operationalized.  
*Initiative competency – level 2:*  
The supervisor engaged in several initiatives to revert the negative impact of the pilot project. But the approach taken was not aimed at learning and development.

*Team coordinator A:*  
The hourly production targets were seen as unrealistic as only the best operators could meet them – and only by working very focused for the entire 60 minutes. The operators thought that the targets should be feasible for less productive workers too and that personal time should be allowed for in the targets. The hourly registrations were seen as pointless and time-consuming – the team coordinator felt that there would always be a
sound reason for being behind schedule, e.g. change over, lack of materials, or no orders. The team coordinator performed the registrations but had also introduced some other registrations that displayed the progress according to the weekly targets for various products rather than only according to the hourly targets. It appeared that this was a better input for their internal coordination than the hourly issues. She felt that it should be feasible to collect output registrations electronically and would like to see them displayed on screens at the machines.

The team coordinator said that they had now gotten used to the smaller order sizes and some of the other changes even though this had caused considerable frustration during the pilot project. Also the kanban system was seen as providing a good overview and control of the production tasks. And the grouping of CNC machines in one area was welcomed.

It appears that the team coordinator was not against the use of productivity targets, ongoing measurement of production outcome and follow up, or operator driven continuous improvements. But she thought that the changes should have followed their logic and taken their values and work conditions more into account and she was working against the changes for the same reasons.

*Lean development orientation – level 1.*

*System-individual interaction – level 0-1:*

The team coordinator and operators may not have had competences and voice to deal with the surrounding organization in a constructive way. So on the one hand the team coordinator was lashing out after anything associated with the project without attempts to see any positive effects of the introduced systems. On the other hand she and the team felt quite competent in their dealing with machine issues – *their* system.

*Goal operationalization – level 2:*

The re-introduction of two separate work roles; manual work and monitoring work is seen as an example of a carefully planned change including hypothesis and action plan.

*Initiative competency – level 2.*

**Supervisor B:**

*Lean development orientation – level 2:*

The projects were seen as the main step towards lean. Further challenges primarily lay in creating more autonomy and commitment. But the supervisor did not see the need or pressure for new changes of the same order.
**System-individual interaction – level 2:**
The supervisor had worked as a sales person before and felt that selling was a good approach to change management. He felt quite competent in this approach. But did not appear to recognize opportunities for qualitatively different work modes or any change levers with any larger potential than this "slow development approach".

**Goal operationalization – level 1, (3):**
During the post project period the supervisor had slowly been selling his ideas to his employees but did not appear to pursue specific targets. During the project however he had played a big role in a highly operationalized implementation.

**Initiative competency – level 0-3:**
While initiatives were taken to develop the autonomy of the area and especially the team coordinators’ competencies it appeared that other opportunities for development were overlooked. Problem solving was mainly focused on reaching or maintaining output levels and in fact other interviewees stated that the area was run so tight that the employees had no time to think about and participate in problem solving.

**Team coordinator B:**
The team coordinator of the day shift had worked in the area for 30 years. Initially she had objected to the idea of changing from sitting to walking but it had turned out that her back pain had diminished following the change. She was quite enthusiastic about the change. She thought that following the changes the support organization had put bigger emphasis on dealing quickly with technical problems. Earlier, problems and improvement ideas had piled up.

She was in the process of teaching her colleagues one by one how to do setups on a machine. Such increased autonomy was welcome as it enabled the area to go ahead with the tasks without having to wait for other resources. She had not been informed about any upcoming changes and did not know if any changes were going to happen in the area within the next years. She could not identify any learnings from the change and did not appear interested in any further development. She had asked the supervisor to be given leave from participation in daily problem solving meetings as the discussions focused on machines and things she had no input to.

**Lean development orientation – level 0.**

**System-individual interaction – level 1.**
She mastered the daily supervision and coordination and saw the production task and the system as quite stable.

*Goal operationalization – level NA.*

*Initiative competency – level 2.*

**Supervisor C:**
The supervisor showed high trust in the operators and gave them considerable room. E.g. the SOPs did not include a time standard – he thought that perhaps they would in the future but he did not expect everyone to work in the same speed. The operators organized overtime on their own – their responsibility was to produce quality products and meet the deadlines. The operators were working to standardize their work benches but were not expected to switch to a floating setup without individual work areas. Operators could look some days ahead on the order list to see if they could combine orders to complete more of the same kind in the same go as long as it did not jeopardize delivery service. The supervisor was not aware of any requirements or goals regarding the use of hourly registrations but referred the interviewer to the operations team manager regarding such issues. The supervisor did not expect the employees to play a big role in continuous improvements – if they had any suggestions they would bring them forward but most improvements would be dependent on the mechanical engineers that had to alter the design of the products.

*Lean development orientation – level 2:*
Some goals had been setup for the area including the use of some lean tools and principles. But the supervisor did not appear to perceive these goals as something that would change the area or the performance substantially.

*System-individual interaction – level 1:*
The supervisor was not focused on mindset or attitudes; he was more concerned with the production system as a stable and manageable system.

*Goal operationalization – level 1:*
Targets were not operationalized into action plans in the area. The supervisor would take care of his improvement tasks every now and then when he could find some time.

*Initiative competency – level 1:*
On the one hand it appears that the supervisor did not consider the area to have a large improvement potential. On the other hand initiatives in several areas were on the agenda.
– also initiatives that introduced practices that were new to the supervisor. It appeared that these initiatives had not been introduced by the supervisor.

**Team coordinator C**
The team coordinator in the area felt that they as operators had been quite involved in shaping the new systems. The work had not necessarily become easier but new challenges were in focus now as the short lead time demanded quick coordination. He was not sure that productivity had risen but delivery performance had improved. The team coordinator appeared to take ownership for the development goals of the area, e.g. "we wanted to reduce the delivery time – we knew it was a request from the customer". He felt that the area should work more with team building in order to engage better in problem solving. He also thought that they ought to start prioritizing time for improvements but the area had been busy for the past couple of months. In the long run however he thought that "it is a question whether we can afford not to do this [taking time out for improvements]."

*Lean development orientation – level 3:*
He was interested in continuing the work rather than viewing the change as a one time project. Even though the team coordinator may not have had knowledge of other lean tools and practices to draw on he was one of the few interviewees who foresaw global effects of improving / not improving fast enough.

*System-individual interaction – level 3.*
*Goal operationalization – level NA.*
*Initiative competency – level 3.*

Even though the interview did not center on examples of initiatives taken it appears that the team coordinator held learning and development as a goal. He talked of his work in a competent manner also indicating the competencies of the team. No obviously overlooked improvement areas were evident from the interview.

**Summary of individual transformation orientation in Factory Alfa**
Support initiative diversity in Factory Beta

Also in Factory Alfa does the roadmap have a driving role in the transformation.

The major activities and initiatives identified in the interview data from Factory Alfa are listed and numbered below. The following section relates to these numbers/letters.
Appendix Structured case and interviewee analyses, Factory Alfa

Pilot A
I. Building trust through less tight control
II. Reversion of some changes such as separating manual and monitoring work
III. Deemphasizing hourly registrations and implementing order registration instead
IV. Broadening the application of kanban

Pilot B
V. Using simulation to gain operator buy in and suggestions before implementation
VI. Taking the team coordinator off the problem solving participant list
VII. Delegating change-overs to operators

Area AB:
VIII. Involving supervisors in lean practice audits performed by plant management and programme consultants
IX. Team building and well-being seminar for operators
X. Using 8 weeks action plans for support team
XI. Planning to introduce SPC and inspection between machining and assembly

Pilot C
XII. Using a more holistic approach to internal pilot project: Drawing on customer requests and involving operators
XIII. Extending the use of SOPs and kanban, improving workplace organization
XIV. Planning to start using action plans and follow up and to focus on root cause problem solving after delivery issues have been reduced

Factory level:
XV. Cross training for increased flexibility
XVI. Scheduling time for preventive maintenance
XVII. Reduced review frequency
XVIII. Organizational changes, new operations team manager and training of new change agent

Lean challenges addressed:

*Lean tools and practices – level 2-3 – considerable attention – main focus.*
Via the local projects more or less drawing on the pilot project tool box several lean tools and practices was widely diffused in the factory. Furthermore the organization worked on extending the application of tools such as kanban, lead time reduction, preventive maintenance, process capability measurements, and cross functional training.

Complementary resources – level 1 – some attention.
Several organizational changes had been carried out especially regarding the white collar teams and a new change agent had been hired to replace the former change agent who had left for another job. These changes should ensure organizational back up to the lean transformation which may be seen as a complementary resource. Regarding the blue collar part of the organization the factory was still marked by the resistance arising from the first pilot project two years after project finish. The supervisor in the area was working on reducing this resistance – but perhaps in a unconstructive way – agreeing with employees that systems were useless. The factory manager would like to use incentives to change employee behaviors hoping that this would eventually lead to change in attitudes. But this was not possible within the company agreements. Since resistance and frustration existed two years after project finish and since most initiatives were directed towards ensuring quality and delivery it appears that reduction of resistance among employees was not prioritized highly.

Lean principles and organizational capabilities – level 2 – considerable attention.
Rather than aiming for a range of complementary resources the factory manager was aiming more directly at establishing some lean principles and organizational capabilities. The operations teams were challenged to familiarize with and work with some lean practices such as kanban, SPC, preventive maintenance. These efforts were planned and followed up on via 8 weeks action plans. Furthermore root cause analysis was targeted as an important capability.
This is seen as attempts to establish capabilities for continuous improvements extending beyond the technical equipment focus found on shop floor.

Lean performance and manufacturing capabilities – level 2 – considerable attention.
Performance especially in terms of costs, quality, and delivery were directly targeted. The quick diffusion of lean cell layout is seen as a commitment to achieving productivity results. The reduced setup time and batch sizes resulted in reduced lead times. And SPC
was engaged in to reestablish quality levels / reduce quality costs and to enhance process knowledge which in turn would enable the organization to analyze the possibilities of outsourcing.

Strategic direction and advantage – level 1 – some attention.
In area C the project had been targeted at reducing lead time from weeks to days. This is seen as an attempt to ensure strategic advantage through the application of lean as customer requests were moving in this direction.

Comparison across cases

![Figure 29](image-url) Average transformation orientations between interviewees from the three case factories
Figure 30 Amount of focus put into different types of lean transformation challenges.
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