

The effects of lean management on organizational structure and the type of innovations influenced by this structure

Maarten Siemerink
University of Twente
P.O. Box 217, 7500AE Enschede
The Netherlands

m.g.j.siemerink@student@utwente.nl

maarten_siemerink@hotmail.com

Through the fast changing pace of today's environment, organizations are challenged to innovate more than ever, to adequately respond and adapt to these changing conditions. It has become increasingly important for firms to be able to balance exploitation with exploration, to achieve sustained organizational performance. So, how do organizations organize their innovations? Earlier research has mainly focus on larger firms and how these firms organize innovations, through their structure. However, still little is known on how SME structure the organization of innovation. Above all, this research did not focus on randomly selected SMEs but on SMEs engaged in lean management. This, because it is suggested that SMEs engaged in lean management will focus on increasing efficiency within the organization by pursuing exploitative innovations. The aim of this research was therefore to investigate and explore the organization of innovation in SMEs, after implementing lean. So, how is lean management influencing the organizational structure and if this organizational structure has an impact on the balance between exploitation and exploration. The findings of this research suggest that current literature is incomplete in its assumptions about positive and negative relations between different organizational variables and the types of innovation. In addition, this research shows that there is not only a one-to-one relationship between organizational structure and innovation, but also a reversed causality between the two, indicating that current literature might not be completely right about generalizing innovation as being dependent on organizational structure. Furthermore, this research indicates that there is an insignificant influence of organizational structure in SMEs, which are engaged in lean management, on the organization of innovation.

Supervisors: Matthias de Visser and Sander Löwik

Keywords

Lean Management, SMEs, Organizational structure, Structural variables, Product innovation, Explorative innovation, Exploitative innovation,

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1. INTRODUCTION

“Despite the immense interest in the ‘management of successful innovation’ since the 1960s, by practitioners, consultants, policymakers, and academic alike, it is interesting to see that, thirty years on, Dougherty and Hardy found that the creative and innovative potential of individuals was still impeded within many organizations” (Conway & Steward, 2009, p. 240). Past studies mainly focused on the remaining challenge organizations are facing, namely “realizing the adoption of a mode of organizing that encourages innovation and creativity, allows flexibility and agility to respond in a timely manner to changes in the environment, and facilitates integration and coordination both internally, between subunits, and externally, with relevant stakeholders” (Conway & Steward, 2009, p. 240). Emphasizing the seminal work of Burns and Stalker (1961), they argue that mechanistic structures - which rely on standardization, centralization, and hierarchy - support efficiency, whereas organic structures - with their high levels of decentralization and autonomy - support flexibility (Raisch & Birkinshaw, 2008, p. 380), while Duncan (1976) suggests that organizations require both structures: organic to create innovations and mechanistic to implement and deploy them (Raisch & Birkinshaw, 2008, p. 380). The above illustrated examples of research that has been carried out, are framed differently from each other but all encapsulate the challenge of using organizational features that make efficiency and flexibility possible. The findings of these empirical works could serve as a sort of guidance as to which modes of organizing can either encourage or impede innovation within organizations.

It is important to understand what is meant by the ‘*organization of innovation*’: “organizations organize, through their structure, culture, systems etc., to support and promote innovative and creative activity” (Conway & Steward, 2009, p. 242). For the purpose of this research the focus is on how organizations, engaged in lean management, organize innovation in terms of organizational structure (e.g. specialization, functional differentiation, formalization, vertical differentiation). When talking about the ‘*organization of innovation*’ it is highly relevant and inevitable to distinguish explorative innovations from those that exploit current knowledge, because these are two conceptualizations of innovation types, which could both be seen as required when organizations want to strive for sustained organizational performance (Tushman & O Reilly, 1996, p. 24). This operationalization can be defined more precisely by framing exploitation (i.e. incremental) innovations, as innovations which advance existing technology, and explorative innovations (i.e. radical), as innovations which develop new technology (Greve, 2007, p. 947). So, what about incorporating the notion of ‘*lean management*’: Is there a specific mode of organizing and structuring its implementation? And if so, will its structure have an impact on innovation?

Extensive research has been carried out to investigate the interrelatedness between lean management and innovation. However, earlier research did not explicitly state that lean management influences the structure or emphasized that lean management has an impact on the organizational structure, but does not specifically address how different factors of organizational structure will be affected. It is said that the concept of lean and the concept of innovation are two different concepts with sometimes conflicting objectives and therefore also different organizational structures. This interesting link between lean management and innovation will be explained and investigated more extensively later on in this research, to see if the development of the balance in innovation in terms of exploration and exploitation will change after organizations are engaged in lean management.

The aim of this research is to investigate and explore the ‘*organization of innovation*’ in SMEs after implementing lean. The **research question** is therefore:

How is lean management in SMEs affecting and influencing the organization of innovation, in terms of organizational structure?

The research question is composed of and strengthened by incorporating the following **sub-questions**:

1. *What is the impact of lean management on different dimensions of organizational structure?*

2. *How does the organizational structure, influences innovation on an incremental and radical level?*

Innovation streams, the ability of a firm to host both incremental as well discontinuous innovation is one way to operationalize exploitation and exploration (Tushman, Smith, Wood, Westerman, & O'Reilly, 2010, p. 1332). This operationalization can be defined more precisely by framing “incremental innovations, as innovations which advance existing technology, and radical innovations, as innovations which develop new technology” (Greve, 2007, p. 947). Radical innovations fit the definition of exploration because development of new technology is a form of knowledge development. This distinction is consistent with those researchers who define technology in terms of its knowledge component (Greve, 2007, p. 947). However, the above described distinction need some further clarification and elaboration, because it defines innovation as radical with respect to the industry as a whole. To make the definition applicable to firm-level research on exploration and exploitation, this research defines the extent of explorative innovation as its technological and market novelty for the focal firm (Greve, 2007, p. 947). Researchers have emphasized novelty in the technological and market domain as a useful criterion. “Since, innovations that are technologically very different from existing products have lengthy and unpredictable development durations, and innovations that address unfamiliar markets have unpredictable market success” (Greve, 2007, p. 947). In addition, firms can choose not only the extent to which they seek to innovate, but also whether to emphasize exploitation innovations or exploration innovations (Greve, 2007). In the field of the ‘*organization of innovation*’, substantial research supports the fundamental insight of March (1991, p. 71) who has argued that sustained organizational performance is associated with a firm’s ability to balance exploitation with exploration (e.g. He and Wong, (2004, p. 481); Raisch, Birkinshaw, Probst & Tushman, (2009, p. 685); Tushman & O Reilly, (1996, p. 24)). This balancing challenge refers to considerable research describing ambidextrous organizations, which are capable of simultaneously exploiting existing competencies and exploring new opportunities. “This in contrast with earlier research mainly focusing on the the trade-offs between these two activities as insurmountable” (Raisch et al. (2009)). The notion of exploration-exploitation has been studied in a wide variety of literatures, including organizational design (e.g., Tushman & O'Reilly, (1996)), which can be seen as an important and interesting stream of literature where this research wants to contribute to. The concepts of exploration and exploitation have been employed in various contexts such as technology development and product innovation (e.g. Greve, (2007) ; He & Wong, (2004); Tushman et al., (2010)), strategic alliances (e.g. Lavie & Rosenkopf,

(2006)) and senior-management teams. The context of this research will be product innovation, in which the '*organization of innovation*', including the notion exploration and exploitation will be investigated at the organizational level (e.g., Benner & Tushman, (2002); Greve, (2007); Jansen, Van Den Bosch, & Volberda, (2006)) of SMEs. A majority of the studies at the organizational level, some interesting examples are mentioned above, refer to organizations in 'general' (i.e. literature in which no clear distinction is being made between large, mature organizations and SMEs) or refer to large, mature organizations. There are different antecedents of exploration and exploitation in different contexts, including environmental factors such as dynamism, competitive intensity and exogenous shocks. Besides, the tendency to explore or exploit is also affected by an organization's history captured by its age, size, slack resources, absorptive capacity, organizational structure, and culture. "Finally, managerial biases may drive the organization toward exploration and/or exploitation" (Lavie, Stettner, & Tushman, 2010, p. 118). In this study the focus will be on the important parameter '*organizational structure*', in the context of product innovation.

By focusing on SMEs, this study wants to contribute to the innovation and organization design literature by empirically describing the relation between the '*organization of innovation*' and the implementation of lean, in a convenience sample of eight SMEs. Past studies mainly focused on investigating large, mature organizations. SMEs and large, mature organizations face fundamentally different structural challenges and therefore a distinction between the two different types of organizations is essential. "The relative strengths of large firms lie mostly in resources and are predominantly material (e.g. economies of scale and scope, financial and technological resources, and so on), while those of SMEs are generally argued in terms of behavioural characteristics (e.g. entrepreneurial dynamism, flexibility, efficiency, proximity to the market, motivation)" (García- Morales, Lloréns-Montes, & Verdú-Jover, 2007, p. 552). So, the innovation processes of larger firms are typically more structured and professionalized. "As SMEs grow they increasingly develop and apply formal structures, also marked by recruiting specialized workers, and introducing managerial layers, rules and procedures" (Van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009, p. 426).

Incorporating the notion of '*lean management*', this study specifically investigates the organizational structure, which supports the organization of innovation, after implementing lean. Earlier research that is been carried out by Lewis (2000) and Mehri (2006), is about the interrelatedness between lean practices and innovation. In the three companies investigated by Lewis (2000), two of them supported the hypothesis that lean practices will result in an overall decrease in organizations' innovativeness. This because, "the study reveals that the more successful lean principles are applied in an organization, the more focused the organization tends to be on incremental production changes, and the less innovative activities are involved. Since the process of innovation requires greater lengths of experimentation and higher levels of risk, they are usually eliminated from the task list at an early stage" (Chen & Taylor, 2009, p. 828). Based on observations in the Toyota Production System, Mehri (2006) illustrated some of the negative effects of lean design process on product innovation. "Since the focus of lean is on eliminating all forms of waste, Toyota is forced to outsource a large part of new product designs from other companies rather than supporting technological innovations within the company" (Chen & Taylor, 2009, pp. 828-829). However, no studies have investigated yet what the impact of lean implementation is on

the '*organization of innovation*' in SMEs. The goal of implementing lean is to design and manufacture products of high quality and low cost in an efficient manner through eliminating all waste, which range from overproduction and unnecessary transportation to wastes of motion and correction (Chen & Taylor, 2009, p. 826). So, how could or does a lean organization promote product innovation and employee creativity while maintaining a good level of lean practices? "With different or sometimes conflicting objectives and fundamental concepts from innovation, some aspects of lean enterprise management are likely to cause discrepancies within an organization that is striving for product innovations" (Chen & Taylor, 2009, p. 826). Questions concerning the relation between lean and innovation, such as raised above, are very interesting and will be elaborated further in this research. **Figure 1** (see APPENDIX 1) provides the conceptual framework for this research, of which the concepts will be reviewed in the following sections. To conclude, the purpose of this research is to investigate how firms continue to innovate after implementing lean, while current literature is emphasizing the negative effects of lean design process to organization's innovativeness.

2. ORGANIZATIONAL STRUCTURE AND INNOVATION

Through the fast changing pace of today's environment, organizations are challenged to innovate more than ever, to adequately respond and adapt to these changing conditions. "In response to this challenge, several organization theorists have recently attempted to identify particular organizational characteristics that might be most compatible in dealing with the changing environment" (Kim, 1980, p. 225). There are many different conceptualizations of innovation, such as "innovation is used to describe the process whereby an individual or a social system accepts, develops, and implements new ideas" (Kim, 1980, p. 226). Therefore it is important to incorporate one conceptualization as a starting point. This research conceptualizes innovation as '*exploration and exploitation*' (Greve, 2007, p. 947) by incorporating the notion of innovation streams: "the ability of a firm to host both incremental as well discontinuous innovations, seen as one way to operationalize exploitation and exploration" (Tushman, Smith, Wood, Westerman, & O'Reilly, 2010, p. 1332). "Organizational exploration is search for new knowledge, use of unfamiliar technologies, and creation of products with unknown demand. Exploitation is use and refinement of existing knowledge, technologies, and products, and has more certain and proximate benefits. Exploration and exploitation both draw resources, and thus resource constraints require organizations to make trade-offs between them" (Greve, 2007, p. 945).

Organizational innovation is subject to influences in different categories, including the individual, organizational, and environmental (Demanpour, 1991, p. 557). Regarding all these potential influences, organizational variables have been the most extensively studied, and some studies emphasize that these structural variables are much more highly associated with organizational innovation than characteristics of individuals within the organization (Kim, 1980, p. 227). Many past studies have attempted to identify the most important dimensions, also framed as structural variables, of organizational structure. In general there is no universally applied set of structural variables. Many scholars used Weber's basic model of bureaucracy as a point of departure (Kim, 1980, p. 227). Pugh, Hickson, Hinings, Macdonald, Turner and Lupton (1963, pp. 301-308) hypothesized six primary dimensions of organizational structure: specialization, standardization,

formalization, centralization, configuration, and flexibility. However, after empirically testing Pugh, Hickson, Hinings and Turner (1968, p. 65) state that there were four basic dimensions of structure: structuring of activities, concentration of authority, line control of workflow, and size of supportive component. Reimann (1974, p. 693), in a study of 19 manufacturing plants, found three basic dimensions of structure: decentralization, specialization, and formalization. In their study of innovation, Hage and Aiken (1967, p. 73) identified three structural dimensions related to organizational innovation: complexity, centralization, and formalization.

By reviewing the extensive amount of studies which are concerned with the relationship between organizational innovation and structure, it is possible to broadly distinguish two groups (Kim, 1980, p. 228): “The first group composes of studies which are concerned with how organizational structure is related to innovation, ignoring the stages therein. For example, a hypothesis tested by these studies is: ‘*formalization is negatively related to innovation*’. And studies in the second group are concerned with the contingency notion that organizational structure is related differently to the different stages of the innovation process. For example, a hypothesis tested by these studies is: ‘*formalization is negatively related to initiation but positively related to implementation*’”. This study is part of the first group by focusing on a group of four structural variables: specialization, functional differentiation, formalization and vertical differentiation, which consistently have been found in earlier research, and consciously ignoring the different stages within innovation. These structural variables are part of an extensive group of varied structural variables delineated by different studies, and can be grouped under two constructs – *organizational complexity* and *bureaucratic control* (Damanpour & Gopalakrishnan, 1998, p. 6). Each construct is composed of three variables which can be seen as key elements of that construct. The variables: specialization and functional differentiation are elements of *organizational complexity* and the variables formalization and vertical differentiation are elements of *bureaucratic control* (Damanpour & Gopalakrishnan, 1998, p. 6). Nahm, Vonderembse, Koufteros (2003, p. 283) declares that organizational structure includes the nature of formalization, layers of hierarchy, level of horizontal integration, centralization of authority (locus of decision-making), and patterns of communication. Comparing the composition of organizational structure, according to Nahm et al. (2003), with the involving structural variables in this study, respectively nature of formalization is related to formalization, layers of hierarchy is related to vertical integration, level of horizontal integration is related to functional differentiation. This research does not include the structural variable: patterns of communication, and does not distinguish between structural variables (i.e. locus of decision-making and level of communication) that may directly affect the development of manufacturing practices (e.g. lean manufacturing), while nature of formalization, number of layers in hierarchy, and level of horizontal integration may act as antecedents for locus of decision-making and level of communication (Nahm, Vonderembse, & Koufteros, 2003, p. 283). In this study, the concept of innovation is defined into two separate terms, by focusing on explorative and exploitative innovative activities. This distinction in conceptualization is congruent with the *theory of innovation radicalness*, which refines the term innovation by dividing it into two separate terms: radical innovations and incremental innovations (Damanpour & Gopalakrishnan, 1998, p. 8). The radicalness theory is referred as a middle-range theory of organizational innovation, which is a response to the criticized uni-dimensional theories, because of

inconsistencies in the results of research. “Uni-dimensional theories of organizational innovation develop the relationships between a structural variable and innovation. For example, professionalism affects innovation positively because it increases boundary-spanning activity, self-confidence and a commitment to move beyond status quo” (Damanpour & Gopalakrishnan, 1998, p. 5). At the same time, the *theory of innovation radicalness* takes the view that adoption of radical vs. incremental innovations hinges on a distinction between two structural conditions. “That is, radical innovations are facilitated more than incremental innovations by *organizational complexity*, while incremental innovations are hindered less than radical innovations by *bureaucratic control*” (Damanpour & Gopalakrishnan, 1998, p. 9). See **Table 1: Structure-innovation relationships in one theory of organizational innovation** (Damanpour & Gopalakrishnan, 1998, p. 7). In their study, Damanpour and Gopalakrishnan (1998) described the link between six structural variables and the radicalness theory, including the four structural variables defined in this study, which makes it very applicable to focus on these four structural variables. So, what is the relation between the organizational structure and innovation on an incremental and radical level?

Hage (1980) argued that innovative organization with organic structures would innovate on an incremental level, because they have more democratic values and power that is shared, whereas organizations with more mechanistic structures may be a fertile ground for radical change (Damanpour & Gopalakrishnan, 1998, p. 8). Besides, according to the paper written by Ettlie, Bridges and O’Keefe (1984, p. 682), they found that radical innovations are more likely to occur in organizations with centralized and informal structures, while incremental innovations are more likely in those with complex and decentralized structures.

Table 1: Structure-innovation relationships in one theory of organizational innovation (Damanpour & Gopalakrishnan, 1998)

Structural variables	Organizational Innovation	Radicalness Theory Incremental Innovation	Radical Innovation
<i>Organizational Complexity</i>			
Specialization	+	Low	High
Functional Differentiation	+	Low	High
Professionalism	+	Low	High
<i>Bureaucratic Control</i>			
Formalization	-	High	Low
Centralization	-	High	Low
Vertical Differentiation	-	High	Low

^a *Specialization* represents different specialties found in an organization.

Functional differentiation is the extent to which an organization is divided into different units.

Professionalism reflects professional knowledge of organizational members, which requires both education and experience.

Formalization reflects the emphasis on following rules and procedures in conducting organizational activities.

Centralization is the extent to which decision-making autonomy is dispersed or concentrated in an organization.

Vertical differentiation represents the number of levels in an organization's hierarchy.

3. LEAN

What is meant by the notion of ‘*lean management*’? The starting point of this section is to describe the concept of lean management. The concept of lean management contains the following: *lean manufacturing*, *lean production*, *lean production concept*, *lean thinking*, *lean*, these are all terms used interchangeably to describe the same concept. However, some definitions are framed somewhat differently because they are described from a certain point of view. The varied conceptualizations of lean management are generally described from two points of view, either from a philosophical perspective related to guiding principles and overarching goals, or from a the practical perspective of a set of management practices, tools or techniques that can be observed directly (Shaha & Ward, 2007, p. 787). This distinction is supported by

Hines, Holweg and Rich (2004, p. 1006). According to their research, lean exists at two levels: strategic and operational. The customer-centred strategic thinking applies everywhere, whereas the shop-floor tools do not. This can lead to confusion or misunderstanding where lean is applied. Therefore they encourage the use of *lean production* for the shop-floor tools following Toyota's example, and *lean thinking* for the strategic value chain dimension (Hines, Holweg, & Rich, 2004, p. 1006). The philosophical perspective taken by Bhasin & Burcher (2006) indicates that organizations often implement lean as a process whereas, if they want to implement it successfully, they should embrace it as a philosophy. Furthermore, if lean is seen as a philosophy it becomes a certain way of thinking, while the tactics or processes are mechanisms to action this way of thinking (Bhasin & Burcher, 2006, pp. 56-57).

The distinction between the strategic level and operational level is crucial for the understanding of lean as a whole, in order to apply the right tools and strategies to provide customer value and hereby creating a consistent link between the strategic level and the operational level. The link between the strategic level and operational level is clearly illustrated through their goal alignment: Lean thinking emphasizes "less is more" in terms of – less space, less time, less equipment, less cost, less human effort (Womack & Jones, 1996, p. 12) – to enhance value (or perceived value) to customers (Hines, Holweg, & Rich, 2004, p. 995), while the objective of lean production is to eliminate wasteful activities, composed of – over production, waiting, transportation, inappropriate processing, inventory, unnecessary motions and defects (Bhasin & Burcher, 2006, p. 58). After 1990, there was a little shift in focus that went away from the "shop-floor focus" on waste and cost reduction (*i.e. lean production*) to the adaption of production systems, to include a new design based upon "lean principles" (*i.e. lean thinking*) (Hines, Holweg, & Rich, 2004, p. 995). Womack and Jones (1996, p. 5) identified five steps or principles of lean thinking:

1. Identifying and precisely specifying customer value by specific product.

Value must flow across many companies through many departments within each company. Each entity will define value for itself which consequently leads often to added value that conflict or cancel out one another. It is the end customer whose define value, in terms of a specific product with specific capabilities offered at a specific price and time. To prevent pure *muda*¹ it is very important to specify value correctly before applying lean techniques.

2. The management of the value stream for each product. Identifying and managing the value stream for each product helps to identify the required and all the value adding activities needed to create and produce a specific product. Additionally, identifying the value stream for each product helps to identify waste that occurred along the value stream due to different interacting departments and organizations. The organizational mechanism for defining value and identifying the value stream from concept to launch, order to delivery, and raw materials to finished product is the *lean enterprise* – all parties concerned should facilitate continuing consultation to create a channel for the stream, disposing all the *muda* (Womack & Jones, 1996, p. 5).

3. Developing the capability to flow production.

Meant by flow is, making the remaining value-creating steps,

after waste activities are identified and eliminated, flow. In business terms, work should be not organized around departments based on a "throw it over the wall" mentality, which results in cues that can be categorized as a type of waste. Organizations should develop a lean strategy throughout the organization, which usually requires new types or organizations of technologies, to introduce *flow* correctly and reduce the throughput time for physical production significantly (e.g. from months or weeks to days or minutes (Womack & Jones, 1996, p. 5)).

4. Let the customer pull value from the producer.

Use "pull" mechanisms to support the flow of materials and deliver exactly the demanded products to the customer, and prevent "push" mechanisms, through which an organization pushes possibly unwanted products onto the customers. Assuming, an organization has accurately specified the meaning of value and the related value streams, a pull mechanism allows it to respond immediately to changing customer demands. As a result, *muda* is eliminated, including designs that are obsoleted before the product can be introduced and finished-goods inventories.

5. Pursue perfection.

Pursuing perfection through continuing the process of reducing effort, time, space, cost, and mistakes, while offering a product that is ever more nearly what is requested by the customer. There will always be room for further improvement.

The first four principles interact with one another in a virtuous circle, to aim for the fifth principle: *perfection* (Womack & Jones, 1996, p. 5). This virtuous circle makes that there is a continuous process of improvement and further reduction of effort, time, space, cost and mistakes. This continuous process could be illustrated by the following example, "the harder the customers *pull*, the more the stumbling blocks to *flow* are revealed, admitting them to be removed" (Womack & Jones, 1996, p. 5). This ongoing, continuous changing process of lean thinking, as illustrated above, is only being understood by organizations, when all of the five principles are understood and well aligned with each other. Petterson (2009) supports the notion of continuous improvement and reduction by characterizing lean in four different ways and categorizing lean thinking as ostensive and continuous by conceptualizing the term continuous "as a process oriented perspective, focusing on the continuous efforts" (Pettersen, 2009, pp. 7-8):

1. ostensive(philosophical) & discrete(strategic)
2. performative(practical) & discrete(strategic)
3. ostensive(philosophical) & continuous(operational)
4. performative(practical) & continuous(operational)

3.1 Lean implementation

This research briefly described the concepts of *lean production* and *lean thinking* as differing perspectives (Shaha & Ward, 2007, p. 787), but at the same time these concepts could be seen as complementary (Hines, Holweg, & Rich, 2004, p. 1006). To measure the extent to which firms are engaged in lean management, an operational measure is needed. Shaha & Ward (2007) conceptualizes lean production in such a way, which will help to bridge the gap between the differing philosophical and practice/tools perspectives. By incorporating such a conceptualization, this study is also aware of the distinction between the strategic level (*i.e. lean thinking*) and operational level (*i.e. lean production*) and therefore its complementary nature. Shaha & Ward (2007) identified 10 factors in their study, which consists of three factors that are supplier related, one is customer related, and six are internally related.

¹ *Muda* is the Japanese word for waste, in the sense of wasted effort or time (Hines, Holweg, & Rich, 2004, p. 1008).

Incorporating all the 10 factors, “these 10 factors constitute the operational complement of the philosophy of lean production and characterize 10 distinct dimensions of a lean system. They are” (Shaha & Ward, 2007, p. 799):

1. **SUPPFEED (supplier feedback):** “provide regular feedback to suppliers about their performance”.
2. **SUPPJIT (JIT delivery by suppliers):** “ensures that suppliers deliver the right quantity at the right time in the right place”.
3. **SUPPDEVT (supplier development):** “develop suppliers so they can be more involved in the production process of the focal firm”.
4. **CUSTINV (customer involvement):** “focus on a firm’s customers and their needs”.
5. **PULL (pull):** “facilitate JIT production including kanban cards which serves as a signal to start or stop production”.
6. **FLOW (continuous flow):** “establish mechanisms that enable and ease the continuous flow of products”.
7. **SETUP (set up time reduction):** “reduce process downtime between product changeovers”.
8. **TPM (total productive/preventive maintenance):** “address equipment downtime through total productive maintenance and thus achieve a high level of equipment availability”.
9. **SPC (statistical process control):** “ensure each process will supply defect free units to subsequent process”.
10. **EMPINV (employee involvement):** “employees’ role in problem solving, and their cross functional character”.

3.2 Relation: ‘lean – structure – innovation’

By incorporating the notion of ‘lean management’, the idea is that lean management has an influence on innovation, on an incremental and radical level, by affecting the organizational structure. Therefore, it is suggested that lean has an indirect influence on innovation. This indirect relationship can be explained as the following: lean management consists of lean techniques and different lean concepts. “Among the lean techniques, standardization is a key component. It defines how the process is to be completed by sequencing all the tasks, and helps build new technologies or products on existing proven ones. Use standardization to simplify and formalize the work procedures, a lean organization expects its system to be less prone to variability and attain higher level of process visibility. Other lean concepts include the pull-bases systems, just-in-time manufacturing, total quality management, lean supply chain and customer management. Applying these lean concepts to the product design means fast product design and development based mainly on customer orders” (Chen & Taylor, 2009, p. 827). It is obvious that these different lean techniques and lean concepts require a supportive organizational structure to apply these lean concepts to the product design (i.e. innovation) and to realize an efficient lean structure. This theoretical reasoning is conceptualized in the conceptual model, **Figure 1** (APPENDIX 1). “Lean production is generally described from two points of view, either from a philosophical perspective related to guiding principles and overarching goals or from the practical perspective of a set of management practices, tools, or techniques that can be observed directly” (Shaha & Ward, 2007,

p. 787). However, by proposing that lean management is affecting the organizational structure it is reasonable to conclude that lean management can be conceptualized from the practical perspective as a set of management practices, tools, or techniques that can be observed directly and not just as some sort of guiding principles and overarching goals. Several studies emphasized the link between implementing lean, and organization’s innovativeness (e.g. Lewis, (2000)), product innovation (Mehri, (2006)), radical innovation (e.g. Nahm et al. (2003)) et cetera. Although not all encapsulated the importance of organizational structure regarding the link between implementing lean an innovation in terms of incremental and radical. Ward, Bickford and Leong (1996) argue that an organic structure is necessary for the strategic pursuit of lean manufacturing, which is closely related to time-based manufacturing. There appears to be an agreement that organizational structure is highly relevant when implementing hard and soft manufacturing technologies. In addition, an organic structure appears to be congruent with the demands of a time-based manufacturing environment (Nahm, Vonderembse, & Koufterosc, 2003, p. 288). Besides, Nahm et al. (2003) investigates the impact of organizational structure on implementing a radical innovation (i.e. time-based manufacturing). Lean practices are composed of some elements of time-based manufacturing, as “a set of practices designed to reduce throughput time” (Koufteros, Vonderembse, & Dol, 1998, p. 22) and the goal of lean thinking: “do more and more with less and less – less human effort, less equipment, less time, and less space – while coming closer and closer to providing customers exactly what they want” (Womack & Jones, 1996, p. 12), emphasizing the notion of *less time*. In their study, Doolen & Hacker (2005) present an overview of factors impacting lean implementation. Based on their review of previous literature they state that there is evidence that factors, such as changing economic condition, high levels of demand uncertainty, ‘rigid organizational structure’ may limit the applicability of lean manufacturing practices or may prevent manufacturers from realizing the full benefits of these practices (Doolen & Hacker, 2005, p. 56). In addition, Leonard (2007, p. 4) states that leadership roles, organizational structure, and job design are changing in order to be aligned with the latest practices in industry, such as the implementation of lean practices. Finally, the paper of Bamber & Dale (2000) reports the findings of a research study into the application of lean production methods to a traditional aerospace manufacturing organization and identified two main stumbling blocks to the application, including the redundancy programme. The company needed a fundamental shift in its management approach to introduce a lean production approach. Despite improved organizational structures, e.g. the IPTs, CIAGs and DRB, this reorientation was not possible during the widespread redundancy programme. If the implementation of lean wants to be successful, the organizational structure should be supportive.

By influencing the organizational structure as explained earlier, lean will have an impact on the different factors which the structure is composed of. The impact on the different factors will be elaborated further in this research. However, speaking more generally it can be stated that when and after organizations implement lean, they need a more focused (Sohal & Egglestone, 1994, p. 43) and organic organizational structure for the strategic pursuit of lean manufacturing (Nahm, Vonderembse, & Koufterosc, 2003, p. 288). Such an organic structure has (Nahm, Vonderembse, & Koufterosc, 2003, p. 282): (1) rules and regulations that encourage creative, autonomous work and learning (the nature of formalization), (2) few layers in the organizational hierarchy to enable quick response, (3) a high level of horizontal

integration to increase knowledge transfer, (4) a decentralized decision-making so operating issues can be dealt with effectively and quickly, and (5) a high level of vertical and horizontal communication to ensure coordinated action. "Several researchers have labelled this organizational structure as "organic", as opposed to "inorganic" or "mechanistic" " (Nahm, Vonderembse, & Koufterosc, 2003, p. 282).

To conclude, some studies emphasize the importance of a supportive organizational structure for implementing lean management (e.g. Doolen & Hacker, (2005) ; Ward et al. (1996)), but do not explicitly state that lean management influences the structure. Another group of studies state that organizational structure will change or should be improved when lean practices will be implemented, but do not specifically address how different factors of organizational structure will be affected (Bamber & Dale, (2000); Sohal & Egglestone, (1994)). Finally, another different study investigates any meaningful effects of organizational structure on time-based manufacturing practices (i.e. to which lean is closely related), which "include the extent to which processes and procedures are altered to achieve faster response to customer needs" (Nahm, Vonderembse, & Koufterosc, 2003, p. 283), in terms of the relationship with plant performance. Concluding, the contribution of this study will be to investigate how organizational structure, in terms of specialization, functional differentiation, formalization and vertical differentiation, will be affected by lean management.

3.3 Organizational structure in lean SMEs

Based on extensive literature research, propositions will be formulated and framed in an interview conducted at eight SMEs throughout the Netherlands. This study is a case study. Therefore there will be no hypothesis formulated and tested. The propositions that will be formulated are based on proposed relationships between the following important constructs: '*lean management*', organizational structure in terms of '*specialization*', '*functional differentiation*', '*formalization*' and '*vertical differentiation*' and innovation in terms of '*incremental innovation*' and '*radical innovation*'. Because of the type of study, the aim of this research is not to test the propositions on themselves, but to identify and describe cases which are corresponding to the propositions and cases which are not corresponding and to look for the reasons why some cases are corresponding or not corresponding to the formulated propositions. Besides, the purpose of formulating propositions is to structure the interview in such a way as the theoretical framework, through which a clear view of eight practical cases will be presented. To explain the above mentioned four different structural variables and their interrelatedness with the notion of '*lean management*' and the type of innovation, this research formulates nine propositions. These nine propositions can be divided into two groups: one group (i.e. five propositions) focuses on the proposed relationship between lean and the four structural variables and the second group (i.e. four propositions) focuses on the proposed relationship between the four structural variables and the two types of innovation. So, the first group of propositions is about questioning and proposing how the four individual structural factors are influenced by lean:

Organizational complexity

Specialization: "specialization represents different specialties found in an organization" (Demanpour, 1991, p. 588). More clearly it can be defined as the extent to which jobs in the organization require narrowly defined skills or expertise. The variable, specialization, is typically measured by the number of different occupational types or job titles in an

organization (Demanpour, 1991, p. 589). The lean organization affects four different activities, including *manufacturing* (Paez, J., A., S., Karwowski, & Zurada, 2004, p. 293): "by implementing problem-solving analysis, lean manufacturing is visibly different from mass manufacturing, because waste not only includes inefficiency but elements such as inventories, rework, and supervision". Specifically related to the concept of specialization, lean manufacturing will lead to a simplification of tasks and these tasks are performed in a reduced space (Paez, J., A., S., Karwowski, & Zurada, 2004, p. 293). Besides, at the workforce level responsibilities that mass production attempted to specialize, such as quality control, performance tracking, and material handling will be taken back (Paez, J., A., S., Karwowski, & Zurada, 2004, p. 293). To be capable as an organization to eliminate wasteful activities and creating flow, all employees need to understand the notion of standardization. All employees should think of simplifying their work by standardizing their work, so that a given task will take the same amount of time every time and also will be done correctly on the first attempt (Womack & Jones, 1996, p. 10). So, though the simplification and standardization of tasks, individual founding team members are able to focus their efforts on a broader set of tasks, which indicates lower degree of specialization.

Proposition 1: *After implementing lean, there will be less specialization (i.e. implies a reduction of the variety of occupations/specialism/job types within an organization)*

Functional differentiation: "functional differentiation is the extent to which an organization is divided into different units" (Demanpour, 1991, p. 589). A coalition of professionals is created within the differentiated units (Damanpour, 1987, p. 679). However, in case of a lower degree of specialization there are less organizational members, which represent different specialists and therefore this will possibly lead to a lower degree of functional differentiation. Besides, incorporating the notion of specialization, value must flow through many units (departments) within a company. It is the end customer whose defines value, in terms of a specific product with specific capabilities offered at a specific price and time (Womack & Jones, 1996, p. 5). However, each single unit will define value for itself which consequently leads often to added value that conflict or cancel out one another (Womack & Jones, 1996, p. 5). An example of a contradictory performance objective is manufacturing efficiency vs. delivery punctuality (Ton & Tonchia, 1996, p. 221). While the before mentioned contradictory performance objectives are both elements of lean production, these two performance objectives do not seem to be two contradictory performance objectives involving two differentiated units. To prevent pure *muda* within an organization, which is implementing lean, it is important to overcome functional organization rigidity, also known as "functional silos" (Ton & Tonchia, 1996, p. 221). Fewer functional departments will make it easier for an organization to define the added value of each department and the total added value. Consequently, that will make it easier to comply with the defined value of the customer. As firms shift from an industrial to a post-industrial mode of operations that uses time-based manufacturing, which is closely related to lean manufacturing, they need a structure that has rules and regulations that encourage creative, autonomous work and learning (i.e. nature of formalization), a decentralized decision-making so operating issues can be dealt with effectively and quickly (i.e. centralization), few layers in the organizational hierarchy to enable quick response and a high level of horizontal integration to increase knowledge transfer (Nahm, Vonderembse, & Koufterosc, 2003, p. 282). "High complexity and

decentralization indicate a differentiation among functional specialties or groups, integration indicates the degree of integrating efforts of these differentiated groups” (Kim, 1980, p. 239).

Proposition 2: *After implementing lean, there will be less functional differentiation (i.e. implies a reduction of the number of functionally specialized units or departments within the organization) and more horizontal integration (i.e. implies an increasing of the numbers of departments and workers, which are integrated in their work, capabilities and education/training)*

Bureaucratic control

Formalization: “formalization reflects the emphasis on following rules and procedures in conducting organizational activities” (Damanpour, 1991, p. 589). More specifically, it refers to (1) the degree of codification specifying who is to do what, where, and when and (2) the degree of dedication exerted in enforcing these rules (Kim, 1980, p. 229). Many studies characterize formalization by its rigid rules and procedures, which provide little room and incentives for employees or other organization participants to consider new alternatives and thus discourage initiative in suggesting and coming up with new ideas (Kim, 1980, p. 230). It is suggested that there is a negative relationship between formalization and the initiation of innovation and a positive relationship between formalization and the implementation of innovation (Kim, 1980, p. 228). According to Pierce and Delbecq (1977, p. 31) the negative relationship with initiation may be greater than its positive relationship with implementation, suggesting that less formalized organizations may be more innovative, because they foster the greater numbers of new ideas (Kim, 1980, p. 230). However, for the empirical part of this research there is no distinction being made between the initiation and the implementation of innovation, because it is outside the scope. Womack, Jones and Roos (2008), characterize the lean producer through different attributes, which are needed to be an excellent manufacturer. Related to the structural variable *formalization*, organizational flexibility and adaptability are cited as increasingly important ingredients for excellent manufacturers (Ward, Bickford, & Leong, 1996, p. 619), because, “competitive priorities in manufacturing are defined by four dimensions: quality, dependability, cost-efficiency and flexibility” (De Meyer, Nakane, G. Miller, & Ferdows, 1989, p. 139). When looking to following elements of lean manufacturing: “the reduction of the lead times in production, the development of new processes for new products, the reduction of set-up times and giving workers a broader range of tasks, all point in the same direction: flexibility” (De Meyer, Nakane, G. Miller, & Ferdows, 1989, p. 140). However, the danger in adopting formal programs (i.e. which can be part of lean management) is that formalization often results in a loss of organizational flexibility. In addition, as firms shift from an industrial to a post-industrial mode of operations that uses time-based manufacturing, which is closely related to lean manufacturing, they need a structure that includes rules and regulations that encourage creative, autonomous work and learning (i.e. the nature of formalization) (Nahm, Vonderembse, & Koufteros, 2003, p. 282). Flexibility and low emphasis on work rules facilitate innovation. Low formalization permits openness, which encourages new ideas and behaviours (Damanpour, 1991, p. 558).

Proposition 3: *After implementing lean, there will be less formalization (i.e. implies less codification in terms of who has to what, where and when and less dedication exerted in maintaining and applying these rules) and more emphasis on*

organizational flexibility

Proposition 4: *After implementing lean, there will be a change in the nature of formalization (i.e. implies rules regulations which stimulate creativity, autonomous working and learning) and more emphasis on organizational flexibility*

Vertical differentiation: “vertical differentiation represents the number of levels in an organization’s hierarchy” (Damanpour, 1991, p. 590), these hierarchical levels increase links in differentiation communication channels, making communication between levels more difficult and inhibiting the flow of innovative ideas (Damanpour & Gopalakrishnan, 1998, p. 6). As firms shift from an industrial to a post-industrial mode of operations that uses time-based manufacturing, which is closely related to lean manufacturing, they need a structure that not only has rules and regulations that encourage creative, autonomous work and learning (i.e. formalization), a decentralized decision-making so operating issues can be dealt with effectively and quickly (i.e. centralization) but also has few layers in the organizational hierarchy to enable quick response (Nahm, Vonderembse, & Koufteros, 2003, p. 282).

Proposition 5: *After implementing lean, there will be less vertical differentiation (i.e. implies a reduction in the number of hierarchical levels within the organization)*

The second group of propositions is about questioning and proposing how are the four individual structural factors affecting innovation in terms of incremental innovation and radical innovation. These propositions are based on and derived from **Table 2: Structure-innovation relationships in one theory of organizational innovation** (Damanpour & Gopalakrishnan, 1998, p. 7)

Proposition 6: *Less specialization will result in a focus on incremental or radical innovation*

Proposition 7: *Less functional differentiation will result in a focus on incremental or radical innovation*

Proposition 8: *Less formalization will result in a focus on incremental or radical innovation*

Proposition 9: *Less vertical differentiation will result in a focus on incremental or radical innovation*

To conclude, this study proposes a lower degree of formalization and a change in the nature of formalization, a lower degree of vertical differentiation, a lower degree of specialization and a lower degree of functional differentiation (so a higher degree of horizontal integration) after implementing lean. The organic ideal type of organization has a lower degree of formalization (i.e. low job codification) (Kim, 1980, pp. 229-230), a lower degree of vertical differentiation (i.e. low hierarchy of authority) (Kim, 1980, pp. 229-230), a lower degree of specialization (Sine, Mitsuhashi, & David, 2006, p. 124) and a lower degree of functional specialization (i.e. high levels of horizontal integration) (Nahm, Vonderembse, & Koufteros, 2003, p. 287). However, according to Zammuto and O’Conner (1992), an organizational structure is flexibility-oriented and organic with low formalization and centralization and high differentiation and professionalism, and the structure of a ‘hierarchy’ is inflexible and mechanistic, characterized by high formalization and centralization and low specialization and professionalism. These contradictions, concerning the distinction between an

organic and mechanistic type of organization, makes it even more interesting and valuable, to see the organizational structure as four different structural variables and not as a specific ideal type of organization.

4. METHOD

4.1 Sample selection

By carrying out this research, a sample composed of eight cases was selected. Each of these eight cases represents a company in the Netherlands that was included, because they met the following criteria: (1) The company is a SME (Small and Medium sized Enterprise), this means that the number of its employees could not exceed 250 employees. More precisely, the number of employees has to be between the 20 and 250. (2) The company is engaged in lean management (i.e. philosophy and methods), so the concept of lean is implemented. (3) The company should have/produce an own product, therefore it involves a production company. In case the company is a subunit from a parent company, the company should be independent: department (sales, R&D, finance). (4) The company has to be innovating in a certain extent, on its products and/or production processes. The characteristics of the different companies are represented in **Table 6** (APPENDIX 4).

4.2 Measures

Sending out questionnaires and taking interviews are two different and complementary methods for data collection in this study. The questionnaire is based on the conceptual framework presented in the study of Borrèl (2013) it was composed to evaluate the internal factors (company strategy and internal organizational antecedents), the external factors (external environmental antecedents), the tension (orientation on exploration and exploitation), and lean management (ten factors of lean). More specifically, the internal factors (the company strategy and the different organizational antecedents) and external factors involved: *bedrijfsstrategie* (measured by the scale of Conant, Mokwa and Varadarajan (2006)); *middelen beperking* (measured by the two item scale of Norhia and Gulati (1996)); *flexibiliteit* (measured by the scale of Barringer and Bluedorn (1999)); *cultuur sterkte* (measured by the scale of Kotter and Heskett (1992)); *centralisatie*, *'connectedness'*, *risico aversie and mate van concurrentie* (measured by the scales of Jaworski and Kohli (1993)); *formalisatie* (measured by the scale of Desphandé and Zaltman (1982)); *routinialisatie* (measured by the scale of Whitey et al. (1983)); *markt dynamiek* (measured by the scale of Baum and Wally (2003)). The tension involved: *exploitatie* and *exploratie* (measured by the scale of Lubatkin, Simsek, Ling and Veiga (2006)). Besides, the 10 factors of lean implementation were divided in three categories as follow: *leverancier gerelateerd* (three factors), *klant gerelateerd* (one-factor), and *intern gerelateerd* (six factors). All the three categories were first measured separately by the scale of Shah and Ward (2007), when subsequently the mean of the three categories was calculated to measure the total lean implementation. Finally, there was an additional measurement by evaluating 31 lean tools for each SME, with the goal to control for the 10 factors of lean implementation. The reason for controlling the 10 factors of lean implementation, as a goal, was to find out whether the SME is really engaged in lean management by implementing lean tools into the organization. The thing is that if a SME did not implement any of the lean tools, they could have still scored high on the scale of Shah and Ward (2007), but should not be seen as a SME engaged in lean management as defined by this research.

The questionnaire (APPENDIX 6) is thus constructed on the basis of fifteen measurement scales, all based on current literature, and send out to eight participants. The results out of these questionnaires are evaluated and can be found in **Table 7** (APPENDIX 4). As described by Borrèl (2013), the scored company strategy for each SME is shown in **Table 7** as D (Defender), P (Prospector), A (Analyzer), R (Reactor). All scores of items with a 5-point scale or a 7-point scale, which is mentioned under **Table 7** (the second table, which translated the scores), were rounded off to one decimal. Based on the scale of each item, each score was given a - /-/+ /++ of which the results can be found in the second table which pertains to **Table 7** and is also named **Table 7**, because those results are only translations of the other table, which involves the numbered scores and involves no other differences. In case, an item scored exactly on the boundary of e.g. a + and a ++ by scoring a 5,5 for a 7-point scale item, the item was given a ++.

5-point scale items were given: a - - for a score between 1,0 – 2,0; a - for a score between 2,0 – 3,0; a + for a score between 3,0 – 4,0; a ++ for a score between 4,0 – 5,0.

7-point scale items were given: a - - for a score between 1,0 – 2,5; a - score between 2,5 – 4,0; a + for a score between 4,0 – 5,5; a ++ for a score between 5,5 – 7,0.

In addition Borrèl (2013) described that based on the findings in **Table 7**, a score card was filled in for the antecedents of each company. The template of this score card for antecedents is shown in **Table 5** (APPENDIX 4). In these score cards, items scoring a - / - - were translated as scoring 'laag of los', whereas items scoring a + / ++ were translated as scoring 'hoog of strak'. Based on the current literature, **Table 4** shows for all five innovation strategies whether the items are 'laag/hoog' or 'los/strak'. Based on the translated scores of 'laag' or 'los' and 'hoog' or 'strak', **Table 4** could partly be filled in for each SME. The filled in score cards (i.e. **Table 4** and **Table 5**) for each company can be found in APPENDIX 4, where the score items are highlighted blue. The idea is that based on these score cards, a most fitting innovation strategy is proposed out of the literature.

The questionnaires formed the foundation of this research, by showing the extent of lean implementation, in terms of the amount of lean tools used, in the different companies and illustrating different internal organizational antecedents which can be influenced by lean. However, in the questionnaires there is no direct link made between implementing lean and its impact on the different internal organizational antecedents. This research is specifically focusing on organizational structure in terms of: specialization, functional differentiation, formalization and vertical differentiation and how these structural variables can or are being influenced by lean. Therefore the questionnaires were used as a preparation for the interviews that were conducted at all eight SMEs. Interviews were conducted to ask the participants questions concerning relationships and/or causalities that current literature proposes. The proposed relationships and/or causalities together with the most important concept regarding this research, can be illustrated and presented schematically below, see **Figure 2: Schematic illustration of the theme of the interview**. Moreover, it is important to bear in mind that some companies scored relatively low on the implementation of lean tools in their organization, because they just started implementing lean this year, implemented lean for a year now or two years. It is reasonable to believe that some questions and propositions could not be answered completely, because a few companies may lack practical experiences in

‘fully’ implementing lean. Therefore it is important to keep this in mind, when analysing the data. For example, it might be the case that a company will agree with a certain proposition by looking to a theoretical lens, but may lack practical experience to react on a proposition in its practical application.

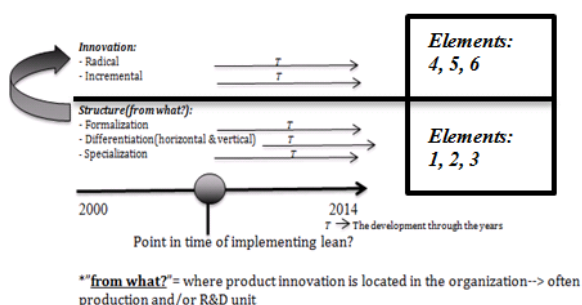


Figure 2: Schematic illustration of the theme of the interview

During these interviews, the first step was to ask the participants how they should describe (1) *lean management, and to what extent they agree with lean management on a strategic level ('lean thinking, lean principles') and operational level ('lean tools')*. Regarding the literature, varied conceptualizations of lean management are generally described from two points of view, either from a philosophical perspective related to guiding principles and overarching goals, or from a practical perspective of a set of management practices, tools or techniques that can be observed directly (Shaha & Ward, 2007). The distinction between the strategic level and operational level is crucial for the understanding of lean as a whole, in order to apply the right tools and strategies to provide customer value and hereby creating a consistent link between the strategic level and the operational level. So, according to literature it is important for companies to distinguish between the strategic level and the operational level and therefore this first step is used to describe and understand lean management from the same point of view and look for the importance of the strategic level and operational level in practice. The second step, is about (2) *the proposed relationship between lean and its impact on organizational structure*. The participants were asked to what extent they agree or are familiar with the proposed relationship, to get an indication when organizations implement lean if they need a more focused (Sohal & Egglestone, 1994) and organic organization structure for the strategic pursuit of lean manufacturing as before implementing it (Nahm, Vonderembse, & Koufteros, 2003). After which the participants were asked to describe (3) *how the individual factors of the organizational structure have developed over time, in terms of more or less, and how these are now structured in the product innovation unit(s)*. To define and explain 'how' more clearly, propositions are formulated to direct and structure the described development and to be able to identify and describe cases which are corresponding to the propositions and which are not corresponding and look for the reasons why. In addition, by formulating propositions, a clear and structured view of the proposed relationships of eight practical cases can be presented. The above mentioned elements (i.e. 1, 2 and 3) are part of the lower half (below the thick line) of the schematic illustration (i.e. the relation between lean and organizational structure). To illustrate the highest part of this illustration, the interview continues with the fourth step, by asking the participants to

what extent they agree with (4) *defining product innovation in terms of exploration and exploitation*. This distinction between explorative innovations from those that exploit current knowledge is important, because the general concept of 'innovation' refers to the criticized uni-dimensional theories. Uni-dimensional theories of organizational innovation develop the relationships between a structural variable and innovation (Damanpour & Gopalakrishnan, 1998), but the perspective taken in this study is that the adoption of radical (i.e. exploration) vs. incremental (i.e. exploitation) innovations could hinges on a distinction between structural variables, which is referring to the *theory of innovation radicalness*. If this distinction is not present in a specific kind of setting, this study incorporates the general concept of 'innovation' and therefore applies the uni-dimensional theory. Furthermore, the fifth step implies (5) *the proposed relationship between organizational structure and the type of product innovation*. The participants were asked to what extent they agree or are familiar with the proposed relationship, to get an indication if organizational structure affects innovation in terms of incremental and radical. So, does the organizational structure prescribe one of the two types of innovation? Or is there a reversed causality, which means that a certain innovation type is developed and the organizational structure is adapted to it? After which the participants were asked to describe (6) *how innovation on an incremental level and radical level has developed over time after implementing lean*. To define and explain 'how' more clearly, propositions are formulated to direct and structure the described development and to be able to identify and describe cases which are corresponding to the propositions and which are not corresponding and look for the reasons 'why'. In addition, by formulating propositions, a clear and structured view of the proposed relationships of eight practical cases can be presented.

So, does the proposed developed of a structural variable over time, after implementing lean, has an impact on innovation? In case it does, is there more focus on incremental or radical or no difference (i.e. which mean the structural variable influences both equally, so there is no distinction made between incremental and radical innovation)? In case it does not influence innovation, this means that there is no relation between the structural variable and innovation. Concluding, if there is an impact of different structural variables on innovation, does this influences the "balance" between the two types of innovation in the organization? The above mentioned elements (i.e. 4, 5 and 6) are part of the upper half (above the thick line) of the schematic illustration (i.e. the relation between organizational structure and type of product innovation).

5. RESULTS

Based on the composition of this study and the structuring of the interviews, see

, the results found in the interviews can be separated into two different parts, one part (below the thick line) belongs to the **first sub-question** and the other part (above the thick line) belongs to the **second sub-question**. Supportive statements and descriptions from the interviews will be used (including the time it concerns) to construct the analysis in this study.

5.1. What is the impact of lean management on different dimensions of organizational structure?

To be able to answer the **first sub-question** completely, two steps have to be completed. The first step was to ask the participants how they should describe:

(1) lean management, and to what extent they agree with lean management on a strategic level (“lean thinking, lean principles”) and operational level (“lean tools”).

As mentioned earlier, a majority of the studies incorporating the notion of lean management, conceptualize lean management from two points of view, either from a philosophical perspective related to guiding principles and overarching goals, or from a the practical perspective of a set of management practices, tools or techniques that can be observed directly (Shaha & Ward, 2007). So, do the companies take the same point of view in describing lean management and do all companies see those two different conceptualizations: strategic level and operational level, as equally important for their company:

All eight cases are able to conceptualize lean management on a strategic level as well as on an operational level, however there are some differences between the cases. **Five cases (companies 1, 3, 4, 7 and 8)** stated that the focus will be more on the strategic level. Company 1, with the highest degree of lean implementation described lean management as follow: “Lean in its most extreme form is affecting the supply chain, your production processes, your total lead time and your cost price” (40;09 - 40;23) and supported the focus of lean management on the strategic level: “Lean has to do a lot more with being able to break through classical thinking patterns and sub-optimization, because the classical thinking is that it starts on the drawing table, you have an design engineer, which is only thinking in terms of how could I make this as good as possible for the function of the product. And then it goes into production, and they find out that is absolutely impossible to produce it in such a way” (40;44 - 41;23). Company 3 is stated the following: “What I see as more important, than maintaining our competitive position, is the engagement of people with producing products and in solving problems, this will have a higher culture value for us. Which can be seen as a focus on the strategic level” (07;08 - 07;41). Company 4 explained that they do not describe lean management in terms of ‘5’s’ and ‘value map streaming’, but they are looking for standardization and described lean as “working reasonable” (18;10 - 18;21). The company supported the focus of lean management on the strategic level: “Lean has to be something throughout the whole organization (18;37 - 18;40). We, as management, are very aimed at not telling ‘how is must be done’, but we like to hear from the people ‘how they want it to be’ and we will look for the possibilities” (18;42 - 18;54). **One case (company 2)** stated: “I am thinking more in operational terms” (20;09 - 20;12). So, what about the remaining **two cases (companies 5 and 6)**? Company 5 really emphasized the link between the operational level and the strategic level, which is respectively supported by the following statements: “The principles of lean are indeed, eliminating waste, acceleration of your production process, less resource deployment etc. If you produce products, you want to do it in the most efficient manner, and lean is an instrument for that. The lean way to accomplish that is that you acknowledge you could not only do this with specializations, but this is done jointly. Thus, by learning people jointly a process structure, you get an acceleration (35;43 - 36;47). The waste activities are not that concrete that you can solve it by placing everything upright, like lean is indicating, but is more abstract in the sense that the settings which are the smartest for one person should also be the smartest for another person. ‘Thus, what is now the smartest setting for that paper? How, do we find out? How do we measure that? How do preserve?’ First, it has to be understood and kept in mind by management and afterwards it has to be in the heads of the employees. Which can be seen as a focus on the strategic level” (40;50 -

41;34). Having a look at company 6, this company represents a subsidiary of a company which is located in Italy and indicates the difference between lean on the strategic level, which is mainly taking place in Italy and lean on the operational level, which concerns the production location in the Netherlands: “So, what I am seeing is that there is a big change in the company on strategic thinking in Padova (Italy), this will also find its impact over here. Parallel to that we are also implementing lean tools in our production at the moment. So, we are moving from a traditional production to a lean production facility, where we are going to implement a ‘one-batch flow’ principle and we are doing that at this moment” (06;50 - 07;21).

The notion of lean management is for most companies not only a set of management practices, tools or techniques that can be observed directly (i.e. operational level), but also guiding principles and overarching goals (i.e. strategic level). The strategic level (i.e. lean thinking) is even mentioned more often, as being more present within and important for most of the **cases (companies 1, 3, 4, 7 and 8)**, as illustrated in **Table 2** (APPENDIX 3)

The second step is about:

(2) the proposed relationship between lean and its impact on organizational structure.

The participants were asked to what extent they agree or are familiar with the proposed relationship. Elaborating step two could give an indication if companies think they have to change their organizational structure when implementing lean or if the organizational structure is changed by implementing lean.

Four cases (companies 3, 6, 7 and 8) agree with the proposed relationship between lean and its impact on organizational structure and are familiar with this relationship. However, company 3 stated that there is no absolute need to change the structure, this indicates that there can be an impact of lean on organizational structure, as also holds for the company itself: “Personally I prefer to change the organizational structure. Briefly worded, it is better to implement lean in a flat organized structure. So, we consciously decided to do that, however it is not at all costs necessary, because lean can also be implemented in a normal/conservative organization. Although the time period for fully implementing lean will also be longer and the effort will be higher, because you have to go through more layers. Ultimately you will have more burdens in terms of hierarchy, decision making, responsibilities” (09;52 - 11;15). Company 6, also mentioned the term ‘a flat organizational structure’ and emphasized the following: “Lean definitely impacts the organizational structure. Both the nice part and the difficult part about lean is that you cannot implement lean ‘bottom-up’. You have to do it ‘top-down’ and because of that your organizational structure will become flatter, otherwise you are not able to implement it” (09;04 - 09;31). Companies 7 and 8 both concerned with cutting people out of the middle management, however the development is contradictory, as illustrated respectively as follow: “Implementing lean has definitely an impact on the organizational structure. For example, we try to reap out one person in the middle management and act with less people” (11;42 - 11;59) and “Implementing lean has definitely an impact on the organizational structure. A few years ago (‘seen as the first wave of lean’) the organization was cutting drastic in middle management functions, currently (‘seen as the second wave of lean’, about one year ago) we even add some functions. For example, on a certain moment there was no product manager anymore, which stood above the foremen, therefore the foremen had to divide the work by themselves. That will not

work, because there has to be somebody who can set out the most important core objectives and tasks. For the engineering department, the same holds. For the production department as well as the engineering department we saw that is important to have one manager for each department, who can take care of the complete overall picture and who can take care of the people's needs. By taking care of this, these managers can discuss with management what the possibilities are. As a company you can see that this will facilitate easier and faster decision making" (21;55 – 23;21). The remaining **four cases (companies 1, 2, 4 and 5)** understand the proposed relationship between lean and its impact on organizational structure, but are not familiar with this relationship in terms of: 'this impact/relation is not (obviously) present in our company'. Company 1, stated that the causality between lean and organizational structure is different: "In the classical situation: departments are created and within these departments functions are made up and consequently an organization is structured. There is less thinking in terms of how a process 'flows'. If you turn it around, and you look simply from the viewpoint of lean, than you start with the primary process: what is the shortest way from A to B for the product, my customer wants and everything else is subordinated. So, therewith lean has also impact on the organizational structure, but not so much formally, but you are really looking after all the resources: people, means, machines, which have to 'flow' to that product (43;19 - 44;23). The structure is becoming lava, which will fold (45;34 - 45;40). You will see it also in our culture. Fifteen years ago we had an operator which said: 'Yes, but that is my workbench?'. I did not hear that question for five years now. Everybody is looking around where the next product is, so it can move as quickly as possible and there is the focus on" (45;41 – 46;02). Company 2, explained that you cannot speak of an one-to-one relationship between lean and organizational structure, anyway it is not demonstrable: "The development is absolutely present (23;10 – 23;13). If you place a real leader in a specific profession, for example mechatronica, you will see that lean is originating. And if this person is really capable and good, then this person is placed in the organization in such a way, that he/she will become a manager, or in other words that this person has a certain influence. So, if the person is really good, he/she will be placed on the right place and he/she will introduce lean further. Thus, this can be a process engineer which is growing for example. (24;05 – 24;41). The above description will illustrate, why a one-to-one relationship is not demonstrable: if I employ a person, whom I place in the organization, for example 'head of drivers'. The person is placed, but this will not mean that the organization is already implementing lean. If the person will pick it up fast and good, lean becomes also more important within the organization. It is not the case that we, as management, say: 'this principle and this principle you should pass through, through which the organizational structure will change etc. If somebody is not picking it up, it is exit for him/her (26;00 – 26;49). Having a look at company 4, the organization is described as very transparent and open. In fact, you could speak of a flat organizational structure, but there is no real structure in place: "There is not really an organized hierarchy. Everyone takes his/her own responsibility. Talking about the production unit, of course there is a certain direction: a production department with a production head. So, there is a sort of hierarchy, which is mainly meant to facilitate communication instead of directing or supervising the people. However, to conclude: there is not a real organizational structure in place, which is changed after implementing lean" (08;40 - 09;45). Company 5 has a different viewpoint, with regard to implementing lean. And this will explain why the proposed relationship between lean and its impact on

organizational structure is not directly present in company 5: "There is impact on organization structure, not directly but indirectly. In case of directly: as a dictator and a functional structured organization, I can still implement lean (46;50 – 47;14). Literature thinks that cause and effect are structured in a certain way, while I think this cause and effect relationship is differently in practice. Literature thinks you start with strategy, followed by tactics and end with operation. However, often this relation will not hold: a lot of talking is finding place on the strategic level than something is implemented on the operational level and then you consider what this will mean 'for this and this', 'and what is your feeling'. This can lead to a wave of resistance and a confrontation on the operational level, which results in feedback or resistance towards the strategic level. With regard to the structure, it is not the case that a person is at a training and gets an 'aha Erlebnis' (strategic) and considers, if we do this in such a structure than we will get this feeling (48;06 – 50;50). It is about getting a feeling on the operational level, for example a manager feels that he/she is losing power, and he/she realizes: 'I do not want to lose power'. Resulting in a manager, who is shouting at a group. After which a new solution is originated on that level, resulting in adjustments on the strategic level and leadership issues etc. (51;03 - 51;28). I would not change the structure, because I believe in a mix between being functionally organized and process oriented working, which can be realized by a matrix structure. However, this matrix structure will not be formalized, but you start a project organization: including an intervention group, different support groups etc. and temporarily you are creating a sort of island. So, to get this project organization 'structured' in the organization you are making an indirect/adjunct organizational structure (51;48 – 53;09). So, do you see the impact of lean on structure? You can see this impact temporarily and you can see it maybe, because there will be less functional differentiation. However, do not reverse the causality to: because it is good to have one layer less and do that first and then put lean on top. No, start with lean instruments and see what it does in your company" (56;05 - 56;46).

Four cases (companies 1, 2, 4 and 5) do not fully agree with the proposed relationship between lean and organizational structure (i.e. which mean this relationship does not hold for their company), as illustrated in **Table 2**. Some declare that theoretically this relationship is correct, however in practice there is not such a direct one-to-one relationship present and not so formally as indicated. This does not have to mean that despite the fact some companies do not agree with the proposed relationship, they also indicate that all the structural variables did not developed over time, after implementing lean. When continuing the analysis, it should become clear if there is a difference between the perspectives taken towards the proposed relationship: lean management and organizational structure (i.e. yes or no) and the development of structural variables over time.

After completing step one (1) and step two (2), the third step (3) is structured to answer the **first sub-question** by incorporating five propositions. The participants were asked to describe:

(3) how the individual factors of the organizational structure have developed over time, in terms of more or less, and how these are now structured in the product innovation unit(s).

Propositions are formulated to direct and structure the described development and to be able to identify and describe cases which are corresponding to the propositions and which are not corresponding and look for the reasons why.

Proposition 1: *After implementing lean, there will be less specialization (i.e. implies a reduction of the variety of occupations/specialism/job types within an organization)*

Six cases (companies 1, 3, 4, 6, 7 and 8) are corresponding to proposition one, and can be found in **Table 2**. Company 1 stated that there is less specialization: “The tasks that were first executed by some specialist, are now executed by more people in the organization. So, you become more flexible as an organization. For example, before there was a time that a balancing bench was not operating, because ‘person x’ had a free day. This period of time is over. However, the specialism: balancing, itself is still existing. The goal is not that every employee becomes an ‘allrounder’. The goal is to strive for precisely that organizational flexibility, so that you can deliver the whole combination of products ‘just-in-time’ (52;35 – 53;53). Now, we have only a few function descriptions, for example we make no distinction between ‘spinning’ and ‘milling’. This change is really originated, by implementing lean” (75;50 – 76;05). Company 3 also emphasized that there is less specialization: “Specialization in terms of complexity is less. By standardizing more working methods, people should be able to execute different tasks, without needing much explanation. Something we see in the organization, is that the acceptance in this standardization process is low, because people are afraid that if work is been defined and formulated, the internal competition will be bigger, and which will result in the expense of employment. Therefore, in general people try to keep the task complex” (13;27 – 14;47). Company 4 supported proposition one by the following statement: “Production workers become ‘operators in a completely automated working environment (11;32 – 11;52). We arranged the bulk of activities in the production environment in such a way, that it can be executed by almost everyone” (12;03 – 12;11). Company 6 explained the following: “In production, one of the elements of lean we implement is, we try to make people more ‘allround’: more people which can execute more tasks. Flexibility in the organization has to be higher. So, yes specializations will disappear to some extent” (10;30 – 10;55). Regarding company 7, this company also emphasized the development to less specialization: “What we do on the lowest level, and that is also an element of lean, is that we train people to be able to work on different work stations in production. So, we can transfer people between departments. For example, at first we had people which were specifically located near the oven, so we had only one operator responsible for one oven. That is dangerous, because if this person is not present, the oven is standing still” (14;50 – 15;58). Having a look at company 8, the following statement supported proposition one: “A creed within the organization is: ‘knowledge has to be transferred from the person, into the organization’. All information about ‘why do we always do something the way we do’, should not reside in the head of your workers, but it has to be formulated on paper and in drawings. For example, concerning the amount of rubber in a little box: if I have such a box, how much rubber do you need and if I have another box, how much rubber do you need then? This is now been formulated, so if you come here and it involves this kind of box, you need that amount of rubber. Resulting, in independence and less specialization, because you do not have to ask people: ‘what do you think?’” (24;57 – 26;26). The remaining **two cases (companies 2 and 5)** are not corresponding to proposition one, and can be found in **Table 2** (APPEND 3). Company 2 described the following: “In the past there was a person with knowledge from grinding, another person with knowledge from milling and somebody who did the assembly and someone who was responsible for engineering. That is now not anymore the case. Especially, you see that for

example, to reach a higher accuracy people need to collaborate more with each other and also anticipate on each other (27;50 – 28;15). However, I do not see the described link, that after implementing lean there is less specialization. The process will be different, but that does not mean your task will be different” (46;10 – 46;36). Referring to company 5: “We are at the beginning of the leancycle, so the effects of lean on specialization (i.e. less specialization) can not be observed yet. Theoretically: if you are standardizing more, you need less specializations. However, we are not that far yet” (58;20 – 60;36).

Proposition 2: *After implementing lean, there will be less functional differentiation (i.e. implies a reduction of the number of functionally specialized units or departments within the organization) and more horizontal integration (i.e. implies an increasing of the numbers of departments and workers, which are integrated in their work, capabilities and education/training)*

Four cases (companies 1, 4, 6 and 8) are corresponding to proposition two, and can be found in **Table 2**. As described and supported by company 1, after implementing lean there is less functional differentiation: “Briefly described, there are more colleagues which can take over or carry out your job (55;28 – 55;36). Flexibility is increasing, more specifically a person’s own organizing capability is increasing” (75;15 – 75;23). Company 4 stated: “There is less functional differentiation, but we try to keep everyone within their departments (15;55 – 16;01). However, for example, the restaurant is for us the most important place within the company. The Sales force, the office sales force, R&D, production everyone meets each other in the restaurant, where the interaction find place” (06;00 – 06;16). Company 6 also supported proposition two, by the following statement: “What we see is that we try to integrate the amount of production units into one whole, while the production function of these units will still exist. In the past, we planned and directed all the production units independent, we are now striving for one whole production unit. So, the functional differentiation will become less” (11;20 – 11;51). Having a look at company 8, the following statement supported proposition two: “In fact, we have three sales organizations: one concerns vertical transport, one concern projects and the squeezer. These three sales organizations are still in place, however before the engineering department was also divided. And in production, you will still see this breakdown a little bit. But in the production, we are already started working on it to take this breakdown out of the working place. So, it does not mind if you are a mechanic, for which sales organization you will work for. The same holds for engineering, we also started here to take the breakdown out of engineering, so engineers can also work for all the three sales organizations. Thus, it can be stated that we are combining those” (27;43 – 28;40). The remaining **four cases (companies 2, 3, 5 and 7)** are not corresponding to proposition two, and can be found in **Table 2**. Starting with the explanation given by company 2: “What you see is, that we are still working in functional departments, but there is some indication of horizontal integration. Every department (step) is a sequenced step/adaptation (28;58 – 29;11). If you talk about horizontal integration, the person who is responsible for grinding should also be able to assemble (i.e. these are two separate departments). Besides, we linked the head of assembly with expedition and warehouse, resulting in the ‘pull’ effect of one on the other” (31;12 – 31;36). To conclude, if you look to bearings there is no difference in functional differentiation, however if you look to project, then there is much more possible. Then there is some sort of matrix organization in place, which could result in a grinder which will decide

something about a milling process” (44;30 – 44;56). Company 3 stated: “I think we are not far enough in implementing lean, to see or recognize a difference in terms of functional differentiation. According to what you expect is, that on the long run, horizontal integration should be stimulated to optimize it” (17;07 - 17;32). Having a look at company 5: “Theoretically, that is the right order. However in practice these developments are difficult to see and identify within 10 years. There is no real difference to see, as before implementing lean. However, there are also in this organization some indications of departments which are fading away, this is also directly my fear for generalizing” (61;55 – 63;56). Company 7 emphasized the following: “There is no change on the functional level. Production, project preparation etc. are still structured in functional departments. The multifunctional availability of employees is now more present and emphasized as in the past, something lean indicates” (19;20 – 19;52).

Proposition 3: *After implementing lean, there will be less formalization (i.e. implies less codification in terms of who has to what, where and when and less dedication exerted in maintaining and applying these rules) and more emphasis on organizational flexibility*

Three cases (companies 1, 3 and 7) are corresponding to proposition three, and can be found in **Table 2**. Company 1 stated there is less formalization: “The organization is changed from a functional to process oriented. Now, we have much less function descriptions for example. Something we learned is that instead of delegate the solution, delegate the problem. So, for example if you think some department is not operating well, you can say as a manager: ‘from tomorrow we will do it in this way’ and everybody is against you. However, you can also say: ‘listen, we want to reduce the lead time and you have the responsibility for this. You will get the budget, and the solution has to be in such a way that it can be done with the same machines, the lay-out of the work floor can be changed, but we want to keep the same color coding en we do not want that the solution is resulting in expanding people capacity’. Thus, in this way you delegate the problem. We expect from people to not only execute their primary task, but also be organizational good. And that has everything to do with not thinking in terms of function descriptions, rules, procedures. The focus must be on that product which will head to the customer, and adjust to this. The above description of the development of formalization is absolutely due to the implementation of lean. It is much more fun to work in such an organization, than an organization in which everything is strongly regulated” (47;35 – 50;43). Company 3 described the following: “At first, you have to make everything more clear. As lean is implemented further and is optimized in my point of view, rules becomes less relevant: for the people who are already working in the company, however for a newcomer rules will keep the same relevance (19;22 – 20;10). After implementing lean there will be less formalization in place” (26;48 – 26;51). Company 7 also supported proposition three, by the following statement: “There is absolutely less formalization. Related to this, is that we are now trying to work with a foreman construction. In the past, we had a chief production, who headed for 30 production workers. Now we have a foreman ‘assembly’, a foreman ‘welding’ and a foreman ‘production of parts’. Those people will get once a week a task list. This is your task for this week, and we will monitor if you succeed or not succeed and the rest is arranged by the department. There is no leader role, so they can do it in their own way. We expect independence, and by giving this independence, we expect more creativity and effort” (32;55 – 33;39). The other **five cases (companies 2, 4, 5, 6 and 8)** are

not corresponding to proposition three, and can be found in **Table 2**. Company 2 explained the following: “Less formalization depends on the tool you select out of the toolbox. For example ‘kanban’ in general, results in a very flexible state of mind. If you define the frameworks for people, they also start to help thinking: ‘when something is coming out of production, as something is not delivered anymore’. They assume everything is available and right in place. The other side is that by formalizing more, as explained as follow, there is a lack in the thought processes (42;03 – 42;47): we implemented some changes. Partly this is good, because therefore causes become clearer, like loss registration, 8d reports for customers etc. Whereas, you are looking to what are the underlying causes. This has a certain impact on the registration of people, and not only concerning ‘there is something wrong’, but also analyzing why. The first two or three times, people will carry this out, however afterwards it becomes difficult for them and they are not motivated anymore to do this. That is the moment you have to be right in place. Concerning formalization and loss registration, I would say this has a one-to-one relationship with lean. As a result of carrying out loss registration, people become also more conscious about lean thinking. Besides, we are certificated ‘AC 900’ for aerospace and this will limit innovation to some extent. For example, people have to carry out FEMA analysis for projects. What you see is, people are being busy with executed checklists, while one is not concerning about how can I get that thing as fast as possible to production and tested and additionally an element of quality management is behind it. On a certain moment you see that people are less conscious about what they are really doing, because they are operating for certification and for the customer by taking care their ‘homework’”(34;55 – 37;12). Company 4 stated: “Yes, I think there is more space for creativity, after implementing lean (17;48 - 17;57).We must have bureaucracy, because we are in the chemical factory, so we must put a lot of stuff: rules and procedures on papers.(23;40 – 23;55) The number of rules ‘who has to do what, when and where’ is not reduced, but more structured, because we are working such a way we also have more stricter rules (34;10 – 35;04). I am asking myself if there is more or less formalization in place and I think a change in the nature of formalization is the right description. For example, people can do more and it becomes more easy, however there is more restriction to this freedom” (36;03 – 36;40). Having a look at company 5: “Theoretically I agree with the development to less formalization, however in practice this development is not taking place in our organization. (73;09- 73;17). I think you will get more formalization. If you standardize, you will get more formalization, so thinking in terms of: ‘we will do in this way’. After the standardization is settled or integrated, a development directed to less formalization could be in place, however in first instance you will get more formalization” (65;17 – 65;40). The following description is been given by company 6: “It becomes more important to follow the rules. However, there is no increase in the number of rules, but the extent in following the documented production method is becoming more important. (12;15 – 12;38). In practice, I prefer to decrease the number of rules. Too much rules and complexity makes it unclear for employees” (12;59 - 13;11). Company 8 gave the following explanation: “There is more formalization, because we want to register everything we do more clearly (29;08 - 29;19). So, on one side we are very formal, to make the standard product better and faster. On the other side, this will result in more space and time for creativity” (40;05 – 42;04).

Proposition 4: *After implementing lean, there will be a change in the nature of formalization (i.e. implies rules regulations which stimulate creativity, autonomous working and learning) and more emphasis on organizational flexibility*

Six cases (companies 1, 2, 3, 4, 5 and 7) are corresponding to proposition four, and can be found in **Table 2**. Company 1, and 2 both supported proposition four by their identical statement: “Correct” (74;00-74;35 and 42;59 – 43;12). While company 3 also supported proposition four by giving a clear illustration: “Correct. For example, take initiative to improvements and the pertaining authority with regard to investments or improvements. It is about relatively small amounts of money” (26;58 – 27;42). Company 4 stated: “Be independent and take initiative are both seen as really valuable in the organization and the space to do this, is present. We try to develop all people as good as possible. There is the possibility for people, to do some more extra effort and stimulate their personal development” (13;43 – 14;06). As described and explained by company 5, there is a change in the nature of formalization: “Correct. However, I think there is more emphasize on standardization, with regard to the nature of formalization and less on creativity” (73;18 – 73;46). Having a look at company 7, this company stated: “Correct. There is more emphasize on creativity as explained in terms of less formalization. Less formalization and the change in the nature of formalization is associated with each other” (33;45 – 33;58).

Two cases (companies 6 and 8) are not corresponding to proposition four, and can be found in **Table 2**. This is explained as follow by company 6: “I do not think this is taking place in our organization. It becomes even more important to follow the rules, which are in place” (21;00 – 21;09). Company 8 stated: “Creativity is not described and formulated in rules and procedures” (42;00- 42;13).

Proposition 5: *After implementing lean, there will be less specialization (i.e. implies a reduction in the number of hierarchical levels within the organization)*

Four cases (companies 1, 3, 4, and 5) are corresponding to proposition five, and can be found in **Table 2**. As described and explained by company 1, there is less vertical differentiation: “This is correct, there is more vertical integration. Hierarchical levels and positions within the organization are fading away” (74;35 – 74;58). Company 3 explained the following: “In this department, where we took away all the supervisors, you can see this development. That process did introduce the shaping of self-organized teams (21;00 – 21;43). After implementing lean there will be absolutely less vertical differentiation, and perhaps less vertical differentiation has to be you starting point, before implementing lean (27;50 – 28;09). However organization-wide the before described development is not recognizable yet” (21;25 – 21;38). Company 4 also emphasized that there is less vertical differentiation: “That is totally correct” (15;19 – 15;31). Having a look at company 5, this company explained: “If you standardize, a more flat organization structure will originate” (64;37 – 64;59). **Four cases (companies 2, 6, 7 and 8)** are not corresponding to proposition five, and can be found in **Table 2**. Company 2 described the following: “If you look to the organizational structure, this structure will not become more flat. I do not see this relation between vertical differentiation and implementing lean, which will result in less vertical differentiation” (43;15 – 43;45). Company 6 stated: “In practice, I hope there will be less vertical differentiation, however this development is not recognizable yet. Perhaps, next year this development can be identified” (13;16 – 13;40). Company 7 emphasized the following: “We are trying to reduce

the vertical integration, because of lean. We just want to be flat (21;59 – 22;24). However, it still has to be proved if this development of less vertical integration will succeed. We doubt this, because it concerns the competences of our people. For example, head production must be capable of executing the functions of the planner, if you want to be able to drop out one layer. Where the function of planner is positioned as one layer above head production” (34;00 – 35;13). Having a look at company 8, this company stated: “There is more vertical differentiation (29;42 – 29;46). It cannot be stated that implementing lean will result in less vertical differentiation (42;24 – 42;50). In our case, a few years ago (‘seen as the first wave of lean’) the organization was cutting drastic in middle management functions, currently (‘seen as the second wave of lean’, is about one year ago) we even add some functions” (22;00 – 22;11).

To conclude, having a look at the propositions 1 to 5, you can conclude that there is a strong support for the propositions 1 (i.e. less specialization): six cases and 4 (i.e. change in the nature of formalization): six cases, not a strong support for propositions 2 (i.e. less functional differentiation): four cases and 5 (i.e. less vertical differentiation): four cases and a weak support for proposition 3 (i.e. less formalization): three cases. These data is all illustrated in **Table 2** (APPENDIX 3).

5.2. How does the organizational structure, influences innovation on an incremental and radical level?

To be able to answer the **second sub-question** completely, first two additional steps have to be completed. The fourth step was to ask the participants to what extent they agree with:

(4) defining product innovation in terms of exploration and exploitation.

This distinction between explorative innovations from those that exploit current knowledge is important, because this study is not only about innovation in general terms. The perspective taking in this research is that the view that adoption of radical (i.e. exploration) and incremental (i.e. exploitation) innovation, hinges on a distinction between structural variables, which refers to the *theory of innovation radicalness*. If this distinction is not present, the companies can also describe innovation in general terms, which refers to the uni-dimensional theory. So, do all companies define innovation in terms of exploration and exploitation and to which ratio:

All eight cases, are able to, define innovation in terms of exploration and exploitation, however there are some differences between the cases in terms of the ratios and the perspectives taken to innovation, illustrated in **Table 3**. **Two cases (companies 1** (70% exploitation and 30% exploration) and **2** (50% exploitation and 50% exploration)) described the following: “Exploitation is or can be continuously carried out, exploration depends on the type of product and the market need” (81;24 – 81;44 and 62;38 – 62;04). **Two cases (companies 3** (50% exploitation and 50% exploration) and **4** (50% exploitation and 50% exploration)) explained the following: “Basically in our case the ratio is or should be 50% : 50%, depending on the new type of product we want to design” (31;08 – 31;24 and 37;29 – 37;46). Having a look at **company 5**, this company emphasized: (50% exploitation and 50% exploration): “In our type of business, exploitation is more the thing to use, because exploration is totally new and we have two machines which make paper and these are limited. You have a limited talent of production units; you have a limited amount of money. So, you are limited. You can do exploration,

because it is very rewarding in the beginning, but in getting it to the market we have not been successful yet” (88;41 - 89;47). **Company 6** (10% exploitation and 90% exploration) described its perspective towards innovation as follow: “More focusing on exploration and to a less extent in which we focus on exploitation” (22;08 – 22;34). **Company 7** (80% exploitation and 20% exploration) described the balance as follow: “80% exploitation and 20% exploration (59;25 – 59;34). We do both, for example our core business: the plough machines are always seen as exploitation. Besides, exploration can be seen as an take-over we did three years ago, something that is not our daily job” (37;46 – 39;16). **Company 8** (80/90% exploitation and 20/10% exploration) stated: “At first, we are practicing exploitation, afterwards we are also considering exploration” (44;38 – 45;10).

Furthermore, the fifth step implies:

(5) the proposed relationship between organizational structure and the type of product innovation.

The participants were asked to what extent they agree or are familiar with the proposed relationship, to get an indication if organizational structure affects innovation in terms of incremental and radical. So, does the organizational structure prescribe one of the two types of innovation? Or is there a reversed causality, which means that a certain innovation type is developed and the organizational structure is adapted to it?

Two cases (companies 5 and 8) agree with the direction of the relationship between organizational structure and the type of product innovation (i.e. organizational structure→innovation) and see this relationship in practice. To start with the explanation provided by company 5: “I believe that lean is a method that takes in a certain kind of energy, and this energy will get a kind of shape. Thus, originating from lean you will get shape and not the other way around. So, lean will result in a work form, this work form you want to embed and from that point there will originate a structure. And the originating structure is also structuring innovation and maybe also another functional layout” (77;53 – 78;37). Company 8 explained: “Now we have an existing product and we are busy with getting the organization ‘lean’, whereby the product can be produced in the most efficient way. If we want to produce a completely product later on, we are trying to produce that product in the current structure as soon as possible. So, implementing lean will result in a specific organizational structure, through which you can innovate” (47;20 – 48;52).

Three cases (companies 3, 6 and 7) agree with the direction of the relationship between organizational structure and the type of product innovation (i.e. organizational structure→innovation), but this relation is not uniformly present in practice. Company 3 explained that the direction ‘organizational structure-innovation’ can be present as well as the direction ‘innovation-organizational structure’: “The direction ‘structure-innovation’ is possible. However, the direction depends on the kind of industry you are operating in and depends on how big is your innovation. If you go back to the ‘ideal world’, then it is right that a complex innovation needs a different structure than a relatively simple innovation. On a micro-level you will see this in practice, for example we have different kind of structures for different kind of innovations: with one innovation there will be more integration of varied disciplines than with another kind of innovation” (38;13 – 39;52). Company 6 and 7 both stated that the relationship can be present, however for both cases it is not uniformly present in practice, relatively stated as follow: “I agree with the proposed relationship of the impact of ‘lean on structure’ and ‘structure on innovation’. What we see is that

radical innovation will exist as usual, and production has to adapt to this radically new innovations, but within the lean structure. And from lean, you will see that incremental innovations are necessary to structure lean better in you product organization. To explain more clearly, you should distinguish between a bottom-up and a top-down implementation of lean. I prefer a top-down approach; however in practice you will see that bottom-up, originating from production, is more in place. If you implement lean top-down, you will see that you really get the structure of lean in you production. However, in case of a bottom-up approach it is the other way around: radical innovation is in that case completely independent from the implementation of lean” (31;02 – 33;15) and “I would say that innovation is separated from the things we do with lean. The positive effects of lean on engineering cannot be identified yet. I agree with the thought that we should structure the engineering department. However, we are positioned in a very dynamic market where things are happening fast. And lean causes that the people around the drawing table, are been stucked: that person is busy with a project of half a year, another person is busy with a project for four months etc. and that is bothering us” (43;14 – 46;24). The remaining **three cases (companies 1, 2 and 4)** agree with the direction of the relationship between the type of product innovation and organizational structure (i.e. innovation→structure). To start with the explanation given by company 1: “I think, it is no so much the organizational structure that influences innovation. Briefly said, twenty years ago we were thinking in terms of organization structures. The starting point is the organizational structure and everything is resulting from that. A lot is changed now, now you define your customer need and you make clear what is the fastest and cheapest way to satisfy this customer need and the organizational structure is subordinated. The function of the organizational structure is shifted from an important parameter to an supporting function. You are thinking in terms of processes. The organizational structure has no determining influence but a subsequent influence. Your organizational structure serves innovation and not the other way around” (85;40 -87;44). Having a look at company 2, this company described: “It is never the case that somebody has an idea that can be directly placed in the current organizational structure. So, first innovation and then the project organization will be present” (50;29 – 51;18). Company 4 described that their organization is maybe somewhat different compared to other organizations, but that the direction ‘innovation-structure’ is most reasonable for them: “I think, innovation comes first and that the organizational structure has to be adapted to the innovation” (27;00 – 27;05).

There are two causal linkages between organizational structure and innovation: ‘organizational structure→innovation’ and ‘innovation→organizational structure’, which are supported or not supported by different companies, as illustrated in **Table 3**. You would expect that if a company takes the perspective ‘innovation→organizational structure’, the link between a structural variable and its influence on innovation will become less clear. After analyzing step six (6) it should become clear if there is a difference between the perspectives taken towards the relationship between organizational structure and innovation (i.e. either one direction or both) and less or more influence of the structural variables on innovation.

After completing step four (4) and step five (5), the sixth step (6) is structured to answer the **second sub-question** by incorporating four propositions and a concluding section, comprising: ‘if there is a change in the balance between incremental and radical innovation over time?’

The participants were asked to describe:

(6) how innovation on an incremental level and radical level has developed over time after implementing lean.

Propositions are formulated to direct and structure the described development and to be able to identify and describe cases which are corresponding to the propositions and which are not corresponding, and look for the reasons why. The propositions include the proposed development of a structural variable over time (i.e. as shown by the propositions formulated at step three (3), excluding proposition 4), and if this structural variable has an impact on incremental innovation, radical innovation, innovation in general (i.e. which mean the structural variable influences both types of innovation equally. So, there is no distinction made between incremental and radical innovation) or it does not influence innovation, which means that there is no relation identified between the structural variable and innovation.

Proposition 6: *Less specialization will result in a focus on incremental or radical innovation*

Four cases (companies 1, 3, 7 and 8) are corresponding to proposition six, and can be found in **Table 3**. As described and supported by company 3: "If there is less specialization, the focus will be more on radical rather than incremental innovation" (47;27 - 47;38). Having a look at company 8, this company explained: "I think that if there is less specialization, people can more easily focus on radical innovation, because they can think sooner 'out of the box'. In case, people stay very specialized, they will think only in terms of sub-problems and do not see the bigger picture" (53;33 - 54;02). While company 7 stated: "Looking to production, there will be more focus on incremental innovation. For example, consider the 'laser cutter'. There is less specialization, so people can interchange between departments and then you have to take care of the fact that your products or not difficult" (51;25 - 52;26). The remaining **four cases (companies 2, 4, 5 and 6)** are not corresponding to proposition six, and can be found in **Table 3**. Company 2 supported the proposition, however this company is not corresponding with the proposed development in terms of less specialization: "If there was less specialization, the focus will be more on radical rather than incremental innovation" (59;03-59;14). Company 4 and 6 identically stated the following: "Less specialization is not resulting in a focus on radical innovation or incremental innovation. So, both not (no relation)" (32;37 - 32;58 and 37;37 - 37;50). Company 5 explained: "There is no link between less specialization and more focus on incremental or radical innovation. However, purely reasoning you would expect that there is less focus on incremental innovation, because of less in-depth knowledge about the product and more unrestricted knowledge about everything. That can also mean that this knowledge is outside your comfort zone or expertise" (83;02 - 83;30).

Proposition 7: *Less functional differentiation will result in a focus on incremental or radical innovation*

Two cases (companies 6 and 8) are corresponding to proposition seven, and can be found in **Table 3**. Companies 6 and 8 stated: "If there is less specialization, this will result in more incremental innovation" (36;37 - 36;52 and 52;38 - 52;52). **One case (company 2)** supported proposition seven, however this company is not corresponding with the proposed development in terms of less functional differentiation (except for projects): "If you are involved in more projects, you become

more innovative and in general this mean you become also more radical oriented" (59;20 - 59;40). **Three cases (companies 1, 3 and 4)** described that there is a relation between less functional differentiation and a focus on innovation in general. Having a look at company 3, this company emphasized: "There will be a focus on both (innovation in general), however the development of getting less functional differentiation is not taken place in this organization" (04;42 - 04;53). Company 4 stated the following: "Focus on both" (31;40 - 31;57). **Two cases (companies 5 and 7)** stated that there is no relation between less functional differentiation and innovation. Company 5 explained: "No relation" (82;40 - 82;58) and company 7: "Functional differentiation is not more or less, so it did not change and had no effect on innovation" (50;40 - 50;52).

Proposition 8: *Less formalization will result in a focus on incremental or radical innovation*

None of the eight cases is corresponding to proposition eight, and can be found in **Table 3**. **One case (company 2)** supported proposition eight, however this company is not corresponding with the proposed development in terms of less formalization: "If it would be less formalized in our organization, we would be more radical oriented" (56;22 - 56;29). **Two cases (companies 5 and 8)** stated that there is a relation between formalization and innovation, which is described as follow by the two companies respectively: "Lean results in more formalization. So, first very radical and now mainly a mix of radical and incremental innovation" (81;44 - 82;05) and "At this moment, if I formalize more, this will result in a focus on incremental innovation" (50;42 - 51;33). Because of the fact that company 5 and 8 have no less formalization but more formalization in practice, these cases are not corresponding to proposition eight. However, company 5 and 8 implicitly stated that there is a relationship between less formalization and innovation. **The remaining five cases (companies 1, 3, 4, 6 and 7)** described that there is a relation between less formalization and a focus on innovation in general. Companies 1 and 3 explained: "I think both equally" (90;50 - 90;58 and 03;34 - 03;45). The description given by company 4: "There is not really a focus on one of the two types of innovation" (30;44 - 30;58). Company 6 and 7 identically stated the following: "I think it holds for both types of innovation" (34;34 - 34;51 and 48;14 - 48;39).

Proposition 9: *Less vertical differentiation will result in a focus on incremental or radical innovation*

None of the eight cases is corresponding to proposition nine, and can be found in **Table 3**. **One case (company 6)** supported proposition nine, however this company is not corresponding with the proposed development in terms of less vertical differentiation: "As a result of lean thinking, the focus tend towards incremental innovation" (35;37 - 36;00). **Four cases (companies 1, 2, 3 and 4)** described that there is a relation between less vertical differentiation and a focus on innovation in general. Company 1, 2, 3 and 4 identically stated the following: "Focus is on both types" (56;44 - 56;54 and 45;08 - 45;30 and 31;28 - 31;39). The remaining **three cases (companies 5, 7 and 8)** stated that there is no relation between less vertical differentiation and innovation, as described by company 5 as follow: "There is no link between less vertical differentiation and a focus on incremental, radical or both (innovation in general) types of innovation" (82;28 - 82;37). Company 7 explained: "Yet, it is too early to conclude something about it" (49;53 - 50;06). Having a look at the

description given by company 8: “I do not see one of those links” (51;37 – 51;57). Because of the fact that company 8 has no less vertical differentiation but more vertical differentiation in practice, this case implicitly states that there is also no link between less vertical differentiation and innovation.

Concluding, looking to the above described propositions and how the described developments within these propositions are present in practice, is far from being a general rule. With regard to the scope of this research, we defined innovation in terms of radical and incremental. Related to theory, it is stated that some structural variables are more positively related to radical innovation and some to incremental innovation. However, there is no strong relation between the type of structural variable and its impact on a specific kind of innovation, as illustrated in **Table 3**. For example, having a look at proposition 6, four cases emphasizes that there is a focus on a specific kind of innovation: two cases indicated a focus on incremental innovation and two cases indicated a focus on radical innovation. It is outside the scope and not the purpose of this research to validate the proposed relationship between a structural variable and a specific type of innovation, but to look if there is a relationship between a structural variable and one of the innovation types and therefore if the “balance” between the two types of innovation is changed. With regard to the propositions illustrated in **Table 3**: Proposition 6 is corresponding to four cases, Proposition 7 is corresponding to two cases, Proposition 8 to zero cases and proposition 9 also to zero cases. Besides, it holds for only a few cases that there is a real impact of a structural variable on the “balance” between the two types of innovation. The relations between a structural variable and the types of innovation are too weak to conclude that there is a relationship between a structural variable and a type of innovation, and that because of this relationship and its described development the “balance” between the two types of innovation in the organization will change.

6. DISCUSSION

In this section there will be looked at those cases that are not corresponding to the propositions and the reasons why. The reasons why are briefly discussed by including some statements and short answers. Additionally, reasons will be compared to see whether certain cases provide the same reasons for not corresponding to the propositions.

The first proposition, which proposes that there is less specialization in the organization after implementing lean, is not corresponding to **two cases (companies 2 and 5)**. The main reason why company 2 has more specialization instead of less is that the internal process will be different after implementing lean. However, the task will be still the same. This is supported by: “However, I do not see the described link: that after implementing lean there is less specialization. The process will be different, but that does not mean your task will be different” (46;10 – 46;36). For company 5, the main reason that there is no less specialization is that “We are at the beginning of the leancycle, so the effects of lean on specialization (i.e. less specialization) can not be observed yet. Theoretically: if you are standardizing more, you need less specializations. However, we are not that far yet” (58;20 – 60;36). This indicates that it really depends on the extent to which lean is implemented (i.e. not only in terms of the amount lean tools, but also and maybe even more in terms of time (learning process)) at that point in time, if the proposed development can be identified in practice. For example for one company, within two years the proposed development is may already be visible and for another company, this could be within four years. To conclude, the relationship which is described in proposition one, holds for six

of the eight cases. So, it can be stated that there is a strong relation between implementing lean and less specialization.

The second proposition, which proposes that there is less functional differentiation in the organization after implementing lean, is not corresponding to **four cases (companies 2, 3, 5 and 7)**. The main reason why companies 2 and 7 have the same degree of functional differentiation instead of less functional differentiation is that the number of functional departments is still the same, however on an individual level there is some indication of more horizontal integration: “What you see is, that we are still working in functional departments, but there is some indication of horizontal integration. Every department (step) is a sequenced step/adaptation (28;58 – 29;11)). If you talk about horizontal integration, the person who is responsible for grinding should also be able to assemble (i.e. these are two separate departments). Besides, we linked the head of assembly with expedition and warehouse, resulting in the ‘pull’ effect of one on the other” (31;12 – 31;36). Company 7 explained: “Production, project preparation etc. are still structured in functional departments. However, the multifunctional availability of employees is now more present and emphasized as in the past, something lean indicates” (19;20 – 19;52). The above statements indicate that in current literature there is not really a difference formulated in terms of ‘department level’ or ‘individual level’, regarding functional differentiation. While it is maybe helpful and clearer to distinguish between the two, because both company suggest that in terms of the integration of workers there may be some indication of more horizontal integration. Additionally, company 3 and 5 are also not corresponding to the second proposition and emphasized that they are in the early phase of implementing lean. Company 3 stated: “I think we are not far enough in implementing lean, to see or recognize a difference in terms of functional differentiation. According, to what you expect is that on the long run, horizontal integration should be stimulated to optimize it” (17;07 - 17;32). Having a look at company 5, this company explained: “Theoretically, that is the right order, however in practice these developments are difficult to see and identify within 10 years. There is no real difference to see, as before implementing lean. There are also in this organization some indications of departments which are fading away, this is also directly my fear for generalizing” (61;55 – 63;56). The statements of company 3 and 5 are also indicating that it really depends on the extent to which lean is implemented (i.e. not only in terms of the amount lean tools, but also and maybe even more in terms of time (learning process)) at that point in time, if the proposed development can be identified in practice. To conclude, the relationship which is described in the second proposition holds for four of the eight cases. So, there is not a strong relation between implementing lean and less functional differentiation.

The third proposition, which proposes that there is less formalization in the organization after implementing lean, is not corresponding to **five cases (companies 2, 4, 5, 6 and 8)**. The assumption in current literature for this proposition is that a lean producer is characterized through different attributes, which are needed to be an excellent manufacturer. Related to the structural variable *formalization*, organizational flexibility and adaptability are cited as increasingly important ingredients for excellent manufacturers. This is because, “competitive priorities in manufacturing are defined by four dimensions: quality, dependability, cost-efficiency and flexibility” (De Meyer, Nakane, G. Miller, & Ferdows, 1989, p. 139). When looking to following elements of lean manufacturing: “the reduction of the lead times in production, the development of new processes for new products, the reduction of set-up times

and giving workers a broader range of tasks, all point in the same direction: flexibility” (De Meyer, Nakane, G. Miller, & Ferdows, 1989, p. 139). However, the danger in adopting formal programs (i.e. which can be part of lean management) is that formalization often results in a loss of organizational flexibility. Flexibility and low emphasis on work rules facilitate innovation. Low formalization permits openness, which encourages new ideas and behaviors. However, the current literature made no distinction between the industry the organization is operating in (i.e. company 4) and the early phase of implementing lean in your organization and the subsequent phase of implementing lean (i.e. company 5). This research found out these that these characteristics differentiate some SMEs from each other. **Company 4** stated the following: “We must have bureaucracy, because we are in the chemical factory, so we must put a lot of stuff: rules and procedures on papers (23;40 – 23;55). The number of rules ‘who has to do what, when and where’ is not reduced, but more structured, because we are working such a way we also have more stricter rules (34;10 – 35;04). I am asking myself if there is more or less formalization in place and I think a change in the nature of formalization is the right description. For example, people can do more and it becomes more easy, however there is more restriction to this freedom” (36;03 – 36;40). **Company 5** stated during the interview: “I think you will get more formalization. If you standardize, you will get more formalization, so thinking in terms of: ‘we will do it in this way’. After the standardization is settled or integrated, a development directed to less formalization could be in place, however in first instance you will get more formalization” (65;17 – 65;40). Due to these statements it can be suggested that current literature it not completely right in generalizing all the organizations with regard to the industry in which they are operating and by not describing lean as a process which comprise different phases, which probably mean also different characteristics. The remaining **three cases (companies 2, 6 and 8)** respectively stated the following. The main reason why company 2 has no less formalization, is that after implementing lean there will be more formalization in place to make causes clearer, like loss registration: “If you define the frameworks for people, they also start to help thinking: ‘when something is coming out of production, as something is not delivered anymore’. We implemented some changes; partly this is good, because therefore causes become clearer, like loss registration, 8d reports for customers etc. Whereas, you are looking to what are the underlying causes. Concerning formalization and loss registration, I would say this has a one-to-one relationship with lean. As a result of carrying out loss registration, people become also more conscious about lean thinking” (34;55 – 37;12). The following reason is given by company 6: “It becomes more important to follow the rules. However, there is no decrease and increase in the number of rules, but the extent in following the documented production method is becoming more important. (12;15 – 12;38). In practice, I prefer to decrease the number of rules. Too much rules and complexity makes it unclear for employees” (12;59 - 13;11). Company 8 gave the following explanation: “There is more formalization, because we want to register everything we do more clearly (29;08 - 29;19). To conclude, the relationship which is described in the third proposition holds for three of the eight cases. So, there is a weak relation between implementing lean and less formalization.

The fourth proposition, which proposes that there is a change in the nature of formalization in the organization after implementing lean, is not corresponding to **two cases (companies 6 and 8)**. The main reason why company 6 stated that there is no change in the nature of formalization is that “I

do not think this is taking place in our organization. It becomes even more important to follow the rules, which are in place” (21;00 - 21;09). Company 8 reasoned: “Creativity is not described and formulated in rules and procedures” (42;00-42;13). To conclude, the relationship which is described in the fourth proposition holds for six of the eight cases. So, it can be stated that there is a strong relation between implementing lean and a change in the nature of formalization.

The fifth proposition, which proposes that there is less or more vertical differentiation in the organization, after implementing lean is not corresponding to **four cases (companies 2, 6, 7 and 8)**. The main reason given by company 2 is: “If you look to the organizational structure, this structure will not become more flat” (43;15 – 43;45). The main reason why companies 6 and 7 have no less vertical differentiation is that these organizations are in the early phase of implementing lean: “In practice, I hope there will be less vertical differentiation, however this development is not recognizable yet” (13;16 – 13;40). Company 7 emphasized the following: “We are trying to reduce the vertical integration, because of lean. We just want to be flat (21;59 – 22;24). However, it still has to be proved if this development of less vertical integration will succeed” (34;00 – 35;13). The statements of company 6 and 7 are also indicating that it really depends on the extent to which lean is implemented (i.e not only in terms of the amount lean tools, but also and maybe even more in terms of time (learning process)) at that point in time, if the proposed development can be identified in practice. Company 8 explained the following: “There is more vertical differentiation (29;42 -29;46). In our case, a few years ago (‘seen as the first wave of lean’) the organization was cutting drastic in middle management functions, currently (‘seen as the second wave of lean’, is about one year ago) we even add some functions” (22;00 – 22;11). To conclude, the relationship which is described in the fifth proposition holds for four of the eight cases. So, there is not a strong relation between implementing lean and less vertical differentiation.

For the proposition six, seven, eight and nine holds that these are described in step six (6) in **sub-question two**. This means, including a brief reason why some cases are not corresponding to the propositions.

The practical implications of this research are as followed: the development of the structural variables over time can be affected by implementing lean, while the development depends on the extent to which lean is implemented (i.e. not only in terms of the amount of lean tools, but also and maybe even more in terms of time (learning process)). However, there are more parameters which can have an influence on the organizational structure, as indicated by different managers, such as the industry the organization is operating in and the phase the organization is in with regard to implementing lean. Besides, separate units in an organization can be structured in a different way, such as the rules and procedures in an innovation unit can be different compared to the rest of the organization. Therefore, companies need to clearly define and describe the unit(s) in which product innovation is taking place. So, by clearly defining the unit(s) in which product innovation is taking place, the development of the structural variables can be described more straightforward.

7. LIMITATIONS & FUTURE RESEARCH

Several limitations to this research deserve attention and provide guidance for future research. First of all, this research only investigated the propositions and proposed relationships by looking at a sample size of eight SMEs throughout the Netherlands. Second, the SMEs were selected by their company size, which was determined by the number of employees with a

permanent contract. Third, the participants for this research were randomly selected and not all fulfilling the same positions within their organization. Fourth, the proposed relationships in this research were formulated as one-to-one relations and therefore there was a limited amount of parameters or antecedents. Different managers indicated that there are more parameters which can have an influence on the organizational structures besides lean management, and that there are more parameters which can have an influence on the organization of innovation besides organizational structure. Fifth, the development of the structural variables over time can be affected by implementing lean, while the development depends on the extent to which lean is implemented (i.e. not only in terms of the amount of tools, but also and maybe even more in terms of time (learning process)). For these reasons, the results of this research are limited and cannot be taken for granted for all SMEs. However, the results of this research show some interested findings on how the organizational structure, in terms of: specialization, functional differentiation, formalization and vertical differentiation, of SMEs engaged in lean management is changed. Not only changing in such a way as proposed, but also changing in an unexpected way. Besides, the insignificant relation between organizational structure and innovation is surprising. In addition, this research showed that current literature might be incomplete in its assumptions about positive and negative relations between different structural variables and the types of innovation. Besides, also incomplete in the sense that if a structural variable will change over time in more or less, what this will mean for the relation of this structural variable with the types of innovation. Further, this research shows that there is not only a one-to-one relationship between organizational structure and innovation, but also a reversed causality between the two, indicating that current literature might not be completely right about generalizing innovation as being dependent on organizational structure. Because of these findings, future research might conduct a similar research but with including participants which fulfill similar positions within their organization. Additionally, it would be interesting if the size of the SMEs is not only determined by the number of employees with a permanent contract, but also other firm characteristics such as turnover, profit sales etc.

8. CONCLUSION

The notion of lean management is for most companies not only a set of management practices, tools or techniques that can be observed directly (i.e. operational level), but also guiding principles and overarching goals (i.e. strategic level). This is corresponding to the shift in focus after 1990 that went away from the “shop-floor focus” on waste and cost reduction (i.e. lean production) to the adaption of production systems, to include a new design based upon “lean principles” (i.e. lean thinking). So, just thinking in terms of lean production, by for example offering your employees the lean tools and let them work and not in terms of lean thinking, by for example engaging your employees in the continuous process of implementing lean and make them conscious of lean principles, is not recommended. Companies need to understand the link between the operational level and the strategic level in order to apply the right tools and strategies to provide customer value, and to take optimal advantage of their goal alignment. Having a look to the proposed relationship between lean and organizational structure, it can be concluded that there is no difference between the perspectives taken towards the proposed relationship: lean management and organizational structure (i.e. yes or no) and the development of structural variables over time. This is because of the fact that despite some companies are not corresponding to this proposed relationship, all

companies indicate that at least one of the structural variables has changed after implementing lean. Therefore, this study shows that the concept of organizational structure would be too general, without incorporating different structural variables. Besides, it shows that it is very important to be cautious with relationships and causalities, in terms such as organizational structure: organic and mechanistic. The relation and the direction of the relationship between lean and organizational structure is obvious, but there are two causal links between organizational structure and innovation. However, it seems that the causal link has no influence on the impact a structural variable can have on the type of innovation. Concluding, there is no difference between the perspectives taken towards the relationship between organizational structure and innovation (i.e. either one of the two directions or both) and less or more influence of the structural variables on innovation. Related to theory, it is stated that some structural variables are more positively related to radical innovations and some to incremental innovation. However in this study there is no strong relation identified between the type of structural variable and its impact on a specific kind of innovation. If this was the case in practice, you would expect that if a structural variable is focusing more on one type of innovation, the “balance” of innovation would also shift to more a focus on that type of innovation. However, by analysing across **Table 2** and **Table 3**, it is obvious that if a structural variable has an impact on one of the two types of innovation, there is no strong indication that the “balance” of innovation will also change. Illustrated by the following example, out of the six cases which are corresponding to proposition 1, four cases emphasize that there is a focus on a specific kind of innovation (i.e. incremental or radical), while only two of the four cases explain that there is a change in the “balance” of innovation. Besides, the relationship between organizational structure (i.e. the development of the structural variables) and its influence on the “balance” of innovation (i.e. incremental or radical) is not strong in practice. For example, case eight: proposition 6 is supporting incremental innovation, proposition 7 is supporting radical innovation, proposition 8 is supporting innovation in general and proposition 9 states that there is no relation, while the “balance” of innovation is changed to more a focus on incremental innovation. Having a look to the relationship between organizational structure and innovation, companies make insignificant distinctions between the influence of structural variables on incremental or radical innovation. **Table 3** illustrates that only six cases distinguish between incremental and radical innovation and fourteen cases emphasize innovation in general. So, with regard to this study it can be concluded that the combination of *the radicalness theory* and the uni-dimensional theory of innovation provide a complete oversight of all the interesting findings with regard to innovation.

To conclude, lean management in SMEs is not strongly affecting the organization of innovation, by influencing the organizational structure, in terms of specialization, functional differentiation, formalization and vertical differentiation. The impact of lean management on organizational structure is evident. However the impact of this organizational structure on the organization of innovation is insignificant. Some structural variables developed over time as proposed. However, also when these structural variables have (or have not) an impact on one of the types of innovation, this does not have to have an influence on the “balance” of innovation. In brief: first, there is no strong indication that there is a clear relation between different structural variables and a specific focus on one of the two types of innovation. Second, there is no indication that there is a relation between the impact the structural variables have on the two types of innovation and

the “balance” of innovation, which is then expected to be determined by the type(s) of innovation(s) which is (are) influenced by the structural variable(s). So, because of this insignificant influence of organizational structure on the organization of innovation, it can be expected that there should be more parameters which are influencing the organization of innovation, together with the organizational structure.

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APPENDIX 1

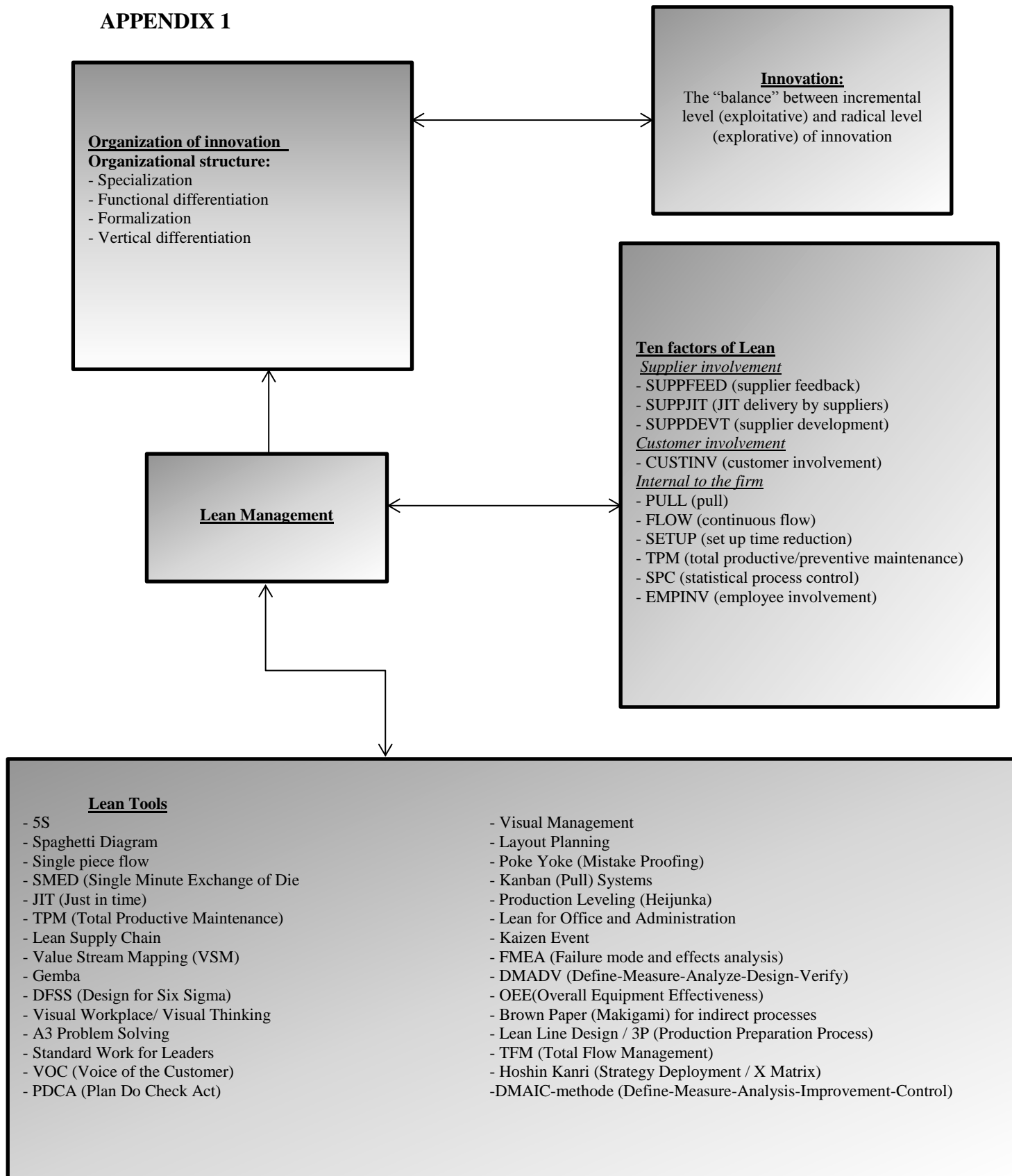


Figure 1: The Conceptual Framework

APPENDIX 2:

Definitions and Measures of Variables

1. Specialization (proposition 1 & 6): This represents different specialties found in an organization. Some studies have used other names to portray this variable, such as "complexity" (Hage & Aiken, 1967) and "role specialization" (Aiken et al., 1980); it is typically measured by the number of different occupational types or job titles in an organization.

2. Functional differentiation (proposition 2 & 7): This represents the extent to which an organization is divided into different units. Authors have also used names such as "horizontal differentiation" (Aiken et al., 1980), "structural differentiation" (Blau & McKinley, 1979), and "departmentation" (Young et al., 1982). The name notwithstanding, this variable is normally measured by the total number of units under the top management (chief executive) level.

3. Horizontal integration (proposition 2 & 7): The degree to which departments and workers are functionally specialized versus integrated in their works, skills, and training.

3. Formalization (proposition 3 & 8): This reflects the emphasis on following rules and procedures in conducting organizational activities. Formalization is typically measured by the presence of rule manuals and job descriptions, or more generally, by the degree of freedom available to organizational members as they pursue their functions and responsibilities versus the extent of rules that precisely define their activities (Cohn & Turyn, 1980; Kaluzny et al., 1974).

5. The nature of formalization (proposition 4): The degree to which workers are provided with rules and procedures that deprive versus encourage creative, autonomous work and learning.

6. Vertical differentiation (proposition 5 & 9): This represents the number of levels in an organization's hierarchy. It is measured by the number of levels below the chief executive level.

APPENDIX 3:

- **Table 2:** Overview of the structure of the interview, the first part:

'Lean management' & 'Relation between lean management-structure' & 'Propositions 1 to 5'

- **Table 3:** Overview of the structure of the interview, the second part:

'Innovation' & 'Relation between structure-innovation' & 'Balance of innovation' & 'Propositions 6 to 9'

Company:	1.	2.	3.	4.	5.	6.	7.	8.	Total corresponding companies: (for each proposition)
Lean management (in terms of strategic level & operational level)	Strategic	Operational	Strategic	Strategic	Clear link between strategic as well as operational	Clear link between strategic as well as operational	Strategic	Strategic	-
Relation: lean management – structure	No	No	Yes	No	No	Yes	Yes	Yes	-
Proposition 1 (i.e. less specialization)	Corresponding	Not corresponding	Correspond	Corresponding	Not corresponding	Corresponding	Corresponding	Corresponding	6
Proposition 2 (i.e. less functional differentiation)	Corresponding	Not corresponding	Not corresponding	Corresponding	Not corresponding	Corresponding	Not corresponding	Corresponding	4
Proposition 3 (i.e. less formalization)	Corresponding	Not corresponding	Corresponding	Not corresponding	Not corresponding	Not corresponding	Corresponding	Not corresponding	3
Proposition 4 (i.e. change in nature of formalization)	Corresponding	Corresponding	Corresponding	Corresponding	Corresponding	Not corresponding	Corresponding	Not corresponding	6
Proposition 5 (i.e. less vertical differentiation)	Corresponding	Not corresponding	Corresponding	Corresponding	Corresponding	Not corresponding	Not corresponding	Not corresponding	4
Total corresponding propositions (for each company):	5	1	4	4	2	2	3	2	

Company:	1.	2.	3.	4.	5.	6.	7.	8.	Total corresponding companies: (for each proposition)
Innovation (i.e. of exploration & exploitation level)	“Exploitation (70%) continuously, exploration (30%) depends”	“Exploitation (50%) continuously, exploration (50%) depends”	“50% and 50%, basically it depends on the new type of product we want to design”	“50% and 50%, basically it depends on the new type of product we want to design”	“In our type of business, exploitation (80%) is more ‘the thing’ to use”	“Focus is on exploration (90%)”	“Exploitation (80%) continuously, exploration (20%) depends”	“First practicing exploitation (80/90%), afterwards considering exploration (20/10%)”	-
Relation: ‘structure → innovation’ and/or ‘innovation → structure’	‘Innovation-structure’	‘Innovation-structure’	‘Structure - innovation’ as well as ‘Innovation-structure’	‘Innovation-structure’	‘Structure-innovation’	‘Structure-innovation’, however in practice there can be a difference	‘Structure-innovation’, however in practice there can be a difference	‘Structure-innovation’	-
Balance changed (i.e. yes or no)	No	Yes, more incremental	No	No	No	Yes, more incremental	Yes, more incremental	Yes, more radical	-
Proposition 6 (i.e. incremental/radical/innovation in general(both)/no relation)	Incremental	No relation	Radical	No relation	No relation	No relation	Incremental	Radical	4
Proposition 7 (i.e. incremental/radical/innovation in general/no relation)	Innovation in general	No relation	Innovation in general	Innovation in general	No relation	Incremental	No relation	Incremental	2
Proposition 8 (i.e. incremental/radical/innovation in general/no relation)	Innovation in general	No relation	Innovation in general	Innovation in general	Innovation in general	Innovation in general	Innovation in general	Innovation in general	0
Proposition 9 (i.e. incremental/radical/innovation in general/no relation)	Innovation in general	Innovation in general	Innovation in general	Innovation in general	No relation	No relation	No relation	No relation	0
Total corresponding propositions (for each company):	1	0	1	0	0	1	1	2	2

2

Proposition 6 is based on the proposed development described in proposition 1: Specialization(Table 2)

Proposition 7 is based on the proposed development described in proposition 2: Functional differentiation(Table 2)

Proposition 8 is based on the proposed development described in proposition 3: Formalization(Table 2)

Proposition 9 is based on the proposed development described in proposition 5: Vertical differentiation(Table 2)

APPENDIX 4

Table 4: The internal and external factors for each innovation strategy

Innovation strategy	Middelen beperkingen	Cultuur sterkte	Centralisatie	'Connectedness'	Formalisatie	Routinalisatie	Risico aversie	Flexibiliteit	Markt dynamiek	Mate van concurrentie
Exploration	-/--	-/--	-/--	+/++	-/--	-/--	-/--	+/++	+/++	-/--
Exploitation	-/--	+/++	+/++	+/++	+/++	+/++	+/++	-/--	-/--	+/++
Structural ambidexterity	+/++	+/++	-/--	+/++	+/++	+/++	+/++	+/++	+/++	+/++
Contextual ambidexterity	+/++	-/--	-/--	+/++	-/--	+/++	-/--	+/++	+/++	+/++
Punctuated equilibrium	-/--	-/--	+/++	+/++	+/++	-/--	+/++	+/++	+/++	+/++

Table 5: Scoring card for the antecedents based on + / + + and - / - -

Internal/external factors	Exploration	Exploitation	Structural ambidexterity	Contextual ambidexterity	Punctuated equilibrium
Eenheden	Enkel	Enkel	Meerdere	Enkel	Enkele
Bedrijfsstrategie	Prospector	Defender	Analyzer	Analyzer	Analyzer
Middelen beperking	Laag	Laag	Hoog	Hoog	Laag
Cultuur sterkte	Los	Strak	Strak	Los	Los
Centralisatie	Laag	Hoog	Laag	Laag	Hoog
Connectedness	Hoog	Hoog	Hoog	Hoog	Hoog
Formalisatie	Laag	Hoog	Hoog	Laag	Hoog
Routinalisatie	Laag	Hoog	Hoog	Hoog	Laag
Risico aversie	Laag	Hoog	Hoog	Laag	Hoog
Flexibiliteit	Hoog	Laag	Hoog	Hoog	Hoog
Markt dynamiek	Hoog	Laag	Hoog	Hoog	Hoog
Mate van concurrentie	Laag	Hoog	Hoog	Hoog	Hoog

Table 6: Sample characteristics

Case	Industry (of the company)	Company size (# of fixed employees)	Position Respondent
Company 1	Aerospace industry	130	General Manager
Company 2	Applications in the Semiconductor, Medical & Optical industry	90	Financial director
Company 3	Packaging industry, with applications in the media industry for 90%	80	Operations Manager
Company 4	Chemical industry, with applications in the construction industry	118	CSR specialist/CSR Ambassador
Company 5	Paper industry, with applications in the textile industry; furniture industry and pharmaceutical industry	150	HR manager (with a Lean Six Sigma Black Belt)
Company 6	Heater industry	94	Plant Manager
Company 7	Agricultural & Horticulture industry	40	General Manager
Company 8	Manufacturing industry, with applications in Food & Beverage industry; Warehousing industry and Energy industry	50	Operations Manager

Table 7: Company scores based on the questionnaire and interview

Company name		Internal factors									External factors		Lean implementation				Tension		Lean tools			Innovation strategy	Number of employees
		Bedrijfsstrategie	Middelen beperking	Cultuur sterkte	Mate van centralisatie	Connectedness	Formalisatie	Routinialisatie	Risico aversie	Flexibiliteit	Marktdynamiek	Mate van concurrentie	Leverancier gerelateerd	Klant gerelateerd	Intern gerelateerd	Totaal	Mate van exploratie	Mate van exploitatie	Score lean technieken	Lean technieken bekend	Lean technieken geïmplementeerd		
Scores	Company 1	A	3	4.3	2.2	6.3	5.6	4.6	4.2	4.2	2.8	3.3	3.6	5	4.8	4.5	4.8	6.5	3.5	25	25	Punctuated Equilibrium	130
	Company 2	P	2.5	5	2.6	5.5	3.8	3.4	3.4	4.7	4	2.5	3.5	3.6	2.5	3.2	5.3	4.7	1.2	13	11	Contextual Ambidexterity	90
	Company 3	D	3.5	5.3	2	5.8	4.4	4.4	3.2	3.9	3	4.5	2.8	3	3.4	3.1	5.3	5.3	2.1	28	23	Focus Exploitation	80
	Company 4	A	1.5	4	2.6	6.3	5.4	4.4	3	4.9	3.8	4.7	3.6	4.4	4	4	6.2	5.8	*	*	*	Punctuated Equilibrium	118
	Company 5	A	5	5	2.6	5.5	4.8	2.4	3	5	3.8	2.2	2.8	3.8	2.9	3.2	6.2	5.5	2.5	29	19	Punctuated Equilibrium	150
	Company 6	A	2.5	5	4.2	5.8	3.8	4.6	6.2	4.8	3.8	3.2	2.7	3.6	3.5	3.3	5	6.2	2	26	17	Contextual Ambidexterity	94
	Company 7	P	1.5	3.3	3	5.5	2.6	5	2.8	4	5	4.2	3.1	4	3.4	3.5	5.8	5	1.3	11	11	Contextual Ambidexterity	40
	Company 8	P	4	3	2.2	6	4.4	4.8	3.4	4.6	4.6	4.2	2.8	3.4	4	3.4	6	5.7	1.3	12	11	Punctuated Equilibrium	50

Company name		Internal factors									External factors		Lean implementation				Tension		Lean tools			Innovation strategy	Number of employees
		Bedrijfsstrategie	Middelen beperking	Cultuur sterkte	Mate van centralisatie	Connectedness	Formalisatie	Routinalisatie	Risico aversie	Flexibiliteit	Marktdynamiek	Mate van concurrentie	Leverancier gerelateerd	Klant gerelateerd	Intern gerelateerd	Totaal	Mate van exploratie	Mate van exploitatie	Score lean technieken	Lean technieken bekend	Lean technieken geïmplementeerd		
Translated Scores	Company 1	A	+	+	-	++	++	+	+	+	-	-	+	++	++	++	+	++	+	25	25	Punctuated Equilibrium	130
	Company 2	P	-	+	-	++	-	-	-	+	+	-	+	+	-	+	+	+	--	13	11	Contextual Ambidexterity	90
	Company 3	D	+	+	--	++	+	+	-	-	-	+	-	+	+	+	+	+	-	28	23	Focus Exploitation	80
	Company 4	A	--	+	-	++	+	+	-	+	-	+	+	++	++	++	++	++	*	*	*	Punctuated Equilibrium	118
	Company 5	A	++	+	-	++	+	--	-	+	-	--	-	+	-	+	++	++	-	29	19	Punctuated Equilibrium	150
	Company 6	A	-	+	+	++	-	+	++	+	-	-	-	+	+	+	+	++	-	26	17	Contextual Ambidexterity	94
	Company 7	P	--	-	-	++	-	+	-	+	+	+	+	++	+	+	++	+	--	11	11	Contextual Ambidexterity	40
	Company 8	P	++	-	--	++	+	+	-	+	+	+	-	+	++	+	++	++	--	12	11	Punctuated Equilibrium	50

- All items are measured on a 7-point scale, except for the following items: bedrijfsstrategie, middelen beperking, Lean implementation, Lean tools.
- “*” Only holds for company 4, they implemented a lean tool which is developed by and for them: ‘Automation X’. Therefore they implemented none of the 31 lean tools mentioned in the questionnaire and they will do everything in their own way. All items are measured on a 7-point scale, except for the following items: bedrijfsstrategie, middelen beperking, Lean implementation, Lean tools.

APPENDIX 5

Scoring cards: Company 1

Innovation strategy	Middelen beperkingen	Cultuur sterkte	Centralisatie	‘Connectedness’	Formalisatie	Routinalisatie	Risico aversie	Flexibiliteit	Markt dynamiek	Mate van concurrentie
Exploration	-/--	-/--	-/--	+;++	-/--	-/--	-/--	+;++	+;++	-/--
Exploitation	-/--	+;++	+;++	+;++	+;++	+;++	+;++	-/--	-/--	+;++
Structural ambidexterity	+;++	+;++	-/--	+;++	+;++	+;++	+;++	+;++	+;++	+;++
Contextual ambidexterity	+;++	-/--	-/--	+;++	-/--	+;++	-/--	+;++	+;++	+;++
Punctuated equilibrium	-/--	-/--	+;++	+;++	+;++	-/--	+;++	+;++	+;++	+;++

Internal/external factors	Exploration	Exploitation	Structural ambidexterity	Contextual ambidexterity	Punctuated equilibrium
Eenheden	Enkele	Enkele	Meerdere	Enkele	Enkele
Bedrijfsstrategie	Prospector	Defender	Analyzer	Analyzer	Analyzer
Middelen beperking	Laag	Laag	Hoog	Hoog	Laag
Cultuur sterkte	Los	Strak	Strak	Los	Los
Centralisatie	Laag	Hoog	Laag	Laag	Hoog
Connectedness	Hoog	Hoog	Hoog	Hoog	Hoog
Formalisatie	Laag	Hoog	Hoog	Laag	Hoog
Routinalisatie	Laag	Hoog	Hoog	Hoog	Laag
Risico aversie	Laag	Hoog	Hoog	Laag	Hoog
Flexibiliteit	Hoog	Laag	Hoog	Hoog	Hoog
Markt dynamiek	Hoog	Laag	Hoog	Hoog	Hoog
Mate van concurrentie	Laag	Hoog	Hoog	Hoog	Hoog

Scoring cards: Company 2

Innovation strategy	Middelen beperkingen	Cultuur sterkte	Centralisatie	'Connectedness'	Formalisatie	Routinalisatie	Risico aversie	Flexibiliteit	Markt dynamiek	Mate van concurrentie
Exploration	-/--	-/--	-/--	+///	-/--	-/--	-/--	+///	+///	-/--
Exploitation	-/--	+///	+///	+///	+///	+///	+///	-/--	-/--	+///
Structural ambidexterity	+///	+///	-/--	+///	+///	+///	+///	+///	+///	+///
Contextual ambidexterity	+///	-/--	-/--	+///	-/--	+///	-/--	+///	+///	+///
Punctuated equilibrium	-/--	-/--	+///	+///	+///	-/--	+///	+///	+///	+///

Internal/external factors	Exploration	Exploitation	Structural ambidexterity	Contextual ambidexterity	Punctuated equilibrium
Eenheden	Enkele	Enkele	Meerdere	Enkele	Enkele
Bedrijfsstrategie	Prospector	Defender	Analyzer	Analyzer	Analyzer
Middelen beperking	Laag	Laag	Hoog	Hoog	Laag
Cultuur sterkte	Los	Strak	Strak	Los	Los
Centralisatie	Laag	Hoog	Laag	Laag	Hoog
Connectedness	Hoog	Hoog	Hoog	Hoog	Hoog
Formalisatie	Laag	Hoog	Hoog	Laag	Hoog
Routinalisatie	Laag	Hoog	Hoog	Hoog	Laag
Risico aversie	Laag	Hoog	Hoog	Laag	Hoog
Flexibiliteit	Hoog	Laag	Hoog	Hoog	Hoog
Markt dynamiek	Hoog	Laag	Hoog	Hoog	Hoog
Mate van concurrentie	Laag	Hoog	Hoog	Hoog	Hoog

Scoring cards: Company 3

Innovation strategy	Middelen beperkingen	Cultuur sterkte	Centralisatie	'Connectedness'	Formalisatie	Routinalisatie	Risico aversie	Flexibiliteit	Markt dynamiek	Mate van concurrentie
Exploration	-/--	-/--	-/--	+///	-/--	-/--	-/--	+///	+///	-/--
Exploitation	-/--	+///	+///	+///	+///	+///	+///	-/--	-/--	+///
Structural ambidexterity	+///	+///	-/--	+///	+///	+///	+///	+///	+///	+///
Contextual ambidexterity	+///	-/--	-/--	+///	-/--	+///	-/--	+///	+///	+///
Punctuated equilibrium	-/--	-/--	+///	+///	+///	-/--	+///	+///	+///	+///

Internal/external factors	Exploration	Exploitation	Structural ambidexterity	Contextual ambidexterity	Punctuated equilibrium
Eenheden	Enkele	Enkele	Meerdere	Enkele	Enkele
Bedrijfsstrategie	Prospector	Defender	Analyzer	Analyzer	Analyzer
Middelen beperking	Laag	Laag	Hoog	Hoog	Laag
Cultuur sterkte	Los	Strak	Strak	Los	Los
Centralisatie	Laag	Hoog	Laag	Laag	Hoog
Connectedness	Hoog	Hoog	Hoog	Hoog	Hoog
Formalisatie	Laag	Hoog	Hoog	Laag	Hoog
Routinalisatie	Laag	Hoog	Hoog	Hoog	Laag
Risico aversie	Laag	Hoog	Hoog	Laag	Hoog
Flexibiliteit	Hoog	Laag	Hoog	Hoog	Hoog
Markt dynamiek	Hoog	Laag	Hoog	Hoog	Hoog
Mate van concurrentie	Laag	Hoog	Hoog	Hoog	Hoog

Scoring cards: Company 4

Innovation strategy	Middelen beperkingen	Cultuur sterkte	Centralisatie	'Connectedness'	Formalisatie	Routinalisatie	Risico aversie	Flexibiliteit	Markt dynamiek	Mate van concurrentie
Exploration	-/--	-/--	-/--	+///	-/--	-/--	-/--	+///	+///	-/--
Exploitation	-/--	+///	+///	+///	+///	+///	+///	-/--	-/--	+///
Structural ambidexterity	+///	+///	-/--	+///	+///	+///	+///	+///	+///	+///
Contextual ambidexterity	+///	-/--	-/--	+///	-/--	+///	-/--	+///	+///	+///
Punctuated equilibrium	-/--	-/--	+///	+///	+///	-/--	+///	+///	+///	+///

Internal/external factors	Exploration	Exploitation	Structural ambidexterity	Contextual ambidexterity	Punctuated equilibrium
Eenheden	Enkele	Enkele	Meerdere	Enkele	Enkele
Bedrijfsstrategie	Prospector	Defender	Analyzer	Analyzer	Analyzer
Middelen beperking	Laag	Laag	Hoog	Hoog	Laag
Cultuur sterkte	Los	Strak	Strak	Los	Los
Centralisatie	Laag	Hoog	Laag	Laag	Hoog
Connectedness	Hoog	Hoog	Hoog	Hoog	Hoog
Formalisatie	Laag	Hoog	Hoog	Laag	Hoog
Routinalisatie	Laag	Hoog	Hoog	Hoog	Laag
Risico aversie	Laag	Hoog	Hoog	Laag	Hoog
Flexibiliteit	Hoog	Laag	Hoog	Hoog	Hoog
Markt dynamiek	Hoog	Laag	Hoog	Hoog	Hoog
Mate van concurrentie	Laag	Hoog	Hoog	Hoog	Hoog

Scoring cards: Company 5

Innovation strategy	Middelen beperkingen	Cultuur sterkte	Centralisatie	'Connectedness'	Formalisatie	Routinalisatie	Risico aversie	Flexibiliteit	Markt dynamiek	Mate van concurrentie
Exploration	-/--	-/--	-/--	+/++	-/--	-/--	-/--	+/++	+/++	-/--
Exploitation	-/--	+/++	+/++	+/++	+/++	+/++	+/++	-/--	-/--	+/++
Structural ambidexterity	+/++	+/++	-/--	+/++	+/++	+/++	+/++	+/++	+/++	+/++
Contextual ambidexterity	+/++	-/--	-/--	+/++	-/--	+/++	-/--	+/++	+/++	+/++
Punctuated equilibrium	-/--	-/--	+/++	+/++	+/++	-/--	+/++	+/++	+/++	+/++

Internal/external factors	Exploration	Exploitation	Structural ambidexterity	Contextual ambidexterity	Punctuated equilibrium
Eenheden	Enkel	Enkel	Meerdere	Enkel	Enkele
Bedrijfsstrategie	Prospector	Defender	Analyzer	Analyzer	Analyzer
Middelen beperking	Laag	Laag	Hoog	Hoog	Laag
Cultuur sterkte	Los	Strak	Strak	Los	Los
Centralisatie	Laag	Hoog	Laag	Laag	Hoog
Connectedness	Hoog	Hoog	Hoog	Hoog	Hoog
Formalisatie	Laag	Hoog	Hoog	Laag	Hoog
Routinalisatie	Laag	Hoog	Hoog	Hoog	Laag
Risico aversie	Laag	Hoog	Hoog	Laag	Hoog
Flexibiliteit	Hoog	Laag	Hoog	Hoog	Hoog
Markt dynamiek	Hoog	Laag	Hoog	Hoog	Hoog
Mate van concurrentie	Laag	Hoog	Hoog	Hoog	Hoog

Scoring cards: Company 6

Innovation strategy	Middelen beperkingen	Cultuur sterkte	Centralisatie	'Connectedness'	Formalisatie	Routinalisatie	Risico aversie	Flexibiliteit	Markt dynamiek	Mate van concurrentie
Exploration	-/--	-/--	-/--	+/++	-/--	-/--	-/--	+/++	+/++	-/--
Exploitation	-/--	+/++	+/++	+/++	+/++	+/++	+/++	-/--	-/--	+/++
Structural ambidexterity	+/++	+/++	-/--	+/++	+/++	+/++	+/++	+/++	+/++	+/++
Contextual ambidexterity	+/++	-/--	-/--	+/++	-/--	+/++	-/--	+/++	+/++	+/++
Punctuated equilibrium	-/--	-/--	+/++	+/++	+/++	-/--	+/++	+/++	+/++	+/++

Internal/external factors	Exploration	Exploitation	Structural ambidexterity	Contextual ambidexterity	Punctuated equilibrium
Eenheden	Enkel	Enkel	Meerdere	Enkel	Enkele
Bedrijfsstrategie	Prospector	Defender	Analyzer	Analyzer	Analyzer
Middelen beperking	Laag	Laag	Hoog	Hoog	Laag
Cultuur sterkte	Los	Strak	Strak	Los	Los
Centralisatie	Laag	Hoog	Laag	Laag	Hoog
Connectedness	Hoog	Hoog	Hoog	Hoog	Hoog
Formalisatie	Laag	Hoog	Hoog	Laag	Hoog
Routinalisatie	Laag	Hoog	Hoog	Hoog	Laag
Risico aversie	Laag	Hoog	Hoog	Laag	Hoog
Flexibiliteit	Hoog	Laag	Hoog	Hoog	Hoog
Markt dynamiek	Hoog	Laag	Hoog	Hoog	Hoog
Mate van concurrentie	Laag	Hoog	Hoog	Hoog	Hoog

Scoring cards: Company 7

Innovation strategy	Middelen beperkingen	Cultuur sterkte	Centralisatie	'Connectedness'	Formalisatie	Routinalisatie	Risico aversie	Flexibiliteit	Markt dynamiek	Mate van concurrentie
Exploration	-/--	-/--	-/--	+/++	-/--	-/--	-/--	+/++	+/++	-/--
Exploitation	-/--	+/++	+/++	+/++	+/++	+/++	+/++	-/--	-/--	+/++
Structural ambidexterity	+/++	+/++	-/--	+/++	+/++	+/++	+/++	+/++	+/++	+/++
Contextual ambidexterity	+/++	-/--	-/--	+/++	-/--	+/++	-/--	+/++	+/++	+/++
Punctuated equilibrium	-/--	-/--	+/++	+/++	+/++	-/--	+/++	+/++	+/++	+/++

Internal/external factors	Exploration	Exploitation	Structural ambidexterity	Contextual ambidexterity	Punctuated equilibrium
Eenheden	Enkel	Enkel	Meerdere	Enkel	Enkele
Bedrijfsstrategie	Prospector	Defender	Analyzer	Analyzer	Analyzer
Middelen beperking	Laag	Laag	Hoog	Hoog	Laag
Cultuur sterkte	Los	Strak	Strak	Los	Los
Centralisatie	Laag	Hoog	Laag	Laag	Hoog
Connectedness	Hoog	Hoog	Hoog	Hoog	Hoog
Formalisatie	Laag	Hoog	Hoog	Laag	Hoog
Routinalisatie	Laag	Hoog	Hoog	Hoog	Laag
Risico aversie	Laag	Hoog	Hoog	Laag	Hoog
Flexibiliteit	Hoog	Laag	Hoog	Hoog	Hoog
Markt dynamiek	Hoog	Laag	Hoog	Hoog	Hoog
Mate van concurrentie	Laag	Hoog	Hoog	Hoog	Hoog

Scoring cards: Company 8

Innovation strategy	Middelen beperkingen	Cultuur sterkte	Centralisatie	'Connectedness'	Formalisatie	Routinalisatie	Risico aversie	Flexibiliteit	Markt dynamiek	Mate van concurrentie
Exploration	-/--	-/--	-/--	+/++	-/--	-/--	-/--	+/++	+/++	-/--
Exploitation	-/--	+/++	+/++	+/++	+/++	+/++	+/++	-/--	-/--	+/++
Structural ambidexterity	+/++	+/++	-/--	+/++	+/++	+/++	+/++	+/++	+/++	+/++
Contextual ambidexterity	+/++	-/--	-/--	+/++	-/--	+/++	-/--	+/++	+/++	+/++
Punctuated equilibrium	-/--	-/--	+/++	+/++	+/++	-/--	+/++	+/++	+/++	+/++

Internal/external factors	Exploration	Exploitation	Structural ambidexterity	Contextual ambidexterity	Punctuated equilibrium
Eenheden	Enkel	Enkel	Meerdere	Enkel	Enkele
Bedrijfsstrategie	Prospector	Defender	Analyzer	Analyzer	Analyzer
Middelen beperking	Laag	Laag	Hoog	Hoog	Laag
Cultuur sterkte	Los	Strak	Strak	Los	Los
Centralisatie	Laag	Hoog	Laag	Laag	Hoog
Connectedness	Hoog	Hoog	Hoog	Hoog	Hoog
Formalisatie	Laag	Hoog	Hoog	Laag	Hoog
Routinalisatie	Laag	Hoog	Hoog	Hoog	Laag
Risico aversie	Laag	Hoog	Hoog	Laag	Hoog
Flexibiliteit	Hoog	Laag	Hoog	Hoog	Hoog
Markt dynamiek	Hoog	Laag	Hoog	Hoog	Hoog
Mate van concurrentie	Laag	Hoog	Hoog	Hoog	Hoog

APPENDIX 6:

The Questionnaire:

Deze questionnaire dient voorafgaand aan het interview te worden ingevuld en geretourneerd. De questionnaire bestaat uit acht verschillende delen die de positie van uw bedrijf goed weergeven binnen het kader van ons onderzoek.

Kort gezegd is het doel van ons onderzoek om te kijken naar: de effecten van Lean Management op innovatie (radicale/incrementele) binnen maakbedrijven (MKB's).

Graag verzoeken wij u de questionnaire zo spoedig mogelijk in te vullen en te retourneren, zodat wij nog enige tijd voorafgaand aan het interview hebben om de resultaten van de questionnaire te analyseren. Op deze wijze kunnen wij het interview daaropvolgend effectief uitvoeren.

Retourneer de ingevulde questionnaire naar:

m.g.j.siemerink@student.utwente.nl

LET OP!!!

Bij het invullen van de questionnaire is er geen goed/fout antwoord. Geef daarom het antwoord wat als eerst in u opkomt bij de desbetreffende stelling.

Lees daarnaast goed op welke schaal de stelling beantwoord moet worden, omdat elke deel een andere schaalverdeling kent. De indeling van de questionnaire is als volgt:

- Deel 1: De mate van exploratie / exploitatie.
- Deel 2: De externe omgeving.
- Deel 3: De interne omgeving (*centralization, culture strength, risk aversion, routinization, formalization, connectedness*).
- Deel 4: De interne omgeving (*adaptability*).
- Deel 5: De resources.
- Deel 6: De strategie.
- Deel 7: De mate van "Lean" implementatie.
- Deel 8: De "Lean Tools".

Indien u de questionnaire **digitaal** wilt invullen, zet een 'X' in het vakje van uw antwoord, en maak in deel 7 de juiste stelling die het beste bij het bedrijf past **rood**.

Indien u de questionnaire **print en scant**, zet een 'X' in het vakje van uw antwoord, en omcirkel in deel 7 de juiste letter van de stelling die het beste bij het bedrijf past.

Indien u vragen heeft over de questionnaire kunt u contact opnemen met:

Maarten Siemerink:

Tel: 06-57160248

Mail: m.g.j.siemerink@student.utwente.nl

Deel 1: De mate van exploratie / exploitatie.

Voor elk item, beantwoord zoals dit geldt voor u en uw organisatie: 1 = Zeer mee oneens, 2 = Mee oneens, 3 = Beetje mee oneens, 4 = Noch mee eens/oneens, 5 = Beetje mee eens, 6 = Mee eens en 7 = Zeer mee eens.	1. Zeer mee oneens	2. Mee oneens	3. Beetje mee oneens	4. Noch mee eens / oneens	5. Beetje mee eens	6. Mee eens	7. Zeer mee eens
Ons bedrijf verplicht zich tot het verbeteren van kwaliteit en het verlagen van kosten							
Ons bedrijf zoekt naar nieuwe technologische ideeën door ‘outside the box’ te denken							
Ons bedrijf verbetert continu de betrouwbaarheid van zijn producten en diensten							
Het succes van ons bedrijf is gebaseerd op ons vermogen om nieuwe technieken en methoden te verkennen							
Ons bedrijf creëert producten, diensten of methoden die innovatief zijn voor het bedrijf							
Ons bedrijf verhoogt het automatiseringsniveau in de operationele processen							
Ons bedrijf zoekt naar creatieve manieren om aan klantwensen te voldoen							
Ons bedrijf onderzoekt continu de tevredenheid van zijn bestaande klanten							
Ons bedrijf verfijnt wat het aanbiedt om bestaande klanten tevreden te houden							
Ons bedrijf betreedt pro-actief nieuwe markt segmenten							
Ons bedrijf bedient zijn bestaande klantenbestand zo maximaal mogelijk							
Ons bedrijf richt zich actief op nieuwe klantgroepen							

Deel 2: De externe omgeving.

<p>Voor elk item, beantwoord zoals dit geldt voor u en uw organisatie: 1 = Zeer mee oneens, 2 = Mee oneens, 3 = Beetje mee oneens, 4 = Noch mee eens/oneens, 5 = Beetje mee eens, 6 = Mee eens en 7 = Zeer mee eens.</p>	1. Zeer mee oneens	2. Mee oneens	3. Beetje mee oneens	4. Noch mee eens / oneens	5. Beetje mee eens	6. Mee eens	7. Zeer mee eens
De concurrentie in onze sector is moordend.							
Ons bedrijf moet regelmatig producten en methoden veranderen om concurrenten bij te blijven.							
Er zijn veel 'promotie oorlogen' in onze industrie.							
Producten/diensten raken snel verouderd in onze bedrijfstak.							
Alles dat een concurrent kan aanbieden, kan door anderen gemakkelijk worden gekopieerd.							
Acties van concurrenten zijn vrij eenvoudig te voorspellen. (REVERSED)							
Prijsconcurrentie is een kenmerk van onze industrie.							
Klantenwensen zijn vrij eenvoudig te voorspellen in onze bedrijfstak. (REVERSED)							
Men hoort bijna iedere dag wel van een nieuwe concurrerende manoeuvre.							
Technologie verandert snel in onze bedrijfstak.							
Onze concurrenten zijn relatief zwak.							

Deel 3: De interne omgeving (*centralization, culture strength, risk aversion, routinization, formalization, connectedness*).

<p>Voor elk item, beantwoord zoals dit geldt voor u en uw organisatie: 1 = Zeer mee oneens, 2 = Mee oneens, 3 = Beetje mee oneens, 4 = Noch mee eens/oneens, 5 = Beetje mee eens, 6 = Mee eens en 7 = Zeer mee eens.</p>	1. Zeer mee oneens	2. Mee oneens	3. Beetje mee oneens	4. Noch mee eens / oneens	5. Beetje mee eens	6. Mee eens	7. Zeer mee eens
In deze organisatie kan weinig actie ondernomen worden, totdat een leidinggevende een besluit goedkeurt.							
Onze medewerkers praten regelmatig over de manier van doen en de stijl van het bedrijf.							
Een persoon die snel zijn eigen beslissingen wil nemen zou in deze organisatie snel ontmoedigd worden.							
In ons bedrijf is er ruimschoots gelegenheid om informeel een praatje te maken met collega's.							
Het management is naar mening dat hogere financiële risico's de moeite waard zijn voor hogere beloningen. (REVERSED)							
Er zijn schriftelijke functieomschrijvingen voor alle functies binnen ons bedrijf.							
De taken binnen ons bedrijf zijn van dag tot dag hetzelfde							
Zelfs kleine zaken moeten worden goedgekeurd door iemand hogerop.							
Het management voert alleen plannen uit als ze er erg zeker van zijn dat ze zullen lukken.							
Een werknemer moet bij bijna alles eerst de directeur vragen voordat hij actie onderneemt.							
De prestaties van alle medewerkers van ons bedrijf worden schriftelijk vastgelegd.							

Het bedrijf heeft haar waarden kenbaar gemaakt door middel van een credo en doet een serieuze poging om het personeel deze te laten volgen.							
<p>Voor elk item, beantwoord zoals dit geldt voor u en uw organisatie: 1 = Zeer mee oneens, 2 = Mee oneens, 3 = Beetje mee oneens, 4 = Noch mee eens/oneens, 5 = Beetje mee eens, 6 = Mee eens en 7 = Zeer mee eens.</p>	1. Zeer mee oneens	2. Mee oneens	3. Beetje mee oneens	4. Noch mee eens / oneens	5. Beetje mee eens	6. Mee eens	7. Zeer mee eens
Medewerkers hier zijn gemakkelijk toegankelijk voor elkaar.							
Het management neemt graag grote financiële risico's. (REVERSED)							
In principe bestaat het werk van medewerkers binnen ons bedrijf uit het uitvoeren van zich herhalende werkzaamheden.							
Medewerkers worden nauwelijks gecontroleerd op het naleven van voorschriften. (REVERSED)							
Voor elke beslissing die een werknemer neemt, moet hij de goedkeuring hebben van zijn leidinggevende.							
Het bedrijf wordt beheerd volgens een beleid voor de lange termijn en oefent een ander beleid uit dan die van de huidige directeur.							
De taken binnen ons bedrijf zijn niet eentonig. (REVERSED)							
Leidinggevend en ontmoedigen medewerkers om werk gerelateerde zaken met anderen te bespreken dan met hem/haar. (REVERSED)							
In onze organisatie, moedigt het management de ontwikkeling van innovatieve producten en/of diensten aan, goed wetend dat sommige zullen mislukken. (REVERSED)							
Het werk in ons bedrijf is routine.							
Voorschriften en procedures nemen een centrale plaats in binnen ons bedrijf.							

Medewerkers in ons bedrijf voelen zich op hun gemak om elkaar in te schakelen als dat nodig is.							
Het management wil “op veilig spelen”.							
Medewerkers in ons bedrijf doen veelal hetzelfde werk op dezelfde manier.							
Welke situatie zich ook voordoet, er zijn altijd procedures beschreven om met die situatie om te gaan.							

Deel 4: De interne omgeving (*adaptability*).

Hoe moeilijk is het voor uw bedrijf om strategische plannen aan te passen voor elk van de volgende situaties: 1 = Zeer moeilijk, 2 = moeilijk, 3 = redelijk moeilijk, 4 = Noch moeilijk/makkelijk, 5 = redelijk makkelijk, 6 = makkelijk, en 7 = Zeer makkelijk.	1. Zeer moeilijk	2. Moeilijk	3. Redelijk moeilijk	4. Noch moeilijk / makkelijk	5. Redelijk makkelijk	6. Makkelijk	7. Zeer makkelijk
Het opkomen van een nieuwe technologie.							
Veranderingen in de economische situaties.							
Het toetreden van nieuwe concurrente in de markt.							
Veranderingen in de regelgeving van de overheid.							
Veranderingen in klanten behoeften en- voorkeuren.							
Aanpassingen in strategieën van leveranciers.							
Het zich voordoen van een onverwachte kans.							
Het zich voordoen van een onverwachte bedreiging.							
Politieke ontwikkelingen die uw industrie beïnvloeden.							

Deel 5: De resource gedwongenheid.

LET OP!!!!

Schaalwijziging

Voor elk item, beantwoord zoals dit geldt voor u en uw organisatie: De schaal varieert van 1 = Geen effect op de output, tot 5 = De output zal verlagen met 20% of meer.	1	2	3	4	5
Neem aan dat als gevolg van een plotselinge ontwikkeling, 10% van de tijd van alle mensen die werkzaam zijn in uw bedrijf, moet worden besteed aan werk die geen verband houdt met de taken en verantwoordelijkheden van uw bedrijf. Hoe serieus zal uw output van uw bedrijf worden beïnvloed in het komende jaar?					
Neem aan dat als gevolg van een gelijkwaardige ontwikkeling, de jaarlijkse operationele begroting van uw bedrijf met 10% vermindert. Hoe sterk zal het werk van uw bedrijf worden beïnvloed in het komende jaar?					

Deel 6: De bedrijfsstrategie.

Hieronder staan 11 groepjes van 4 stellingen. U wordt gevraagd om bij elk groepje de letter van de meest passende stelling te omcirkelen, of de gehele stelling **rood** te kleuren indien u de questionnaire digitaal invult.

LET OP!!!!

Ga hierbij uit van de huidige situatie (dus niet de gewenste situatie).

1. De producten en diensten die wij leveren aan onze klanten zijn het beste te beschrijven als:

- a. producten en diensten die over de hele linie innovatief zijn, continu veranderen en een breder aanbod bieden
 - b. producten en diensten die vrij stabiel zijn in bepaalde markten, maar innovatief zijn in andere markten
 - c. producten en diensten die goed gepositioneerd zijn, relatief stabiel en duidelijk gedefinieerd in de markt
 - d. producten en diensten die in een fase van verandering verkeren, en vooral een reactie zijn op kansen en bedreigingen vanuit de markt of omgeving
-

2. Onze organisatie heeft het imago in de markt als een bedrijf dat:

- a. minder, maar exclusieve producten en diensten aanbied van hoge kwaliteit
 - b. nieuwe ideeën en innovaties overneemt, maar alleen na een gedegen analyse
 - c. reageert op kansen of bedreigingen in de markt om zijn positie te behouden of te verbeteren
 - d. de reputatie heeft innovatief en creatief te zijn.
-

3. De hoeveelheid tijd die onze organisatie besteedt aan het volgen van marktveranderingen en trends kan het beste beschreven worden als:

- a. veel: we zijn continu bezig met het volgen van marktontwikkelingen
 - b. minimaal: we besteden echt niet veel tijd aan het volgen van marktontwikkelingen
 - c. gemiddeld: we besteden een redelijke hoeveelheid tijd aan het volgen van marktontwikkelingen
 - d. nu en dan: op sommige momenten besteden we veel tijd, en op andere momenten bijna geen tijd aan het volgen van marktontwikkelingen
-

4. De toe- of afname in vraag die we hebben ervaren zijn het meest waarschijnlijk toe te schrijven aan:

- a. onze aanpak om ons te concentreren op het verder ontwikkelen van die markten die we reeds bedienen
- b. onze aanpak om te reageren op spanningen in de markt door het nemen van weinig risico
- c. onze aanpak om actief nieuwe markten te betreden met nieuwe concepten en programma's

- d. onze aanpak om actief meer te investeren in onze bestaande markten, en tegelijkertijd nieuwe producten en diensten over te nemen na een zorgvuldige beoordeling van hun potentie.
-

5. Eén van de meest belangrijkste doelen in onze organisatie is onze betrokkenheid en toewijding aan:

- a. het beheersen van de kosten
 - b. het zorgvuldig analyseren van kosten en opbrengsten, het beheersen van kosten, en het selectief ontwikkelen van nieuwe producten en diensten of het betreden van nieuwe markten
 - c. het zeker stellen van de beschikbaarheid en toegang tot mensen, middelen en uitrusting die nodig zijn om nieuwe producten, diensten en markten te ontwikkelen
 - d. het zorgdragen voor verweer tegen kritische bedreigingen door het nemen van elke actie die daarvoor benodigd is
-

6. De competenties (vaardigheden) van onze leidinggevenden kunnen het beste gekarakteriseerd worden als:

- a. analytisch: door hun vaardigheden kunnen ze zowel trends identificeren, als nieuwe producten, diensten of markten ontwikkelen
 - b. gespecialiseerd: hun vaardigheden zijn geconcentreerd rond één of enkele specifieke gebieden
 - c. breed en ondernemend: hun vaardigheden zijn divers, flexibel en stelt hen in staat om veranderingen te bewerkstelligen
 - d. adaptief: hun vaardigheden zijn gerelateerd aan de korte termijn vraag in de markt
-

7. Het belangrijkste dat onze organisatie beschermt tegen concurrenten is dat we:

- a. bekwaam zijn in het zorgvuldig analyseren van opkomende trends en alleen die trends overnemen die bewezen potentie hebben
 - b. bekwaam zijn in het buitengewoon goed doen van een beperkt aantal zaken
 - c. bekwaam zijn in het reageren op trends, ook als deze slechts een bescheiden potentieel hebben als ze opkomen
 - d. bekwaam zijn in het doorlopend ontwikkelen van nieuwe producten, diensten en markten
-

8. Ons management heeft de neiging om zich te concentreren op:

- a. het behouden van een veilige financiële positie door het beheersen van kosten en kwaliteit
 - b. het analyseren van marktkansen en het selecteren van alleen die kansen met bewezen potentie, alsmede het behouden van een veilige financiële positie
 - c. activiteiten of bedrijfsfuncties die de meeste aandacht vragen, gegeven de kansen of problemen waar we momenteel mee geconfronteerd worden
 - d. het ontwikkelen van nieuwe producten en diensten en het uitbreiden naar nieuwe markten en marktsegmenten
-

9. Onze organisatie bereidt zich op de toekomst voor door:

- a. het identificeren van de best mogelijke oplossingen voor die problemen of uitdagingen die onmiddellijke aandacht vereisen
 - b. het identificeren van trends en marktkansen die kunnen resulteren in de ontwikkeling van concepten of programma's die nieuw zijn voor onze industrie of nieuwe markten bereiken
 - c. het identificeren van die problemen, die wanneer ze verholpen zijn, het huidige productaanbod en marktpositie behouden en vervolgens verbeteren
 - d. het identificeren van die trends in de industrie waarvan concurrenten hebben bewezen dat deze lange-termijn potentie hebben, en ondertussen het oplossen van problemen die te maken hebben met ons huidige productaanbod en klantenbehoeften
-

10. De structuur van onze organisatie is:

- a. functioneel: dat wil zeggen georganiseerd in afdelingen –marketing, financiën, personeelszaken, etc.
 - b. product of markt-georiënteerd
 - c. voornamelijk functioneel (afdelingen), maar met een product- of marktstructuur voor nieuwe of grote afnemers en markten
 - d. continu veranderend om ons in staat te stellen om kansen te grijpen en problemen op te lossen, als deze zich voordoen
-

11. De procedures die in onze organisatie gebruikt worden om onze prestaties te beoordelen, het beste omschreven worden als:

- a. gedecentraliseerd en gericht op het stimuleren van betrokkenheid van veel medewerkers
- b. sterk gericht op die prestatie-indicatoren die directe aandacht behoeven
- c. in hoge mate gecentraliseerd en voornamelijk de verantwoordelijkheid van het hogere management
- d. gecentraliseerd in gevestigde product- en marktgebieden, en meer gedecentraliseerd in de nieuwere product- en marktgebieden

Deel 7: De mate van “Lean” implementatie.

LET OP!!!!

Schaalwijziging

Voor elk item, beantwoord zoals dit geïmplementeerd is in uw organisatie: 1 = Geen Implementatie, 2 = Weinig implementatie, 3 = Beetje implementatie, 4 = Veel implementatie, en 5 = Volledige implementatie	1. Geen implementatie	2. Weinig implementatie	3. Beetje implementatie	4. Veel implementatie	5. Volledige implementatie
We hebben regelmatig nauw contact met onze leveranciers					
Onze leveranciers zijn direct betrokken bij de ontwikkeling van nieuwe producten.					
Onze leveranciers zijn contractueel verplicht om jaarlijkse kosten te reduceren.					
Elke dag wordt tijd besteed aan geplande onderhoudsactiviteiten aan apparatuur.					
Productie wordt 'getrokken' (Pulled) door de verzending van gereede producten.					
Wij zijn bezig om de instel tijden in onze fabriek te verlagen.					
Medewerkers op de werkvloer spannen zich in voor product/proces verbetering.					
Wij maken gebruik van visgraat diagrammen om oorzaken te vinden voor kwaliteitsproblemen.					
Wij hebben regelmatig nauw contact met onze klanten.					
Onze fabriek lay-out is gebaseerd op product families.					
Wij hebben een formeel leverancier certificatie programma.					
Wij maken gebruik van statistische technieken voor het verminderen van proces variatie.					
Wij geven onze leveranciers feedback op kwaliteit en leverprestatie.					

Onze klanten delen regelmatig informatie over de huidige en toekomstige vraag met de afdeling marketing.					
Wij onderhouden al onze apparatuur regelmatig.					
Wij bespreken belangrijke kwesties met onze belangrijkste leveranciers op topmanagement niveau.					
Voor elk item, beantwoord zoals dit geïmplementeerd is in uw organisatie: 1 = Geen Implementatie, 2 = Weinig implementatie, 3 = Beetje implementatie, 4 = Veel implementatie, en 5 = Volledige implementatie	1. Geen implementatie	2. Weinig implementatie	3. Beetje implementatie	4. Veel implementatie	5. Volledige implementatie
Onze klanten geven ons feedback op kwaliteit en leverprestatie.					
Wij maken gebruik van een 'pull' productie systeem.					
Apparatuur is gegroepeerd om een continu 'flow' van product families te produceren.					
Medewerkers op de werkvloer zijn essentieel voor probleemoplossende teams.					
Onze belangrijkste leveranciers beheren onze voorraad.					
Grafieken die fout percentages weergeven worden gebruikt op de werkvloer.					
Onze klanten zijn direct betrokken bij het huidige en toekomstige productaanbod.					
We onderzoeken de mogelijkheden van onze processen voorafgaand aan productlancering.					
Onze belangrijkste leveranciers zijn gevestigd dichtbij onze fabriek(en).					
Wij streven naar langdurige relaties met onze leveranciers.					
Onze medewerkers oefenen vaardigheden om de insteltijden van machines te verlagen.					

Producten worden ingedeeld in groepen met gelijkwaardige verwerkingseisen.					
Onderhoudsverslagen van apparatuur worden actief gedeeld met onze productiemedewerkers.					
Wij evalueren leveranciers op basis van de totale kosten en niet op kosten per product.					
We gebruiken Kanban, Squares, of Containers als signalen voor productiebeheersing					
Werknemers op de werkvloer krijgen cross-functionele training.					
Onze belangrijkste leveranciers, leveren aan ons op basis van Just In Time (JIT).					
Voor elk item, beantwoord zoals dit geïmplementeerd is in uw organisatie: 1 = Geen Implementatie, 2 = Weinig implementatie, 3 = Beetje implementatie, 4 = Veel implementatie, en 5 = Volledige implementatie	1. Geen implementatie	2. Weinig implementatie	3. Beetje implementatie	4. Veel implementatie	5. Volledige implementatie
Wij nemen actieve maatregelen om in elke categorie het aantal leveranciers te verminderen.					
Onze klanten zijn actief betrokken bij het huidige en toekomstige productaanbod.					
Productie op werkstations wordt 'getrokken' door de actuele vraag van het volgende werkstation					
Producten worden ingedeeld in groepen met vergelijkbare routing.					
We hebben lage insteltijden van machines in ons bedrijf.					
Bij veel apparatuur/processen op de werkvloer passen wij momenteel statistische procesbeheersing (SPC) toe.					
De werkvloer voert continu ideeën en suggesties aan.					
Wij houden uitstekende verslagen bij van alle aan apparatuur gerelateerd onderhoudsactiviteiten.					

Deel 8: De “Lean Tools”.**LET OP!!!!****Schaalwijziging**

Voor elke “Lean Tool”, beantwoord zoals dit geïmplementeerd is in uw organisatie: : 1 = Geen Implementatie, 2 = Weinig implementatie, 3 = Beetje implementatie, 4 = Veel implementatie, en 5 = Volledige implementatie. Indien u de “Lean Tool” niet kent: 6 = “Lean Tool” onbekend.						
	1. Geen implementatie	2. Weinig implementatie	3. Beetje implementatie	4. Veel implementatie	5. Volledige implementatie	6. “Lean Tool” onbekend
5S						
Time & motion study						
Visual management						
Visual workplace / Visual thinking						
Spaghetti diagram						
Layout planning						
Single piece flow						
Poke Yoke (Mistake proofing)						
SMED (Single Minute Exchange of Die)						
Kanban (Pull) systems						
JIT (Just-In-Time)						
Production leveling (Heijunka)						
TPM (Total Productive Maintenance)						
Lean for office and administration						

Lean supply chain							
Kaizen event							
Value Stream Mapping (VSM)							
Brown paper (Makigami) for indirect processes							
FMEA (Failure Mode and Effect Analysis)							
<p>Voor elke “Lean Tool”, beantwoord zoals dit geïmplementeerd is in uw organisatie: : 1 = Geen Implementatie, 2 = Weinig implementatie, 3 = Beetje implementatie, 4 = Veel implementatie, en 5 = Volledige implementatie. Indien u de “Lean Tool” niet kent: 6 = “Lean Tool” onbekend.</p>	1. Geen implementatie	2. Weinig implementatie	3. Beetje implementatie	4. Veel implementatie	5. Volledige implementatie		6. “Lean Tool” onbekend
DMAIC (Define-Measure-Analysis-Improvement-Control)							
DMADV (Define-Measure-Analyze-Design-Verify)							
DFSS (Design For Six Sigma)							
OEE (Overall Equipment Effectiveness)							
Gemba							
A3 Problem solving							
Lean line design / 3P (Production, Preparation, Proces)							
Standard work for leaders							

TFM (Total Flow Management)							
VOC (Voice Of the Customer)							
Hoshin Kanri (Strategy deployment / X-matrix)							
PDCA (Plan-Do-Check-Act)							