Identifying the Last Planner System

Lean Management in the Construction Industry

Brinch Jensen, Kenneth

Document Version
Final published version

Publication date:
2010

License
Unspecified

Citation for published version (APA):
Brinch Jensen, K. (2010). *Identifying the Last Planner System: Lean Management in the Construction Industry*. Copenhagen Business School [Phd]. PhD series No. 25.2010

COPENHAGEN BUSINESS SCHOOL
HANDELSHØJSKOLEN
SOLBJERG PLADS 3
DK-2000 FREDERIKSBERG
DANMARK

www.cbs.dk

ISSN 0906-6934
ISBN 978-87-593-8438-1

Identifying the Last Planner System

PhD Series 25.2010

Copenhagen
Business School
HANDELSHØJSKOLEN

Identifying the Last Planner System

Lean management in the construction industry

Kenneth Brinch Jensen

LIMAC PhD School

PhD Series 25.2010

Identifying the Last Planner System

Kenneth Brinch Jensen
Identifying the Last Planner System
Lean management in the construction industry

1st edition 2010
PhD Series 25.2010

ISBN: 978-87-593-8438-1
ISSN: 0906-6934

LIMAC PhD School is a cross disciplinary PhD School connected to research communities within the areas of Languages, Law, Informatics, Operations Management, Accounting, Communication and Cultural Studies.

Identifying the Last Planner System - Lean management in the construction industry

By
Kenneth Brinch Jensen

PhD School LIMAC
PhD programme in Technologies of Managing
Department of Operations Management
Copenhagen Business School

Table of content:

Part I - Introduction

Part II - Analysis

Part III - Conclusion

Resumé (danish):

Ledelsesteknologier såsom Balanced Scorecard, Six Sigma og Activity Based Costing må fremtræde som konkrete, stabile, funktionelle og homogene løsninger, hvis de skal kunne fange både interesse og finansiering i forretningsverdenen. Studier af disse ledelsesteknologiers møde med organisationspraksis viser imidlertid, at disse teknologier er præget af stor ustabilitet og heterogenitet på tværs af implementeringer. Benders & Van Veen (2001) argumenterer for at ledelsesidéer besidder en kvalitet, der kan kaldes for 'fortolkningsmæssig levedygtighed'. Med dette skal forstås, at ledelsesidéerne har en evne til at tilpasse sig lokale forhold og interesser. Argumentet er endvidere, at denne kvalitet er mere afgørende for idéens overlevelse end idéens indhold.

Lean produktion, en ledelsesidé udviklet via studier af Toyotas Produktions System, er i dag blevet oversat til en lang række øvrige brancher og industrier. Således er idéen også nået til byggebranchen, og her har 'Last Planner Systemet' (LPS) opnået en dominerende status i repræsentationen af Lean i byggeriet. LPS består af en strategi, der foreskriver, at styringen af kompleksitet, forstået som variation og usikkerhed, er afgørende for om byggeprojekter bliver succesfulde eller ej. Endvidere består LPS af en række kontroller, som anvendes til konkret at styre på kompleksitet.

Det er netop implementeringen af et LPS i et specifikt renovationsprojekt, der repræsenterer feltstudiet i denne afhandling. Gennem et studie på knapt et år udført via observationer af møder og byggeprocesser samt interviews er ledelsesteknologiens evne til at tilpasse sig blevet fulgt. Afhandlingens analyse og resultater fortæller om en ledelsesteknologi, der formår at opnå en relevant og stabil position i feltstudiet. Dette sker, i overensstemmelse med Benders og Van Veen (2001) ikke på baggrund af, at teknologien fungerer som beskrevet af dens ophavsmænd, men på grund af at den tilpasses lokale forhold og interesser.

Afhandlingens bidrag til litteraturen består i at konkretisere hvorledes tilpasningen foregår, og resultatet af analysen er at det foregår på to distinkte men komplementære måder:

1) Teknologiens to-sidede struktur (strategi og kontroller) øger dens brugbarhed til planlægning og evaluering da der åbnes mulighed selektion og separation mellem netop strategi og kontroller. I feltstudiet forbliver strategien stærk samtidig med at kontroller fjernes.

2) Endvidere tilføjes teknologien identiteter, som ikke drejer sig om planlægning og evaluering, hvilket styrker teknologiens relevans i praksis.

Afhandlingen bidrager specifikt til Busco et al. (2007) vedrørende ledelsesidéers evne til at sprede sig og gøre sig relevante for praksis. Busco *et al.* (2007) argumenterer via et feltstudie af en anden ledelsesteknologi, Balanced Scorecard, at det er *simpliciteten*, der gør den fleksibel og brugbar i praksis. Denne afhandling tilbyder et alternativt argument og påviser, at LPS i feltstudiet forbliver brugbar fordi teknologiens identitet som mekanisme for planlægning og evaluering bibeholdes i en strategisk form selv om teknologiens kontroller i stor udstrækning separeres fra praksis. Dette gøres muligt via teknologiens to-sidede struktur. Kontrollerne separeres fra praksis da en række lokale forhold gør dem irrelevante eller kontraproduktive i forhold til at forøge flowet i byggeprocessen. Endvidere påvises det i afhandlingen, at tilføjelsen af identiteter, der ikke drejer sig om planlægning og evaluering, forøger teknologiens brugbarhed. Eksempelvis påvises det, at ledelsesidéen opnår at repræsentere *effektiv ledelse* ved sin brug i forholdet mellem byggeledere og konsulenter. Et andet eksempel er, at LPS bliver til et vigtigt forum for de involverede faggrupper hvori de indbyrdes kæmper om retten til at kontrollere byggeprocessen.

I relation til Lean Construction litteraturen er konsekvensen af analysen, at kompleksitet i byggeprocesser indbefatter mere end det Ballard (1994, 2000) og Koskela (1992) foreslår. Ballard tilbyder LPS til at gøre kompleksitet ledelsesbart, denne afhandling advokerer for at LPS i sig selv et komplekst objekt som forandres i sit møde med byggepraksis. Konsekvensen er derfor, at LPS i sig selv også bør gøres til en ledelsesopgave.

Konsekvens for ledelse:

Viden om de to typer af tilpasninger/forandringer i teknologien bør anvendes i designsituationer såvel som i evalueringssituationer. Viden om hvorledes LPS separerer strategi fra kontroller i relation til planlægning og evaluering samt endvidere tilføjes identiteter åbner mulighed for at forstå teknologien, som et objekt, der er kapabelt til at administrere langt flere ledelsesproblemstillinger, end hvad der foreslås i litteraturen. Endvidere bør viden om hvorledes kontroller falder fra hinanden samtidig med at strategien forbliver stærk anvendes til at highlighte trade-offs til brug for at evaluere byggestrategi. Eksempler på dilemmaer som ikke løses af LPS er: Hvilke slags fejl bør

tillades for at nedbringe gennemløbstid? Hvordan involveres kunden i renovationsprocessen samtidig med at produktivitet bibevares?

Viden om hvorledes identiteter tilføjes til teknologien bør anvendes til at undersøge muligheden for eksempelvis at designe flere identiteter ind i teknologien, for derved at gøre den stærkere hvis dette er formålet. Tillige kan denne viden bruges til at forsøge at fjerne identiteter såfremt disse ikke tjener foretrukne formål. Kort, kan det opsummeres, at teknologiens foranderlighed synliggør ledelsesmæssige udfordringer der berører organisatorisk effektivitet.

Part I - Introduction

Chapter 1 – Introduction, research questions, contribution and structure

1.1. Introduction, research questions and contribution.

According to Hopper et al. (2008, p. 120) a lacunae exists on how management ideas such as Total Quality Management (TQM), Activity Based Costing (ABC) and Business Process Re-enginering (BPR) gain prominence in companies and national discourse. In particular there is a call for greater clarity on how ideas are formulated, how they travel and their significance for problematisations and enactment of accounting.

Analysing the particular abilities of management ideas to gain prominence and diffuse, Benders & Van Veen (2001, 37) argue that most management ideas that they term 'concepts', lack a material component. As a result it is difficult to pinpoint their exact meaning let alone measure their empirical incidence. This creates a certain degree of *conceptual ambiguity*. This, they argue, is unintuitively a source of popularity because different buyers may recognize their own situation in the description: A concept's promises make it attractive to apply, while its ambiguity means that potential users can eclectically select those elements that appeal to them, or that they interpret as the concepts core idea, or that they opportunistically select as suitable for their purposes (Benders & Van Veen, 2001, p. 38).

This thesis sets out to analyze the diffusion ability of a particular management idea, namely *Lean*. Lean is a management idea with roots in the Toyota Motor Corporation. Management innovations in Toyota resulting from a scarcity of resources and intense domestic competition in the Japanese market for automobiles facilitated the formation of a business system, researched and published by many different sources throughout the 1970s to 1990s (e.g. Shingo, 1981, 1985, 1990; Ohno, 1988; Imai, 1975; Schonberger, 1982). Especially the works of Shingo and Ohno have come to form what is today defined as the Toyota Production System (TPS). The overall goal in the TPS is to achieve highest quality, lowest cost and shortest possible lead time. The elements in the TPS to achieve this goal include Just-In-Time (JIT) and JIDOHKA. JIT is a warehousing and transportation term that refers to goods arriving at a destination at the point that it is required at a plant or facility. JIT is meant to reduce the cost of inventory storage and management. JIDOHKA concerns cellular work

cells and automated mistake proofing invented in order to minimize cycle time and lead time. These two elements rest on foundational elements and ideas such as standardisation, reliability, respect for employees and high levels of problem-solving skills.

The term *Lean* is credited Womack et al. (1990) who in their seminal book account for the Toyota business system as *Lean Production.* This system is argued to be the antidote and also the superior to *mass production* exemplified by American automobile producers in the 20th century. In 1996, Womack & Jones publish their book, *Lean Thinking* where Lean Production is translated into generic, universal principles that proposedly can be applied to any business in any industry wishing to become world class. In the wake of this publication, the Lean concept has managed to spread into many other businesses outside the car manufacturing industry. Among these are the service industry, health care and the public sector (e.g. Sarkar, 2007; Suarez Barraza et al. 2009; de Souza, 2009), and its last name has changed accordingly (e.g. Lean Healthcare and Public Service Lean). A particular management control system (MCS), the *Last Planner System* (LPS) has come to represent Lean in the construction industry (Joergensen & Emmitt, 2008), and it is this MCS that is in focus in this thesis.

Applying the LPS to construction projects the authors propose the delivery of quality projects on-time (e.g. Ballard, 2000; Howell and Macomber, 2005). Howell and Macomber (2005) argue that this is achieved because the LPS creates and improves predictability of workflow in construction projects. The LPS attaches itself to the Toyota Production System and Lean by embracing reliability: Assuming great uncertainty and variation in construction, the LPS is proposed to identify bottlenecks and encourage short term planning by the people at the work-face in order to explicitly decrease the negative consequences of variation and uncertainty on production flow that would arise if planning remains long term and displaced from the actual execution processes.

The LPS is in this thesis argued to constitute a strategy as well as a bundle of controls. The strategy is to make work flow across production units in the best achievable sequence and rate. The controls comprise a range of mechanisms that are to achieve this overall strategy and transform what *should* be done into what *can* be done, thus forming an inventory of ready work, from which weekly work plans can be formulated into what *will* be done and subsequently executed. In this way, weekly

work-plans will, according to Ballard (2000) to a greater extent as compared to traditional construction management, be based on achievable assignments.

Concentrating on the secondary stage of adoption of management ideas (Perera, 2003; Gallivan, 2001), this thesis reports from a longitudinal field study of the performance of the LPS in a project covering the total renovation of approximately 150 bathrooms of varying sizes in apartments and terraced houses. The field study was facilitated through participation in network meetings in the Lean Construction Denmark organisation, a construction community comprising practitioners as well as researchers of Lean Construction covering the Danish construction scene. The top management from a leading lean construction contractor company offered an entrance point into a renovation project in which the Last Planner System was to be deployed. The contractor was a middle-sized Danish contracting company that existed for more than 30 years, applying an explicit focus on innovation of production processes. In 2005 the company received a widely-recognised award for its efforts in rethinking construction and particularly for its dedication to Lean Construction. According to top management, the LPS had been deployed with great success in a couple of previous construction/renovation projects, and the contractor intended to disseminate the MCS to all projects in which they were to have a deciding management role.

This thesis accounts for the ability of the LPS to establish itself in the particular construction project, which, according to the findings, to a great extent takes place because of its conceptual ambiguity, more than because of its ability to perform according to its abstractly proposed function. Concerning the particular contribution, this thesis intends to venture into the *how* of conceptual ambiguity. Inspired by a string of social science (Law, 2005; de Laet & Mol, 2000; Mol & Law, 1994) that has been explicitly occupied with ambiguous objects, this thesis offers a more radical way of understanding objects (in this case: management ideas) than the approach applied by Benders and Van Veen (2000). Benders and Van Veen (2000) use the term *interpretive viability* to account for what it is in conceptual ambiguity that ensures diffusion. As opposed to this the approach Law (2005), de Laet & Mol (2000) and Mol & Law (1994) argue that different practices of objects reflect not only different *interpretations* but also different *realities* (Law, 2005, 13) across time and space. This has consequences for how to account for of the abilities of management ideas to diffuse:

Using the term 'interpretive', assumes an underlying single object, thus the issue is to try and sort out what the object really is on a basis of insufficient information. Re-arranging this 'interpretation of the object' to '*enactment* of the object' makes it possible to examine *multiple practices* of the object, and just as important, the relation between these multiple enactments. This means that the object changes from being a single entity to being multiple entities that are more or less coupled.

Benders & Van Veen (2000) notion of conceptual ambiguity resides explicitly in *innovation diffusion literature* (e.g. Rogers, 1995; Abrahamson, 1996; Malmi, 1999). This thesis, though, additionally, and primarily, intends to engage with literature on *accounting change*. In this domain, the notions of *interpretive viability* and *diffusion qualities* are seldom present; there is, though, still in some articles, attention to what affects the continual existence or abortion of MCSs as they arrive to organisation. The intention to engage in literature on *accounting change* is due to the fact that the LPS is an MCS. The domain of *accounting change* is diversified and represents differing assumptions over what makes an MCS a technology that lasts in organizations:

Modernist literature on the topic does not emphasize particular qualities or characteristics in the object other than being economic rationally efficient, but emphasize *antecedents* such as organisational and behavioral variables (Shields, 1995, Argyris & Kaplan, 1994) or environmental factors ordering its ability to 'fit' (e.g. Baines & Langfield-Smith, 2003). Notions such as success and failure concerning MCS implementation are abundant in this type of literature. The notions of success and failure relate directly to the MCS' pre-ordained functionalities, meaning that success of an MCS is defined by whether it functions according to its abstract propositions. Additionally, modernist literature rests on the assumptions that it is within management's control (thus considering environmental factors) to design a well-functioning technology.

Post-modernist literature questions the economic rational assumptions and assumptions of managerial agency. Inspired by foucauldian theory Miller & O'Leary (1994) argue that stability of MCSs are effects of political discourses running through society, representing dynamic ideas of efficiency. In that perspective MCSs become stable only if they get inscribed to dominating

discourses of efficiency. Organisational and behavioral variables are only secondary to or representative of dominating discourse. Miller and O'Leary's work is representative of the work on institutional isomorphism done by Powell & Dimaggio (1991). This new institutional approach differs in some areas from old institutional approaches (e.g. Burns & Scapens, 2000; Granlund, 2001). Whereas new institutionalists are mainly interested in processes of change, old institutionalists are primarily focused on processes of stability: Burns & Scapens (2000) argue that rules and routines create inertia in organisations, which makes it difficult to implement new management ideas. This inertia is therefore something to be overcome/embraced if MCSs are to retain existence. Though the assumptions in the institutional perspectives differ radically from the modernist perspective there is still an idea that the MCS sooner or later eventually reach stability (or abortion), as it is routinised.

Applying a slightly differing perspective on MCS identities, literature drawing on Actor Network Theory (ANT) assumes a fragile and transitory local reality made up of networks of action, making MCS identities transitory. According to ANT, reality is performative, and what makes reality is never finite. Organisational, behavioral and environmental variables as well as rules and routines might perform reality, but this is an empirical matter. It cannot be assumed a priori. Early ANT approaches analyzing MCS implementations, report from field studies where a lot of work is done from different organisational groupings to overcome *resistance* and *translate* interests in order to *black box* management technologies (e.g. Preston et al. 1992, Chua, 1995). This translation process makes the MCS an indefinite entity: The black boxing affair is fragile and never finite. Early ANT is concerned with issues of power in social groupings, and the stabilization or de-stabilization of technologies is a direct consequence of these struggles.

Later ANT approaches de-emphasize the power issue and become more interested in MCS characteristics. In other words, more focus is granted to the MCS as an actor in itself. Briers & Chua (2001) for example, account for an MCS that achieves durability through *plasticity*: Interests do not necessarily need to be *translated*, instead the MCS *mediate* between interests that are formed by different social worlds. Recent ANT approaches (Quattrone & Hopper, 2001; Andon et al. 2007; Busco et al. 2007) inspired by above mentioned Law (2002, 2005), de Laet & Mol (2000) and Mol

& Law (1994), argue that organisations are transitory and a-centered. This has the consequence that MCSs are viewed as performing in realities that are multiple and diversified across space and time. MCS durability therefore depends on its ability to retain relevance across these multiple realities.

Approaching the LPS as an ambiguous and fluid object (Law, 2005; de Laet & Mol, 2000; Mol & Law, 1994) in order to elaborate on the notion of conceptual ambiguity in management ideas, this thesis sets out to examine how the LPS manages to establish itself in a particular construction project and become *durable*. The term, *durability,* is used in order to emphasize the particular approach applied in this thesis. Doing this it is the intention to avoid alternative theory laden notions such as successes, failures, stabilization (e.g. Argyris & Kaplan, 1994; Granlund, 2001) mentioned earlier. The thesis particularly intends to examine whether there could be other explanations to durability than the ones offered by Busco et al. (2007) and Briers & Chua (2001), and these papers therefore found the thesis' research questions.

Research Questions

Busco et al. (2007) argue in a particular field study of a Balanced ScoreCard implementation, that it is the *simplicity* in the particular MCS is what facilitates its performativity/durability:

'Eventually, it is the simplicity entailed by the four perspectives of the BSC as well as the visual clarity of the strategy map that made such techniques *performable* within MEGOC. The BSC is performable not because it forces users in certain directions, but because it leaves the potential adopters free to enact the space which is offered within it (". . . and now it is up to you, and to your department leaders to find the proper objectives and measures to make sure you can orient yourselves on the [MEGOC] strategic map, and show how you can add value along these longitude and latitude"—as cited earlier). Eventually, it could be said that despite being developed under the umbrella (and the rhetoric) of the six corporate strategic imperatives the BSC has made it possible to preserve each division of MEGOC as a 'kingdom on its own'.

According to Busco et al. (2007) the simplicity in the BSC offers potential space(s) and time(s) in which to perform actions, to practice the BSC and make it work. This thesis engages with Busco et al (2007) by investigating object qualities in relation to diffusion and asks the following question:

1) *Could there be explanations alternative to simplicity as a characteristic that facilitates MCS durability*

Extending the investigation of the diffusion qualities of management ideas the thesis furthermore engages with Briers & Chua (2001) who in their field study of another MCS, namely Activity Based Costing, propose the MCS as a single, yet plastic, reality that makes it possible to negotiate and secure transactions between different cultures or professional groups. The second research question in this thesis is accordingly:

2) *Does the concept of a boundary object account for the LPS investigated in this thesis?*

Moving on to the third and final research question the approach applied in this thesis is particularly inspired by de Laet & Mol, (2000), who use the ideas of fluidity to account for quite a different object than a management idea, namely a Zimbabwe bush pump. Pursuing the a-centered idea of objects, de Laet and Mol account for the fluid qualities of the bush pump that make it *durable* across space and time. It is exactly because of its ability to remain relevant in multiple enactments in different spaces and times, that it achieves durability. This poses a question of similarities and differences between the LPS and the bush pump. The question is important since it serves to re-consider how fluidity can be understood across to seemingly very different objects. Relating the findings from the analysis the question is asked:

3) *How does the account of the LPS differ from the account of the Zimbabwe bush pump?*

Summing up, the three research questions are concerned the thesis' contribution to literature. The first research question represents the main objective in the thesis, whereas the two following questions are discussed as an extension of the answer to the first question. In the following part the contribution of the thesis to literature is outlined.

Contribution

On the basis of the field study, an alternative account of MCS durability is offered from that of Busco et al (2007) and Briers & Chua (2001). In particular the findings from the analysis illustrate that LPS established itself on two grounds: Firstly the technology achieved relevance because of its selective two-sided structure of being both a strategy and bundle of controls. This afforded a dismissal of most controls while the strategy remained strong concerning its identity of being a mechanism for planning and evaluation. Secondly, the LPS took on additional identities that were other to planning and evaluation which increased its relevance to the construction parties:

1) *Selections and separations within the LPS identity of planning and evaluation*

As already argued in the introduction the LPS does in its abstract form both constitute a strategy as well as a bundle of controls. However, as the LPS intermingled with construction practice a myriad of local considerations troubled the functionality of the bundle of controls and their proposed relation to the strategy of managing variability and uncertainty in episodes of planning and evaluation. This was, however, not a problem for the continual existence of the LPS, because of its two-sided structure. The strategy in the LPS remained relevant to the construction participants even though it got separated from the controls. In other words, the strategy remained strong because it got selected and de-coupled from the controls concerning the identity of being a mechanism for planning and evaluation. The ability to *select* and *separate* from the technology in episodes of planning and evaluation is therefore argued to be a source of durability.

Furthermore this thesis argues that the LPS managed to establish itself in the particular construction project because it took on additional identities:

2) *Additions of identities to the LPS*

The LPS took on additional identities apart from being a strategy to manage variability and uncertainty or a bundle of operational controls used for planning and evaluation. In the thesis it is argued that the opportunity for the trades to claim rigidity, and the associated risk of being

overridden by not attending the meetings, made the LPS meetings mandatory for the trades. Additionally, the need for project management to demonstrate lean-management skills facilitated a prolonged existence of the Look-Ahead Plan and, to a lesser extent, of the PPC measure; two fundamental controls in the LPS. The field study, however, illustrated that as the construction project progressed, the consultants softened their stance on how the LPS was to be performed. This took place in order to maintain good relations with project management, avoiding potential conflicts. This development dismissed the urgency of evaluating according to the LPS procedure and using the PPC. Lastly, due to top management's involvement in the Lean Construction community and the explicit company goal of being an innovative construction company, added strength to the continual the presence of the LPS throughout the entire construction project.

This thesis argues that the two above mentioned instances of fluidity facilitated the continual existence of the LPS in the particular construction project. These abilities can be accorded the notion of conceptual ambiguity. This thesis is therefore in line with Benders & van Veen (2000), and also Røvik (1998) in terms of using the notion of conceptual ambiguity as an explanation for diffusion/establishment, however the thesis also adds to the notion of conceptual ambiguity by focusing on the *how* of conceptual ambiguity. This thesis offers a view of an MCS that is enacted in multiple realities and where interests were not stable but transitory. This object therefore differs from a boundary object (Star & Griesemer, 1989; Briers & Chua, 2001) concerning the ontological assumptions of the object. There was no essence in the technology studied in this thesis; quite on the contrary the essence of the technology shifted according to the episodes in which it got involved. There was seemingly no stable core or peripheral elements in the technology, and consequently the distinction seems irrelevant to this study.

Concerning de Laet & Mol (2000) and their account of a fluid object, this thesis adds to the notion of a fluid object by offering an alternative vantage point of observing the object. De Laet & Mol were occupied with an object that came in multiple numbers. They interchangeably discussed a *particular* pump and a *type* of pump that came in thousands. This analytical manoeuvre was pivotal in order to establish the account of fluidity. As they discussed the *particular* pump, there was definitely vulnerability involved. Even though the particular pump comprised several networks and

was reparable to a certain extent, it could cease to exist. Durability was in this situation only secured because de Laet and Mol switched vantage point and focus on a different particular pump or the pump on a 'type' level.

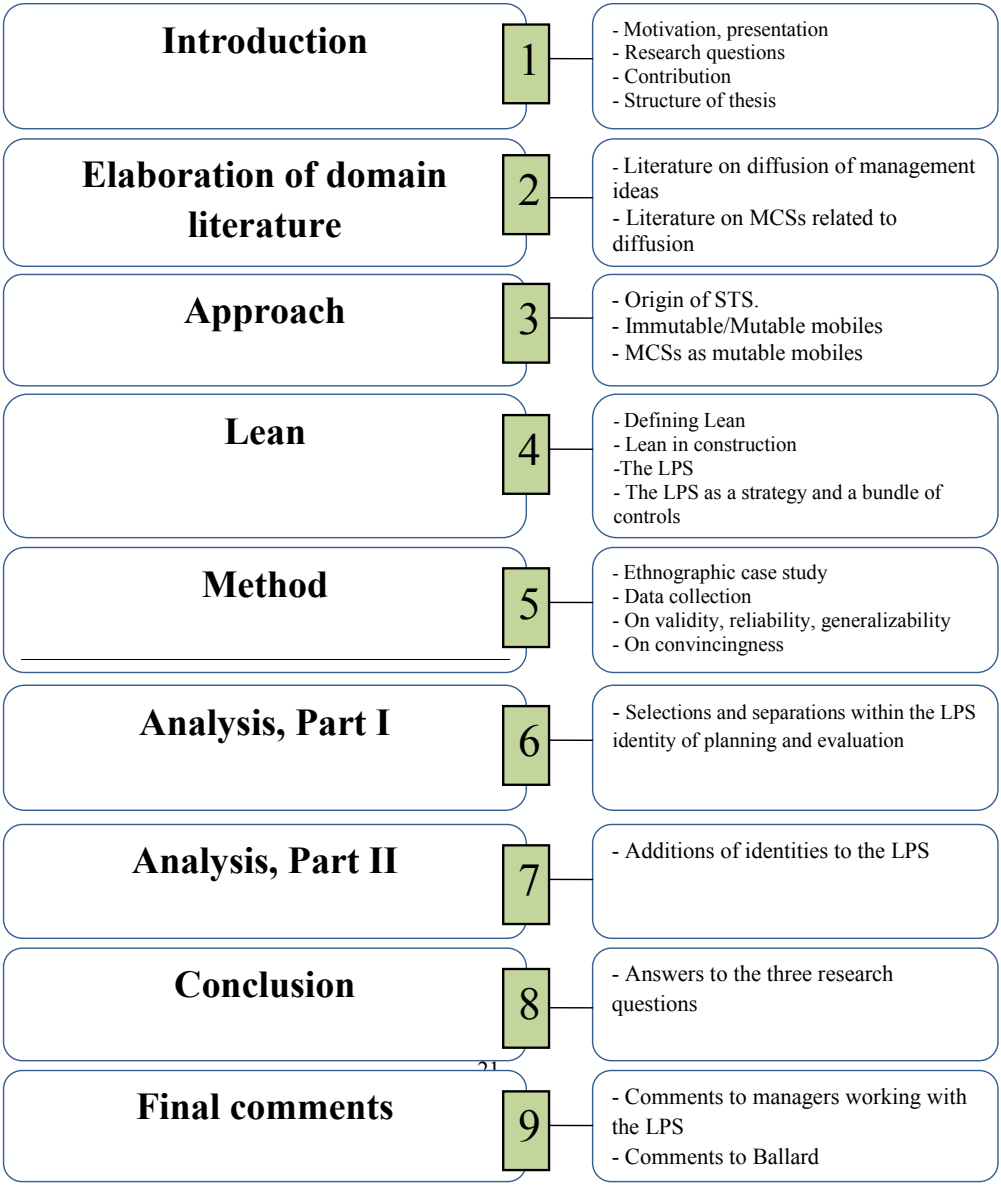
In this thesis the analytical vantage point was different. The focus was on a particular object that existed in several networks across time and space, but the analysis was not broadened to a study of a 'type'. The life of the LPS was, for example, not examined in scientific communities, in yearly statements in consultancy companies, in publishing companies or in other construction projects. Though the thesis was only concerned with the particular, the particular came in many faces; the networks in which the LPS performed were multiple. It is therefore proposed that the ability of the LPS to play many roles exclusively in its particular, does also qualify for an account of a fluid object.

Finally, the thesis contributes to literature particularly on the LPS. The thesis turns around the propositions of Ballard (1994, 2000) and Koskela (1992), that the LPS is a method to discipline and manage construction complexity. The thesis argues that the LPS is ambiguous and fluid and consequently the LPS does not necessarily work as a remedy for complexity, but becomes in itself a slippery and complex object. This thesis therefore makes a praxis contribution to the proposition made by Winch (2006) in response to the general Lean Construction literature on the Last Planner System:

'…it is an important and distinctive innovation in construction project planning, however it suffers from lack of investigations on contingencies. While it is certainly possible to analyse operational flows in isolation from their organisational context using techniques derived from operations research, any implementation of the results of such analysis, or indeed the implementation of any new technology designed to improve that process, requires organisational change to provide the context for the effective use of that technique. This lack of attention to organisational issues is surprising given that the last planner system is, in essence, an organisational innovation in that it proposes weekly meetings to determine which 'quality assignments' can be scheduled for the following week's work' (171).

1.2. Structure of the thesis.

In this section the chronology of the remaining parts of the thesis is accounted for. The structure is illustrated below and thereafter thoroughly explained:



Chapter 2 - Elaboration of domain literature

Chapter 2 is parted into two sections that are to elaborate the two domains (diffusion of management innovations and diffusion of MCSs in particular) that were addressed in the introduction. **Section 1** discusses literature explicitly on diffusion of management ideas. The section serves to elaborate on the notions of conceptual ambiguity and interpretive viability (e.g. Benders & Van Veen, 2000) and discuss its relation to other literature in the particular domain. **Section 2** reviews literature on *accounting change* which is only indirectly or partly occupied with particular MCS diffusion qualities, as part of broader change processes concerned accounting. The section serves to explain how this thesis relates to this particular domain, in which both Briers & Chua (2001) and Busco et al. (2007) are inscribed.

Chapter 3 - Approach

Having established the domains to which the thesis intends to contribute, chapter 3 accounts for the approach that has informed the thesis. The account of the approach is placed here as an elaboration of the ontological and epistemological discussion on management ideas and MCS that underpins chapter 2. In order to 'maintain momentum' the approach is placed as a direct extension on the domain review. **Section 1** accounts for the origins of the approach in the movement called, Science and Technology Studies (STS). It is briefly discussed what this movement rebelled against in contemporary science. **Section 2** covers the notion of the *immutable mobile* fathered by Bruno Latour one of the most influential researchers within the STS movement. The notion of immutable mobiles is covered because it lays the foundation to the notion of the *mutable mobile* **(section 3)** that equals the notion of the fluid object (e.g. Law, 2000; de Laet & Mol, 2000). **Section 4** discusses how the notion of the mutable mobile, or the fluid object, applies to an MCS.

The elaboration of the domain literature and the account of the approach serve to clarify contributions and assumptions of epistemology and ontology of the thesis, however, the Lean idea and the particular MCS, namely the LPS, are at this point not thoroughly accounted for. Chapter 4 turns to a discussion of Lean, its diffusion to the construction industry, the LPS and its status as being an MCS:

Chapter 4 - Lean

Section 1 elaborates on the concept of Lean. This is done in order to accord the reader an in-depth understanding of the assumptions and ideas that constitutes the concept in literature. **Section 2** discusses the diffusion of Lean into the construction industry both in praxis and in theory. **Section 3** extends on section 2 by accounting for the particular development of the Last Planner System. This management innovation is furthermore related to definitions of management control systems in order to argue for its status of being an MCS. **Section 4** discusses how the LPS can be understood as both a strategy and a bundle of controls. This is relevant since the findings in part one of the analysis (chapter 6) exactly argues for this two-sidedness as being a diffusion quality of the LPS.

Having elaborated on the introduction, positioning and contribution in chapters 2-4, the method is dealt with in chapter 5:

Chapter 5 - Method

In this chapter, it will be outlined how the empirics has been approached. The **first section** handles the chosen method in the thesis, the ethnographic case study, and argues for its relevance for the research approach. **Section 2** accounts for the data collection illustrating the total interviews and observations in a timeline. **Section 3** covers the critique from post-positivist literature on using the notions of validity, reliability and generalizability to evaluate method. The section concludes by arguing that it is more appropriate to use the notion of *convincingness* (Golden-Biddle and Locke, 1993) to evaluate on the method applied in this thesis. Accordingly in **section 4** the method will be discussed in relation to convincingness.

Chapter 6 – Analysis, part I: Selections and separations within the LPS identity of planning and evaluation

Chapter 6 consists of the first part (of two) of the analysis. In this part the selection of the strategy and the separation of the bundle of controls from construction practice in episodes of planning and evaluation is accounted for. Chapter 6 is divided into 6 sections. **Section 1** accounts for the structure

of the analysis. **Sections 2-5** account for the selections and separations that took place within the LPS concerning planning and evaluation. In **section 6** the preceding sections are concluded upon.

Chapter 7- Analysis, part 2: Additions of identities to the LPS

Chapter 7 consists of the second part of the analysis, and it accounts for the identities that were added to the LPS apart from the one of being a mechanism of planning and control proposed by its authors. Chapter 7 is similarly divided into 6 sections. **Section 1** accounts for the structure of analysis and **sections 2-5** account for the multiple identities that the LPS takes on increasing its durability in the renovation project. **Section 6** concludes on the second part of the analysis.

Chapter 8 - Conclusion

This chapter concludes the analysis by answering the three research questions formulated in the introductory chapter. The conclusion is parted into three sections each concentrating on its own research question. **Section 1** serves to answer the first research question that is concerned alternatives the notion of simplicity (Busco et al., 2007) to account for MCS performativity and durability. **Section 2** is occupied with the second research question that focuses on whether the notion of the boundary object (Briers & Chua, 2001) captures the LPS investigated in this thesis. **Section 3** answers the third research question that relates the LPS to the Zimbabwe bush pump (de Laet & Mol, 2001) and discusses differences between the two accounts of fluid objects.

Chapter 9 – Final comments

In the final chapter **section 1** offers recommendations to managers working with the LPS in practice. The section is particularly devoted to practitioners **Section 2** is a comment to Ballard (2000) and Lean Construction literature concerning the status of the LPS as a consequence of the findings in the thesis.

Having accounted for the structure of the thesis, the thesis proceeds to chapter 2. In this chapter (section 1 and 2) the two strings of literature domains that this thesis ascribes itself to are discussed.

Chapter 2 – Elaboration of domain literature

As mentioned in the end of the previous section this chapter is parted into two sections in order to clarify the two literature domains addressed in the introduction. **Section 1** discusses literature explicitly on diffusion of management ideas so far. The section serves to elaborate on the notion of interpretive viability (e.g. Benders & Van Veen, 2000) and discusses its relation to other literature in the particular domain of diffusion of management ideas. **Section 2** reviews literature on *accounting change* which is indirectly or partly occupied with particular MCS characteristics concerning diffusion, as part of broader change processes concerned accounting. The section serves to explain how this thesis relates to this particular domain, in which both Briers & Chua (2001) and Busco et al. (2007) are inscribed.

2.1. Literature on diffusion of management ideas.

The emergence and disappearance of 'new' organization concepts is a popular topic for authors of management books and contributors to business magazines. These concepts tend to be represented by their advocates as promising and innovative. At the same time, they are often criticized for not being promising or innovative at all. The latter case has generated terms such as fad, panacea, fashion, myth and hype. Such terminology is used to paint a sharp contrast between 'following fashions' and what serious and rational managers are supposed to do (Benders & Van Veen, 2001, 33). Research on the emergence of 'new' organization concepts is diverse both in terms of approach and object of analysis. Whereas some strings of research focus on generic characteristics of the concepts (Rogers, 1995; Abrahamson, 1996; Røvik, 1998; Benders & Van Veen, 2001; Swan, 2004), other research is more focused on conditions that influence emergence (e.g. Malmi, 1999, Bjørnenak,1997).

Assuming a modernist perspective Rogers (1995) provides a generic list of characteristics of innovations which facilitate or hinder adoption. According to Rogers (1995, p. 16) innovations which have greater relative advantage, compatibility, trialability and observability, and lower complexity, are more likely to be successful in adoption. Rogers (1995, pp. 26–28), Van de Ven et al. (1989) and Firth (1996) also note the importance of two other conditions facilitating adoption;

the existence of a change agent or champion of the innovation, and the availability of labor skills to implement innovation.

Taking on an institutional perspective Abrahamson (1991), (1996), Bjørnenak, (1997) and Malmi (1999), argues against a pro-innovation modernist bias that underpins much adoption of innovation literature. This bias results from the premise that innovations are adopted because they help an organization to attain its goals, and that they rely "on a model of (efficient) choice in which (internal organizational) adopters make independent, rational choices guided by goals of technical efficiency" (Abrahamson, 1991, p. 590). Abrahamson (1996) defines management fashions as:

> … a relatively transitory collective belief, disseminated by management fashion setters, that a management technique leads rational management progress (1996, 257)

Swan (2004) however, questions the nature and utility of the notion of management fashion and calls for academia to unpick the notion. There are problems with Abraham's definition of 'a relatively transitory belief'. According to this definition management fashions are only defined as such retrospectively (as opposed to enduring management ideas); that is, after they have become popular and, more importantly, after they have died or been displaced. Following this logic, management fashions cannot exist as ideas. In addition, this means that fashion setting can't explain the processes by which ideas become popular, because management ideas are not discernibly fashions until *after* they have fallen from favor (Swan, 2004, 311; Benders & van Veen, 2001).

Swan, though, see some potential productivity in retaining notions of 'fashion' and 'fashion-steering' as useful metaphors for explaining the diffusion of management ideas. Røvik (1998) is accordingly interested in the fashion-steering characteristics of management ideas. He discusses the argumentative texture of fashion-setting texts, and asserts a need in the concepts to convince the reader that s/he has a particular problem for which the concept offers *the* solution. Recurring elements in such texts include (Kieser, 1997; Røvik, 1998):

A. Promises of, preferably substantial, performance enhancement;
B. The threat of bankruptcy in case of non-adoption;
C. Using well-known and successful users of the concept in question;

D. Stressing the concept's universal applicability;
E. Presenting the concept as an easily understandable commodity with a catchy title;
F. Presenting the concept as timely, innovative and future-oriented;
G. Interpretive viability, i.e. leaving room for interpretation

Benders & Van Veen (2001, 37) elaborate on the notion of *interpretive* viability, as of critical importance and argue that most management ideas, which they term 'concepts', lack a material component. As a result it is difficult to pinpoint their exact meaning let alone measure their empirical incidence. This creates this certain degree of *conceptual ambiguity*. This is a source of popularity because different buyers may recognize their own situation in the description: A concept's promises make it attractive to apply, while its ambiguity means that potential users can eclectically select those elements that appeal to them, or that they interpret as the concepts core idea, or that they opportunistically select as suitable for their purposes (Benders & Van Veen (2001, 38). According to Benders & Van Veen, (2001) the degree of ambiguity regarding its content endows the innovation with its interpretative viability. Thus, a high level of interpretative viability may make the innovation more compatible with new social settings (Benders and van Veen, 2001). This argument is contrary to Rogers (1995) who underpin that its clarity and measurable effects are sources of popularity.

Supporting the institutionalist perspective, Bjørnenak (1997), in a study of Norwegian manufacturing firms suggests that potential adopters' contacts with the propagators of ABC explains the rate of adoption better than efficient-choice variables. This is consistent with the findings presented in a study of diffusion of ABC among Finnish manufacturing firms (Malmi, 1999). Malmi's study shows that fashion-setting organisations exert considerable influence in the take-off stage of the diffusion process (i.e. during the period with high rates of adoption).

Leonard-Barton and Deschamps (1988) and Gallivan (2001) argue that the adoption process occurs in two stages in organizations: "a firm level decision to adopt the innovation (primary adoption), followed by actual implementation, which includes individual adoption by users (secondary adoption)" (Gallivan, 2001, p. 53). Gallivan (2001, p. 59) argues that the second stage is the more crucial in explaining the process of adoption of innovation. This is because innovations are often initially mandated at organizational level, but this does not ensure that the innovation will be

effectively implemented or used by the target users in the organization. Malmi, (1999) and Bjørnenak (1997) both concentrate on the first adoption stage, they are not particularly interested in how the "ABC packages" are 'unpacked' in organisations. This thesis focuses explicitly on the 'secondary adoption process'. It intends to further analyze the *how* of interpretive viability in management ideas especially at this stage, and it therefore inscribes itself to literature on diffusion of management ideas. In order to open up the black box of diffusion of management ideas in organisations the thesis turns to literature on *accounting change*. The move in this direction is partly due to the fact that this thesis concerns an MCS, and partly due to the extensive research that has been done, thus *indirectly*, in this domain on issues of diffusion characteristics and related conditions. Additionally, it is in the literature domain of *accounting change* that this thesis intends to place its primary contribution. In the following section a review will establish how the topic has been discussed in literature on *accounting change* and the thesis particularly aims at linking it up to Briers & Chua (2007) and Busco et al. (2007).

2.2. Literature on diffusion abilities of MCS in the accounting change domain

In management control literature there has been considerable research on organisations facing 'new' accounting systems, which obviously emanates from the numerous MCS innovations that have gained prominence in management control research in the last couple of decades. Chenhall & Euske (2007) list activity cost management (Shank & Govindarajan, 1993), target costing (Ansari & Bell, 1997), life cycle costing (Shields & Young, 1991), quality costing (Clark, 1985), EVA (McLaren, 1999), non-financial measures (Ittner & Larcker, 1998) and balanced scorecard (Kaplan & Norton, 1998) as examples of management control innovations that has received attention in literature and textbooks on management accounting.

Normative literature is added with strategies and prescriptions concerning how it should be implemented to achieve the desired outcomes (e.g. Anderson & Young, 1999, Argyris & Kaplan, 1994; Shields, 1995) and simultaneously make the management innovations organisational successes. This strand of research is therefore not occupied with particular diffusion characteristics in the MCS. Argyris & Kaplan (1994) offer a strategy for implementing financial recommendations

generated by an activity based costing system. Inspired by Argyris (1990) the strategy involves tasks of overcoming organisational defenses to implementation. Shields (1995), in a survey of 143 firms uses behavioral and organisational variables to analyze the degree of success with ABC. He concludes that top-management support, link to competitive strategies, link to performance evaluation and compensation and training are pivotal.

From a contingency perspective Baines and Langfield-Smith, (2003) have examined how particularly non-financial measures become relevant and stable through contextual variables. They argue that a growing level of global competition intensifies the challenges for managers who need to consider more effective ways of achieving competitive advantage and improving organizational performance. One means of achieving this is through the adoption of clearly articulated strategies, flexible organizational structures and innovative accounting systems. The need for an appropriate 'fit' between the environment and organizational system is an underlying assumption of the empirical contingency-style management accounting research (see for example, Gosselin, 1997; Chenhall & Langfield-Smith, 1998 and Perera et al, 1997). The perspective, though, does not discuss how stability is maintained in the accounting technologies, as they arrive to organisations. Instead they are assumed to function according to normative literature, as long as there is a fit between the technology, the organisation and the organisational context.

Though, the above perspectives are rich in discussing antecedents to successes or failures of management ideas, they also assume a stable, predetermined function in the management ideas: They are to help organisations fulfill economic rational goals of efficiency. They assume that the management technology becomes stable when it functions according to predetermined goals of efficiency, which is made possible by taking care of different behavioral and organisational variables or achieving 'fit'. The identity of the technology is pre-ordained. This perspective is in line with Leonard-Barton and Deschamps (1988) and Gallivan (2001) (see earlier section). This modernist perspective is questioned by Miller & O'Leary (1994) who use a foucauldian inspired approach to question the economic rational perspective on implementations of management innovations.

Miller & O'Leary (1994) argues of 'regimes of ordering' where the particular stabilization of WCM and accounting systems such as ABC in a particular production plant, relied not on contextual 'fit' or behavioral and organisational variables but on political discourse: 'Old' programmes embracing action at a distance accounting controls using overhead recovery rates and Discounted Cash Flow (DCF) became vilified in political discourse. Instead management programmes focusing on quality of products to meet customer needs, and re-engineered factory technology incorporating cellular manufacture, just-in time principles, waste reduction, and electronically coordinated supply chain were advocated. The blending of these discourses with new financial and accounting systems brought new forms of visibility and governance (Miller & O'leary, 1994). In short, Miller & O'Leary argue that stabilization of management innovations depend on political streams of discourse running through organizations.

Miller & O'Leary's findings are in accordance with the ideas of institutional isomorphism (DiMaggio & Powell, 1991). Organizations adopt business practices not because they are efficient (*per se*), but because they furnish legitimacy in the eyes of outside stakeholders for example lenders, government regulators and shareholders. Applying a related perspective to that of Miller & O'leary, namely (old) institutional economics Burns and Scapens (2000) argue that management accounting practices can be conceptualised as rules and routines. According to Burns and Scapens (2000, 6) management accounting is conceived as a routine, and potentially institutionalized, organizational practice. By institutionalized, they mean that management accounting can, over time, come to underpin the 'taken-for-granted' ways of thinking and doing in a particular organization. Routines show a certain degree of inertia, making implementations of management innovations complicated and unpredictable (Becker, 2004, 2005; Hannan *et al.*, 2004; van der Steen, 2008). In the process of routinization, previously formulated rules may become modified as the group locates mutually acceptable ways of implementing them. For example, a new budgeting procedure could be defined in a set of rules laid down in the 'budgeting manual'. These rules might be established, for instance, when one organization is acquired by another, and the acquirer's standard procedures are imposed on the acquisition. However, as these new rules (i.e. budgeting procedures) are

implemented modifications may be introduced, either deliberately or unconsciously. Deliberate changes could occur due to resistance within the acquired organization, or because of the specific circumstances of that organization. Changes may occur unconsciously when, for example, the rules are misunderstood, or are inappropriate to the circumstances (Burns & Scapens, 2000, 6) Resistance is seen to emanate from diverse origins (Malmi, 1997) and rooted in a range of established organisational contingencies and historical legacies (Scapens and Roberts, 1993).

Whereas new institutionalism is concerned processes of organisational change old institutionalism could be said to be concerned processes of organisational stabilization. This difference is, however, easily overcome as demonstrated in Granlund (2001). Integrating the perspectives, an organisation's institutional environment both in terms of institutionalized routines and institutionalising discourses influences the relative importance and role of management innovations. This perspective is in line with Malmi (1999) and Bjørnenak (1997) mentioned in the previous section.

The theory from old institutional theory informs us that stabilization of management innovations, as they are inserted to organisations, will potential be troubled by organisational inertia. Stabilization is only achieved when inertia is coped with somehow. Barley and Tolbert contend that "the institutions relevant to a particular setting will manifest themselves in behaviors characteristic of that setting and, hence, will appear as local variants of more general principles" (Barley and Tolbert, 1997, p. 98), and it is unclear how inertia manifests itself in these local behaviors. In other words, they argue that it is problematic to presume that people perceive institutions similarly and conform to its rules, norms and routines (Steen, 2008). This is an argument for a need to develop investigations of the day-to-day practices around management innovations.

An approach that explicitly draws attention to the day-today enactions, and proposes a more 'flat' ontology where institutions are more or less fragile network assemblages opt for local translation is Actor-Network-Theory. This approach has been applied by a number of researchers and the perspectives are quite diversified. There has been a series of accounts focused on 'power struggles' between different 'programs'. Preston et al.(1992) is an example of this perspective. In this article, different local techniques that are taken in use in order to overcome resistance from particular groups in fabricating budgets are analyzed. This slow and contested path is additionally discussed in

Chua (1995) and Pinch *et al.* (1989). The notion of 'translation' is drawn upon in these studies to reflect the ways in which partisan interests are connected to diverse elements and funneled through 'obligatory passage points' (Chua, 1995 and Robson, 1991). Particular versions of management control systems are advocated in these studies, and stabilization of the management controls is achieved only as interests are translated, which is a rather fragile affair.

Recognising how organisational behavior results from such struggles has been defined as 'multi-rationality'. Multi-rationality recognises a variety of interests, valid sets of knowledge and best organisational practices. As Jones (1992, p. 244) points out, 'there are differences in interests which attach to the different positions in the social structure occupied by individuals or groups'. Distinctions between functions, hierarchies and groups of allegiance within organisations help classify the rationality within which they are bound. Organisational behaviour and the definition of organisational practices are thus an emergent rationality from whatever organisational divisions prevail (Hopper & Quattrone, 2001).

Recent studies on the stabilization of management controls, however, take a less dramatic stand than the assumption of structural dichotomies, applied in the above articles, when discussing the stabilization of management controls. Briers and Chua (2001) argue in a particular field study on Activity Based Costing system that it achieves stability partly because of faith but more importantly because it does not *translate* interests but because it *mediates* interests. The ABC is argued to consist of various types of 'boundary objects' that tie together diverse interests within networks, facilitating the stabilization of the technology (Briers and Chua, 2001). A boundary object is, thus, a single reality that makes it possible to negotiate and secure transactions between different cultures or professional groups. This perspective offers the idea that stability in the ABC is achieved through its *plasticity*. This idea of plasticity has, however, been taken even further.

A string of research focuses on the quality of objects in what is called an 'ontological strategy' (Law & Singleton, 2005: objects are complex *per se* not (only) because people interpret them differently. This ontological approach has been used in a series of works (e.g. Dugdale, 1999; de Laet & Mol, 2000; Mol, 1999, Quattrone & Hopper, 2001, Andon et al. 2007, Busco et al. 2007).

Inspired by the work on fluid spaces Quattrone & Hopper (2001) are in the pursuit of dismantling 'modernist' uses of the concept of *change.* Investigating implementations of SAP systems, they observe that the system is enacted differently across space and time and additionally, that individuals and groups cannot simply be segmented into conflicting camps with homogenous interests and beliefs. Along these findings Quattrone & Hopper reject linear and purposive conceptions of knowledge, action and rationality, and introduce instead categories of enaction, poly-rationality and praxis to redefine change. Abstracted forms of knowledge have little meaning and hence influence upon behavior in organisations. Actors attribute meaning through enaction and everyday praxis in a context of poly-rationality…. Making an idea operational is not a simple, practical conversion of managerial prescriptions but a creative and artistic act emerging from partial connections. Quattrone and Hopper offer this concluding account:

'In the cases there was not adoption but enaction. There was no direct implementation of the SAP package because there was nothing to implement, rather SAP's identity was constructed through praxis. Thus there was no change from one state to another capable of being judged as rational from a single perspective. Rather there were multiple worlds in multiple spaces and times giving rise to poly-rationality' (Quattrone & Hopper, 2001, 426)

According to Hopper & Quattrone (2001) this approach calls for a reformulation of conventional notions of change and organisation through the concept of *drift* and *a-centered organizations. Drift* resembles incomplete attempts at organizing rather than a move from and to tangible, definable and reified objects. This make the organisation *a-centered*: multiple centers and points of view attempts to order events, but each attempt is incomplete and unable to centre the organization in itself (Page 230, methodological issues in accounting research)

Quattrone & Hopper (2001) are not explicitly interested in investigating durability in the SAP systems. They primarily endeavor to redefine processes of organisation change. Their propositions do, however, affect the discussion on qualities of MCS affecting durability. Applying the perspective of *drift* it can be argued that MCS durability depends on its ability to be relevant in the a-centered ties and circulating networks within which it gets embedded. The object may then

become something that is “more than one, but less than many” (Law, 1999: p. 11), sustaining variable constructions of identity, whilst still maintaining a coherent quality.

In the MCS domain a few papers applying the fluid perspective offered by Mol & Law (1994) Law (2000), de Laet & Mol (2000), Quattrone & Hopper (2001) have been partially concerned with the discussion of MCS durability. These are Andon et al. (2007) and Busco et al. (2007).

Andon et al. (2007) study attempts to manufacture performance measures, including a balanced scorecard (BSC) in a business unit of an Australasian telecommunications organisation. Offering the notion of *relational drift*, they highlight the situated and experimental means through which accounting inscriptions are fabricated. They additionally highlight the inherent *unsettledness* of accounting as an object which reflects partial and changing ‘ontologies’, (re)shaped by the variegated and shifting collectives of elements tied to it.’

The account offered by Andon et al. (2007) concludes that the *unsettledness,* the partially and changing ‘ontologies’ in the end leads to the demise of the BSC. Their account of the MCS therefore discusses a technology that does not manage to remain relevant during the ‘incomplete attempts at organising’. The changing ontologies discussed in Andon et al. (2007) are therefore obtrusive to the durability of the BSC in the particular field study.

Busco *et al.* (2007), contrary to Andon et al. (2007) offer an account of an MCS that achieves durability. The BSC discussed manages to activate individual departments in establishing goals in some of the BSC perspectives. It is, however, absent as a thoroughly-integrating, strategically-working technology, a quality it should possess according to its textual promises (136). Busco et al. (2007) propose that it is the *simplicity* entailed in the technology that makes it durable and performable:

‘Eventually, it is the simplicity entailed by the four perspectives of the BSC as well as the visual clarity of the strategy map that made such techniques *performable* within MEGOC. The BSC is performable not because it forces users in certain directions, but because it leaves the potential adopters free to enact the space which is

offered within it (". . . and now it is up to you, and to your department leaders to find the proper objectives and measures to make sure you can orient yourselves on the [MEGOC] strategic map, and show how you can add value along these longitude and latitude"—as cited earlier). Eventually, it could be said that despite being developed under the umbrella (and the rhetoric) of the six corporate strategic imperatives the BSC has made it possible to preserve each division of MEGOC as a 'kingdom on its own'.

In this thesis it is interpreted that Busco *et al.* (2007) propose simplicity as a quality facilitating discretion and performativity in a BSC. The simplicity of the BSC offers potential space(s) and time(s) in which to perform actions, to practice the BSC and make it work, because, as they say:

'Conversely, an attempt that would try to tell it all would not spread, as it would not engage the prospective user who sees a space and opportunity for action. Thus, it is the simplicity entailed by the method and its visual clarity that make management accounting tools *performable* (Busco *et al.* 2007, 143). Paradoxically, the BSC(s) are performable not because they force users to follow certain directives, but because they leave users free to enact that space which is offered by the technique (Busco *et al.* 2007, 143).

In this thesis an alternative, or one might say, additional account is offered on MCS qualities that facilitate object performativity and durability to that of Busco et al. (2007). The thesis is particularly inspired by de Laet & Mol, (2000) and their account of a Zimbabwe bush pump (thoroughly discussed in chapter 3). Pursuing the a-centered idea of objects, de Laet and Mol (2000), in their account of the Zimbabwe bush pump focus on the fluid qualities of the bush pump that make it *durable*. They argue that it is exactly because of its ability to remain relevant in multiple enactments in different spaces and times, that it achieves durability:

'Even if nothing can be taken from it, it is not clear where this pump ends. For what *is* the Zimbabwe Bush Pump? A water-producing device, defined by the mechanics that make it work as a pump. Or a type of hydraulics that produces water in specific quantities and from particular sources. But then again, maybe it is a sanitation device -- in which case the concrete slab, mould, casing and gravel are also essential parts. And while it *may* provide water and health, the Pump can do so only with the Vonder Rig -- or some other boring device -

- and accompanied by manuals, measurements, and texts. Without these it is nothing, so maybe they belong to it too. And what about the village community? Is it to be included in the Pump --- because a pump has to be set up by the community and cannot be maintained without one? But then again, perhaps the boundaries of the Bush Pump coincide with those of the Zimbabwean nation. For in its modest way this national Bush Pump helps to make Zimbabwe as much as Zimbabwe makes it. (p.237)

The Zimbabwe bush pump, it is argued, achieves durability because of its fluid qualities, its ability to take on varying ontologies depending on the networks it gets enmeshed into. The findings in this thesis on the LPS concur with this proposition. As mentioned in the contribution section, the thesis proposes that 1) because the LPS comprises a two-sided structure and it remains strong as a strategy even though its related controls are reconfigured or even dismissed in episodes of planning and evaluation, and 2) because it adds identities across space and time, it manages to establish itself as a durable object. Adding to Busco et al. (2007) it is acknowledged that *simplicity* is definitely a potential explanation to durability in BSCs. However, in LPSs it is argued that it is the two-sided structure that makes *selection* possible coupled with the ability of the technology to *add* identities that facilitates durability of the technology. The main contribution in this thesis is therefore not an attempt to render the proposition of Busco et al. (2007) inadequate, but an attempt to supply an additional account to research on qualities in MCS that facilitates durability. The thesis is additionally a contribution to Briers and Chua (2001), concerning the ontology of the object (a shift from an epistemic object to an ontological object).

2.3. Summing up

In conclusion, it is evident that literature on how MCS become successes, failures, stabilize or durable in organizations is much diversified. In a modernist social, economic perspective (e.g. Shields, 1995; Argyris & Kaplan, 1994), *success* of an MCS is a question of considering behavioral and organisational variables. These are antecedents to MCS success. In this perspective it is possible from a managerial perspective to design both organisation and MCS according to managerial objectives and this design process secures a successful adoption of the MCS.

The contingency perspective (e.g. Baines & Langfield-Smith, 2003) is closely related to the above assumptions, though, it includes environmental considerations and argues that a 'fit' between environment and MCS is paramount. The perspective rests on the similar notion to the above that success of MCS is a functional issue and a question of organisational design coupled with environmental factors.

Questioning this modernist perspective of a-historic economic rationality foucauldian perspectives (Miller & O'Leary, 1994) argue that *stability* of MCS is an effect of political discourses running through society, representing dynamic ideas of efficiency. In that perspective MCS becomes stable only if they manage to inscribe themselves in discourses of efficiency. Institutional approaches (e.g. Burns & Scapens, 2000; Granlund, 2001) take the discursive approach to the microcosmos organizing, and argue that rules and routines create inertia in organisations, which makes it difficult to implement new management ideas. This inertia is therefore something to be overcome/embraced if MCS are to stabilize.

Early ANT approaches analyzing MCS implementations argue that a lot of work has to be done to overcome *resistance* from different organisational groupings and *translate* their interests in order to *black box* management technologies. Additionally, this black boxing affair is fragile and never finite. Later ANT approaches (Briers & Chua, 2001) argue that MCS can achieve durability and stability through *plasticity*. Interests do not necessarily need to be *translated*, instead the MCS *mediate* between interests that are formed be different social worlds. Recent ANT approaches (Quattrone & Hopper, 2001; Andon et al. 2007; Busco et al. 2007) argue that organisations are transitory and a-centered. This means that MCS performs in realities that are multiple and diversified across space and time. MCS *durability* therefore depends on its ability to retain relevance across these multiple realities.

This thesis accounts, in line with recent ANT studies, for a MCS that retains durability exactly because of its ability to stay relevant across different organisational instances. The thesis aims specifically at adding to Briers & Chua (2001) concerning the ontology of the MCS and Busco et al.

(2007) concerning the qualities of the MCS creating durability. In particular, it is proposed that durability is achieved because 1) of the two-sided-structure that affords selections and separations in episodes of planning and evaluation, and because 2) identities are added to the LPS across space and time.

Though the forthcoming analysis in this thesis is informed by an ANT (or After-ANT) approach, and particularly contributes to ANT inspired papers, the insights from social economic rational, discursive and intitutionalist approaches are viewed valuable concerned where and how to look for *networks*. The difference lies primarily, in that this thesis does not *presume* the existence of the insights from these approaches a priori the field study.

Having accounted for the two domains to which this thesis inscribes itself into, the thesis proceeds to the chapter 3. In this chapter the approach is outlined. The chapter is meant to generate a clear understanding to the reader, of how this thesis assumes ontology and goes about analyzing the LPS as a fluid object.

Chapter 3 - Approach

Having established the domains to which the thesis intends to contribute, this chapter 3 accounts for the approach that has informed the thesis. The account of the approach is placed here as an elaboration of the ontological and epistemological discussion on management ideas and MCS that underpins chapter 2. Referring to the introduction this thesis draws on a string of social science (Law, 2005; de Laet & Mol, 2000; Mol & Law, 1994; Star & Griesemer, 1989) that is explicitly occupied with ambiguous objects. This string is placed under the umbrella of Science and Technology Studies (STS). In **section 1** the origin and idea of the movement of STS is accounted for. In **section 2** the notion of the *immutable mobile* developed by Latour (1987) is explained. The immutable mobile founds the discussion of the *mutable mobile,* or in other words, the fluid object (e.g. Law, 2005; de Laet & Mol, 2000) in **section 3**. The relevance of these sections is obvious, since the LPS studied in this thesis, is argued to be a fluid object. **Section 4** discusses how the notion of the mutable mobile (or the fluid object), applies to an MCS.

3.1. Science and Technology Studies (STS)

In the late 1970s and early 1980s a small number of researchers set out to study the *how* of science. Instead of focusing on science in theory, they focused on science in practice. As they went to laboratories to study science-in-action the argument quickly developed: scientific findings and theories are made in specific locations. This was a reaction to the general modernist assumption that science is non-localised. Science is always made somewhere. Scientific facts are regional, not universal (Law & Mol, 2001, 610) However, it is not that simple, because facts also travel between regions. The researchers pointed out that when science is not universal, transport is crucial: in order for a fact to remain a fact, hard work is needed. Otherwise it risks being transformed to, for example, more or less meaningless pieces of paper. If facts are to retain their status, something more is needed. Facts have to be fitted into a context, so the configuration of facts-and-context has to be held stable (Law & Mol 2001, 611). This is where the concept of *immutable mobiles* (Latour, 1987) was created. The transport and the work of holding configurations together and in shape –

with these so-called immutable mobiles – led to what is known as actor-network theory (Law & Mol, 2001, 611).

When configurations are held together and in shape they can be defined as objects. The suggestion is that objects hold together so long as the *network of relations* also holds together and does not change its shape (Law, 2002, 91). The idea is theoretically inspired by Saussurean semiotics, arguing that the significance of a term depends on its relation, and specifically the relations of differences between a term and its neighbors. The significance is therefore arbitrary, though highly determined by the network of relations of differences (Law, 2002, 91). ANT differs from Saussure's structural linguistics in the assumption that there are many modes of ordering, not just one, as proposed by Saussure. In that way ANT can be classified as post-structuralist. Law uses Latour's example of the Portuguese imperialist expansion to clarify what is an object:

'New vessels and new navigational techniques are classified as maritime technologies. They are adaptable (small vessels could be rapidly re-rigged); have substantial carrying capacity; are relatively impregnable to attack by boarding (in part because of the castles fore and aft); carry relatively small crews (which mean that they can stay at sea for months); and they can navigate far from land (which mean that they can take best advantage of prevailing winds and currents) using astrological and astronomical techniques transferred from land to sea' (Law, 2002, 93).

In ANT this object is treated as a *network.* ANT suggests that an object (such as a vessel) remains an object while everything stays in place and the relations between it and its neighboring entities hold steady (Law, 2002, 93). Navigators, Arab competitors, winds and currents, crew, stores, guns: if this *network* holds steady then the vessel does not founder, it does not get seized by pirates and it does not sail on, lost, until the crew are broken by disease and hunger. The vessel is an effect of its relations with other entities, and the job of ANT is to explore the strategies that generate – and are in turn generated by – its object-ness, the syntaxes or the discourses that hold it in place.

3.2. Immutable mobiles

'An immutable object', says Latour, 'is something that moves around but also holds its shape'. Indeed in this way of thinking, it holds its shape in two importantly different ways. On the one hand, it does so in physical or geographical space. On the other, it holds its shape in some relational and possibly functional matter, where it may be imagined as a more or less stable network of associations' (Law, 2005, 335). The immutable objects or mobiles are themselves a network. They are objects. But they also pass down or through a network, held in an array of secure and stable surroundings. If the circuit is broken then the ship starts to degrade, loses its form, and turns into something else (Law, 2002, 93). Law furthers the account of the immutable object:

'An immutable was worked up as a tool for thinking about long-distance control and, at the same time, the work that goes into moving scientific facts around, so producing their apparent universality. Empires, suggested Latour, hold themselves together because immutable mobiles circulate in and through narrow networks that allow them to retain their shape. Codes, information people such as technicians, soldiers or bankers, technological bits and pieces such as ships or scientific instruments, texts such as orders, newspapers or money orders – if objects such as these are able to hold their relational shape as they circulate around the globe, then long-distance control is a possibility' (Law, 2005, 335).

The latter depends on such immutable mobiles. It depends on a process in which networks of relations are built up to secure immutability on the one hand, and mobility on the other (Law & Singleton, 2005, 335). Summing up, in order to retain a status as an immutable mobile and therefore an object in which long-distance control is a possibility, a stable network of associations has to:

- hold its shape in physical or geographical space;
- hold its shape in some relational and possibly functional manner.

These two criteria formed in classical ANT are questioned by Law & Mol (2001), because they believe, they have observed objects that have different qualities. They argue that *shape holding* of the object does not necessarily have to refer to Euclidean space and network space. Law introduces *topology* to pinpoint his alternative argument about shape holding. Topology is a branch of mathematics that explores the character of objects in space. Topologists think about spatiality by asking questions about the continuity of shapes: the properties that the latter retain while they are also being deformed. In topology, for instance, a shape is said to hold its form while it is being squeezed, bent or stretched out – but only as long as it is not also broken or torn. If it is broken or torn, then it changes. Topologically, for instance, a cube is equivalent to a sphere, but not the same as a donut, which can only be made by piercing a hole through the surface of the ball or cube (Law, 2002, 94).

The central question in topology is: under what circumstances can an object be deformed (for instance moved through space in relation to other objects) without changing its shape? This is precisely what is at stake in topology, which is a branch of mathematics that explores the possibilities and properties of different forms of continuous transformation – and the different spaces that express or allow these. According to early ANT, shape holding is only possible if: *it is sustained within a stable network of relations with other entities*. It is the stability of the syntax of those relations that is crucial. Hull, spars, sails, stays, stores, rudder, crew, water, winds – all of these (and many others) have to hold in place *functionally* if we are to be able to point to an object and call it a (properly working) ship. All these bits and pieces have to do their jobs. All have to (as ANT sometimes puts it) be enrolled and stay enrolled. So a properly working ship has to borrow the force of the wind, the flow of the current, the position of the stars and the energy of the members of the crew; it has to borrow all these and include them (so to speak) within itself (Law, 2002, 94).

In Euclidean space a working ship is a constant set of *orthogonal co-ordinates* – for the relative positions of the prow, keel, stern, masts and spars are held fixed as it moves through geographical space and do not change all that much. The Euclidean space is what Law & Mol term *region* in their 1994 paper: regions are those in which objects are clustered together and boundaries are drawn around each cluster. When a region is defined the differences inside it are suppressed. They are

minimised or marginalised (646). To create regional maps is to stress similarities within regions and differences across boundaries. In addition, however, it is also a constant and continuous *network* object, a 'network shape' where the relative syntactical positions of relevant entities are held constant and contribute to object-stability of the vessel: networks are those in which distance is a function of the relations between the elements and difference a matter of relational variety. As Bob Cooper observes, what happens is that network invariances 'fold' regional surfaces. The network brings together two or more locations that are far away from each other on a regional map (1994, 650). This means that vessels are *spatially multiple*, inhabiting both Euclidean (regional) and network spaces. They are also homeomorphic within each of the forms of space, holding together physically in the one, and functionally or syntactically in the other. However, they *move only within Euclidean space*, remaining immobile within network space. (If there is rupture in the relations between the components in network space then they are no longer a network object.).

At the same time it is this *immobility within network space that affords their displacement within Euclidean space*, allowing them to sail successfully from Calicut to Lisbon. So *immutability* belongs to network space while the *mobility*, a Euclidean attribute, becomes possible because of network immutability. As soon as a vessel sets out to sea, it displaces itself. But the space implied in actor-network theory is different. Is there a change in the working relations between the hull, spars, sails, sailors and all the rest? If this is not the case then the ship is immutable in the sense intended by Latour. It does not move in relation to network space (Law & Mol, 2001, 611). So, put this way, the immutable mobile achieves its character by virtue of participation in two spaces: it participates in both network space and Euclidean space. It is the interference between the spatial systems that affords the vessel its special properties. There are two topological systems in action, linked together (Law & Mol, 2001, 611). In actor-network theory there is much writing about the way in which networks generate regions by crossing boundaries and spreading themselves. This is the point of Bruno Latour's notion of the immutable mobile. An entity such as a text or a device is immutable when its elements do not change and the relationship between them is not altered. It holds itself stable wherever it goes. And it is mobile because, from the point of view of a regional topology, it displaces itself from one place to another (Law & Mol, 1994, 643).

3.3. Mutable mobiles (Fluid objects)

Using de Laet & Mol's (2000) case of a Zimbabwean bush pump and the Mol & Law (1994) case of anaemia, Law (2002) offers an object that is different to the immutable mobile. He argues that Anaemia and the pump are successes that spread far and wide exactly because they *change* shape in Euclidean and network space.

Mol & Law (1994) demonstrate that diagnoses, tests, and treatments for anemia in the Netherlands are very different from those used in tropical Africa. Mol & Law (1994) reject the image of two separate geographic regions, each with its own preferred methods, and they reject the network, either in the form of a single clinical network that is exported globally or two interweaving networks, laboratory and clinical. Instead, they visualise a continuously altering mixture of the network of the laboratory (tests, forms, technicians, machines). In de Laet & Mol (2000), the pump similarly slips through the categories of traditional ANT:

'For what *is* the Zimbabwe Bush Pump? A water-producing device, defined by the mechanics that make it work as a pump. Or a type of hydraulics that produces water in specific quantities and from particular sources? But then again, maybe it is a sanitation device – in which case the concrete slab, mould, casing, and gravel are also essential parts to keep out contaminated water.... And while it *may* provide water and health, the pump can only do so with the Vonder Rig for drilling wells. . . and accompanied by manuals, measurements, and tests. Without these it is nothing, so maybe they belong to it too. And what about the village community? Is it to be included in the Pump – because a pump has to be set up by a community and cannot be maintained without one? But then again: perhaps the boundaries of the Bush Pump coincide with those of the Zimbabwean nation. For in its modest way this national bush pump helps to make Zimbabwe as much as Zimbabwe makes it' (de Laet and Mol, 2000: 237).

If the boundaries of the pump are fluid, then so too is what makes it work; there is *fluid functionality.* Bolts that link the pump to its mounting, or the handle to the pump, turn out to be unnecessary. There are pumps that work perfectly well in their absence. Leather seals are replaced with bits of old tyre that work just as well. Perhaps there *is* a core to the pump – some parts that are

essential – but if so, then the identity of that core is constantly being undermined. The 'essential' mechanics often turn out not to be essential (Law, 2002, 98).

Of this pump and everything that allows it to work, nothing in particular necessarily holds it in place. Bits break off the device and are replaced with bits that do not seem to fit. And other components, both parts of the machine and of the social relations embedded in it, are added to it, components that were not in the original design itself (Law & Mol, 2001, 613). With Euclidean and network space alike, the bush pump is an object that changes shape. It looks different from one village to the next, and it works differently from one setup to the next. Thus one might describe it as a failed network, because networks presuppose configurational invariance, and the bush pump shows configurational variance. It is a *mutable mobile.* Is it the same in the two places? A network analyst would say no, and yet it makes sense to say that it is 'the same pump'. It is the 'Zimbabwe bush pump' that moves to so many places in rural Zimbabwe and that moves precisely because it is not an invariant shape in either network or Euclidean space. It changes; it is different (Law & Mol, 2001, 613).

So, according to Law, the first condition is that success is an effect of its variable shape in both network and Euclidean space. Secondly, the mutability of the bush pump also extends to what it means for the pump to work. For instance, the pump works if it produces clean water. But what counts as clean water? This is highly variable according to the narrative. There are international bacteriological definitions of cleanliness, but only water from a subset of bush pumps meets these criteria. Others fail, and yet others are not tested at all because networks of laboratory testing are not developed. Law argues that this does not necessarily mean that the pumps fail. If the levels of water-borne disease are low then this may count as a functional definition of success. And where the bush pump is not only an artefact that produces clean water it is also an element of rural policy of the Zimbabwean government The question of the pumps working in different contexts is open to the variations of fluidity (Law & Mol, 2001, 614):

It does not work by insisting on rigidity and translating every village into a design created in Harare. Nor does it work by forcing villagers to visit Harare for spare parts. Instead it changes shape – it is a mutable mobile rather than the kind of immutable mobile described by Latour when he described the Portuguese ships. So as we read the study, first we learn something about objects: they may reconfigure themselves. Secondly, we learn that different realities may be loosely rather than rigidly associated. And thirdly, we learn that material semiotics does not have to imagine a single actor-network; we have moved on from the core preoccupations of traditional ANT. Webs may be partially associated in endless different ways but the need for a centre has gone.

So what defines shape invariance in a fluid topology? According to Law, although the connections that make a shape invariant in fluid space change shape, they do so *gradually* and incrementally. Links slowly change character. From time to time bits fall off. New bits are patched on. This pump is not quite like that pump. This one functions this way that one functions somewhat differently. The associations or forms of attachment shift and move, but they do so in a way that also allows the performance or continuity. Shape invariance is secured in a fluid topology in a process of more or less gentle flow. It is secured by displacement that holds enough constant for long enough and that resists rupture. A topology of fluidity resonates with a world in which shape continuity precisely demands gradual change: a world in which invariance is likely to lead to rupture difference, and distance (Law & Mol, 2001, 615).

Fluidity suggests a way of letting go, instead of holding onto the rigidities of network space for configurational immutability. This is not good in and of itself. Fluid spatiality merely shows that varying configurations, rather than representing breakdown and failure, may also help to strengthen objects (Law & Mol, 2001, 615). So the fluid suggests that one is dealing with something that is viscous: with things that tend to stick together. But it also points to a possible difference - a difference between fluid and network spaces. For in a network, things that go together depend on one another. If you take one away, the consequences are likely to be disastrous. In a fluid it is different, because there is no 'obligatory point of passage;' no place past which everything else has to file; no panopticon; no centre of translation; all of which means that every individual element may be superfluous (Mol & Law, 1994).

A fluid space, then, isn't quite like a regional one. Difference inside a fluid space isn't necessarily marked by boundaries. It isn't always sharp. It moves. And a fluid space isn't quite like a network, either. For in a fluid, elements inform each other. But the way in which they do so may continually alter. The bonds within fluid spaces aren't stable. Any single component – if it can be singled out – can be missed. Put like this, our story sounds rather regional. It sounds as one is saying that there are sharp divisions between the three types of space, as if they were independent from one another. But this isn't right. Quite to the contrary, in fact. Because the three topologies have intricate relations they co-exist (663) (Law, 2002: 97). In a fluid space it is not possible to determine identities definitively, or to distinguish inside from outside, this place from somewhere else. Similarity and difference aren't like identity and non-identity. They come, as it were, in varying shades and colors. They go together.

The study of fluids, then, will be a study of the *enactments* that form a flow. The definition of *enactment* is important to explain here. Encounters between different realities happen, and this may or may not lead to *single realities*. Latour and Woolgar (1979) talk about *construction:* Their stories are full of talk about the vagueness of objects as they took (or failed to take) shape in the laboratory. They talk of the chosen few that made it through to the stable maturity of a perspectival 'closure'. They add that closure can in principle be undone, but also note that this is unusual because it is usually too expensive to undo the hinterland and remake it in some form. (Law, 2005, 56). Mol and Law, on the other hand, prefer to use the term *enactment* instead of *construction*. Enactments don't just present something that has already been made:

'We may find that no objects are ever routinised into a reified solidity. Hinterlands are not set in stone. By throwing away construction and closure, objects are given a complex present in which their identities are fragile and may differ' (Law, 2005, 57).

The boundaries of a fluid technology are defined by all that is needed to make the technology work, in other words, its enactments. Returning to the Zimbabwe bush pump there are many answers to the question of "What is the Zimbabwe Bush Pump?" It is a water-pumping device, a hydraulic

system, a sanitation device, a health provider, a community builder and a nation builder, among others. Each identity has its own boundaries that are defined by what is needed for the technology to work as that identity. The identities themselves are not stable and change over time and in different contexts. Some identities may be emergent, resulting from collective use of the technology reaching a certain level, such as nation building and water infrastructure. Some identities of the technology are defined by elements in its environment and not by its own elements.

As a consequence of the multiple identities, the fluid can be said to be robust, as it is successful or unsuccessful based on which of its identities is working and not working. It is not clear when it stops acting, achieves its aims and when it fails and falters. Although in the case of the Bush Pump, some components could be substituted or done without, it is not that kind of robustness that is conveyed. There is a multitude of things that can make the pump stop working, but because of the multiple identities, the robustness comes from its multiple purposes and there being no single weak link that can make all the identities come apart. The strongest link (or General of the Army) may also dissolve and not be obvious (de Laet & Mol, 2000).

Thus, notwithstanding their enthusiasm for fluid objects and fluid subjects, de Laet and Mol also caution us against becoming unduly romantic about fluidity (de Laet & Mol, 2000). It may be that sometimes objects really do need to take network shapes if they are to work at all: Portuguese vessels come to mind. And it is no doubt possible to argue that there is a core of stable relations even to the bush pump, which represents the enactment of a network topos – something to do with vertical pipes, levers, valves and connecting rods. More generally, the argument made earlier that objects may be seen as stabilities that arise out of the performances of shape-invariances in more than one topos applies just as much here. The bush pump certainly exists in and enacts Euclidean space, and it may also in some measure exist in and perform network spatiality. Perhaps, then, we need to say that it shuttles between these different topoi, performing relations between them (Law, 2005)

Concerning the issue of becoming unduly romantic about fluidity, Law (2005) discusses a case of alcoholic liver disease that similarly is enacted in a wide range of different locations:

'We were invited to explore the diagnosis and treatment of *alcoholic liver disease*. Call this object number one. But as we moved into the study and interviewed the professionals we found that we were often talking about *liver disease* (object number two) rather than alcoholic liver disease. Or we were discussing *alcoholic cirrhosis* (number three). Or, very commonly, the talk was of *alcohol abuse* and its implications for individuals and the health care system (four). Or it was of *alcoholism* (five). Or, it might be about *overall quality of life* in relation to substance abuse (six). The issue was then how to think about this displacement: The fact that the object seemed to slip and slide from one interview to the next (Law, 2005, 78).'

It proved problematic for Law to map out the process for diagnosing and treating alcoholic liver disease. 'Maps' for patient trajectories differed and they often did not coincide with each other. In many instances, Law found that these differences gave patients differing and wrong expectations. Law (2005, 79-80) summarizes on the object:

'It was an object whose slippery shape-changing also reflected what the managers and other participants took, perhaps, correctly, to be an expression of organisational dislocation, fragmentation and disorganization…… Does this then suggest that objects and their contexts are best when they are fixed and finite? The case of alcoholic liver disease suggests that this might be so. There doesn't seem to be much doubt that the condition would have been better treated and better enacted if the organisation for after care had been better integrated and more tightly structured, if people in the hospital had understood the remit of the Alcoholic Advice Centre a little more clearly, and if the broader and less bounded version of alcoholic liver disease had been more consistently enacted'

Summing up, the Zimbabwe bush pump and alcoholic liver disease are both fluid objects, however, with differing accounts over the consequences of fluidity. Law (2005, 81) proposes that fluidity, shape changing, and name changing are not problems in and of themselves. They *may,* of course, be

problems. Perhaps this is the case for alcoholic liver disease in Waterside, though even this is not entirely clear. This is because the problem may be not that the object changes its shape and its name, but rather that the balance and the movement between the different objects and their contexts is unsatisfactory. If the displacement from one method assemblage to the next had been much easier, then the patient would have been much better off. If the consultants and the doctors caught up in the narrow medical assemblage had devoted more interest to the broader medical-pychiatric-social reality of alcoholism, then the patient would potentially receive a more balanced treatment. As Law states:' The displacement from one method assemblage to the next, 'ought' to be much easier, much more fluid, than it actually is.

The Zimbabwe bush pump, on the other hand, is a fluid object that could be said as being 'well balanced'. De Laet & Mol actually happen to *love* (de Laet & Mol, 2000, p.225) the technology. Those affections, however, can only be attributed to its enactments, not its fluid qualities. Had they accounted for instances of violence between different villages in fights over scarce pumps, had they accounted for use of child labor in the production of the bush pump, had they accounted for deaths as consequences of lacking poison measuring devices, would they then 'love' the technology for its qualities? Probably not, since it touches upon political issues. Relating the issue of politics to the account of *alcoholic liver disease* it is clear that Law is interested in the patients' well-being.

Summing up, the approach offered in the above and the account given on the fluid object will be applied to the study on the Last Planner System in this thesis. In the following section the consequences of investigating a management idea like LPS as a fluid object is addressed.

3.4. MCSs as fluid objects

Investigating MCSs as fluid objects affords a perspective where functionalities and identities are not consolidated *a priori*. As these are not consolidated a priori it is consequently not known a priori what is essential to the MCS; what is essential in it in order for it to be working. What become explicitly interesting in relation to management ideas and MCSs are what kinds of realities they enact, and how it is possible to speak of multiple realities in seemingly one object. Furthermore it becomes interesting to know how different realities and different methods are entangled with one

another. Each of the realities that come to the surface produces its own version of the Last Planner System: There are multiple Last Planner Systems. Where does this take the argument? Is it a good thing to see the erosion of objects as singular (Law, 2005, 50)?

In this thesis, it is definitely assumed enlightening to understand objects as multiple. The perspective offers interesting insights into everyday business activities, and it surfaces issues that in theory are not related to management technologies or performed by management theories. The idea of durability is interesting since it offers a very minimalist account of what to assume in order to understand a management technology as performing. The minimalist account is definitely to be triangulated to what has already been revealed in literature concerning the performance of MCSs. The approach is therefore viewed as supplementary and not substituting existing literature on the issue. It does, however, with its assumptions of multiplicity, a-centeredness and non-essentiality, though also challenge dominating assumptions of MCS performance.

Though this approach proposedly orders an embracement of the 'unexpected', and primarily illuminates issues of durability, this thesis is still in the business of adding to knowledge of management. In that relation, there is obviously also implicitly an idea of *improving* management. Though the notion of improvement is multisided, depending on perspectives, this thesis concurs with Law (2005) that there is a moral obligation to discuss the consequences of fluidity. As already mentioned, there is nothing inherently good or bad in the notion of fluidity. Discussions of good or bad must follow the accounts of fluidity. Obviously this will also increase the potential of accounts of fluidity to make a difference to the practice the account for. As this thesis offers an account of object fluidity, it therefore also becomes the aim of the thesis to discuss the consequences to management. This will be carried through in chapter 9. The primary contribution will, though, still be related to notions of durability.

Having accounted for the approach applied to study the LPS as it travels to practice, the next chapter serves to explain the origin and textual definition of the LPS. The LPS is a management idea that has not been discussed previously in diffusion of innovations literature or accounting

change literature. The section is therefore comprehensive and its proposed status of being an MCS will furthermore be accounted for.

Chapter 4: Lean and the LPS

In this chapter the origin and idea of the Last Planner System are accounted for. The Last Planner system represents a translation of the Lean idea to the construction industry. Though this is certain, it is less certain what Lean is. **Section 1** elaborates the introduction and accounts for the definition of Lean. This is done in order to accord the reader an in-depth understanding of the assumptions and ideas that constitutes the concept in literature. **Section 2** discusses the diffusion of Lean into the construction industry both in praxis and in theory. **Section 3** extends on section 2 by accounting for the particular development of the Last Planner System. This management innovation is furthermore related to definitions of management control systems in order to argue for its status of being an MCS. **Section 4** addresses how the LPS can be understood as both a strategy and a bundle of controls. This is relevant since the findings in part one of the analysis exactly argues for this two-sidedness as being a diffusion quality of the LPS.

4.1. Defining Lean

In the following part the content of Lean is addressed in order to establish a fundament to the discussion of Lean construction and particularly the Last Planner System.

Going through the literature on Lean the first thing that comes to mind is its conceptual ambiguity even in literature. Lewis (2000), Hines et al. (2004) and Shah and Ward (2007) have all made attempts to define the concept based on extensive literature reviews. All papers have in common that the origins of Lean can be found on the shop-floors of Japanese manufacturers and, in particular, innovations at Toyota Motor Corporation (Shingo, 1981, 1985, 1990; Monden, 1983; Ohno, 1988). The innovations, resulting from a scarcity of resources and intense domestic competition in the Japanese market for automobiles includes the Just-In-Time (JIT) production system, respect for employees and high levels of employee problem-solving/automated mistake proofing. JIT is a warehousing and transportation term that refers to goods arriving at a destination at the point that it is required at a plant or facility. JIT is meant to reduce the cost of inventory storage and management.

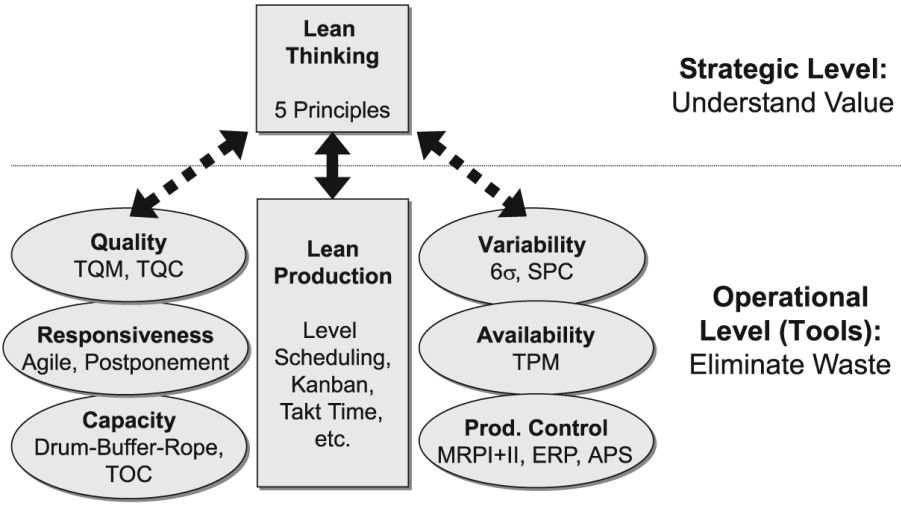
Shah & Ward (2007, 788) explain that to maintain JIT production in Toyota plants, Ohno (the assembly manager at that particular point in time) devised *kanban* as a means to pull material from an upstream station and manage product flow (Ohno, 1988). In the kanban system authorizations to produce more (or replenish inventories of purchased materials) are based on the consumption of the material from controlled inventory locations. "Use one, make one" is the simplest form of this method. Kanban is, however, only one element in JIT. Sugimori et al. (1977) focus on components such as production smoothing, and set up time reduction to add to the methodology of JIT; later definitions incorporate these elements but also include quality improvement and employee involvement (Hall, 1987; McLachlin, 1997) and customer focus (Flynn et al., 1995).

According to Hines et al. (2004, 995) the combination of JIT, quality focus and employee involvement comprises the more general lean operations management design approach that represents an alternative model to that of capital-intense mass production (with its large batch sizes, dedicated assets and "hidden wastes"). In this respect, Lean therefore becomes a theoretical and practical alternative to the principles of scientific management proposed by Taylor (1911).

The interest taken in Lean by the western manufacturing community was limited until the performance gaps between Toyota and other carmakers were highlighted by the book The Machine that Changed the World that also coined the term "Lean Production" (or "Lean Manufacturing") (Womack et al., 1990). According to Hines et al. (2004) the exploration of the enterprise model, the infrastructure and practices that support lean production, promoted explicitly a thesis of "transference" and the ability of non-automotive and non-Japanese emulation based upon the premise that manufacturing problems and technologies were "universal problems" facing management (Womack et al., 1990). In 1996 Womack & Jones proposed a more specific generic set of principles to guide businesses in becoming Lean. These principles involved the identification of customer value, the management of the value stream, developing the capability to flow production, the use of "pull" mechanisms to support flow of materials at constrained operations and finally the pursuit of perfection through reducing to zero all forms of waste in the production system (Womack and Jones, 1996).

According to Hines (2004, 995) the value stream concept extended beyond manufacturing or the single company, and stretched from customer needs right back to raw material sources (Hines and Rich, 1997; Rother and Shook, 1998). This provided the link between lean and the supply chain, as for the first time, the production "pull" was extended beyond the boundary of the single factory to include the up- and downstream partners.

According to Hines et al. (2004) Lean exists at two levels: strategic and operational. The customer-centered strategic thinking applies everywhere, the shop-floor tools do not. Any concept that provides customer value can be in line with a lean strategy, even if lean production tools on the shop-floor, such as kanban, level scheduling, or takt time are not used. The illustration below showing integration with other tools from Hines et al (2004) is not exhaustive.



The above concepts are considering production capacity, quality, responsiveness of the manufacturing system, demand variability, availability of production resources, and production control approaches. These concepts are according to Hines et al. (2004, p. 1007) not part of the lean production methodology, but can be used in support of a wider lean strategy accordingly. For example, a focus within lean thinking is to create capacity by removing waste with the application of improvements in overall equipment effectiveness, and subsequently, the overall supply chain

effectiveness. Added to these existing approaches is the need to increase process capability and attack wasteful bottlenecks. As such the contingent application of tools and methods from six sigma and the theory of constraints (Goldratt, 1990) are useful additions.

Hines et al. (2004) therefore account for a concept that is strategic first and foremost. The tool dimension is secondary. Furthermore it is accounted for as being blendable with other concepts that are customer value oriented. The perspective differs somewhat from Shah & Ward (2007) who, though, grant more primacy to the waste reduction issue in their definition of Lean Production:

> Lean production is an integrated socio-technical system whose main objective is to *eliminate waste* by concurrently reducing or minimizing supplier, customer, and internal variability (791)

Though this definition similarly assumes both a strategic and operational perspective it differs from that of Hines et al. (2004) who state that *value generation* is the main objective. Both perspectives are, however, distanced from the 'toolbox Lean' as fundamental. For Shah and Ward (2007) waste reduction is the overall strategy, and the tools vary. For Hines et al. (2004) Lean strategy is about maximizing customer value and the tools vary.

This difference in Lean accounts reflects a general pattern in Lean literature according to Petterson (2009) who has conducted a review on 12 articles and 13 books on Lean. The review investigates the most frequently mentioned characteristics in the articles and books, and concludes that there are two main traditions of lean; Generally speaking, there are two different types of goals: internally focused (Liker, 2004; Feld, 2001; Ohno, 1988; Monden, 1983; Schonberger, 1982; Shingo, 1985) and externally focused (Womack et al., 1990, Womack & Jones, 1996, Bicheno, 2004). The internally focused literature is generally much more tool oriented.

The Lean literature has definitely not been without critics. The critical voices on its universal applicability, might actually have caused the uprising of the strategic/operational distinctions, since the criticism primarily have been aimed at the universality of the operational methods: It has been argued that lean production as a volume production method provides an unsuitable approach for many manufacturers operation under conditions that do not fulfill the preconditions needed for the

use of lean techniques (Jürgens, 1995; Lillrank, 1995; Katayama and Bennet, 1996). Additionally, it does not encompass influence of social and political institutions on enterprises and the procedures through which supply chains operate (Jürgens, 1995; Williams et al., 1995; Cooney, 2002). Research into working conditions and other HR aspects has revealed negative side effects resulting from lean production practices. Empirical studies have indicated that lean production procedures have come with a high price for Japanese industrial workers who work under very hard and stressful conditions and enjoy rights inferior to those of workers in western industrialized countries (Sullivan, 1992; Williams et al. 1995, Mehri, 2005).

Lean protagonists have argued that these criticisms are not due to weaknesses in the idea but rather inappropriate implementations. Summing up, Lean does definitely comprise ambiguity and plasticity in literature. Especially the later separation of Lean from its 'toolbox' focus, making it a 'universal' concept, has increased its fashion-setting qualities. Referring to Røvik's (1998) account of management ideas characteristics, the Lean idea definitely corresponds:

A. Promises of, preferably substantial, performance enhancement:

Maximizing customer value and minimizing waste is definitely to increase organisational and supply chain profitability, both in terms of superior products/services and efficient use of resources.

B. The threat of bankruptcy in case of non-adoption:

Companies that do not pursue the Lean strategy might risk competitive difficulties, as demonstrated by mass production companies.

C. Using well-known and successful users of the concept in question:

Toyota Motor Corporation as the dominating example of competitive success.

D. Stressing the concept's universal applicability;

Represented a.o. by the five generic principles offered by Womack & Jones (1996)

E. Presenting the concept as an easily understandable commodity with a catchy title;

A couple of authors, Liker (2004) and Womack & Jones (1996, 2005) present normative guidelines about how to commence the 'Lean journey'.

F. Presenting the concept as timely, innovative and future-oriented;

Though it might have some years on its back now, the idea comprises an ongoing pursuit of perfection. No picture of perfect can be perfect (Womack & Jones, 1996).

G. Interpretive viability, i.e. leaving room for interpretation

Concepts such as waste, quality and customer value and the strategic/operational distinction definitely offer discretional space.

In the next section the diffusion of Lean into the construction industry is accounted for in order to lay the ground for the preconditions to the invention of the LPS.

4.2. From Lean to Lean construction

This section is split into a praxis part and a theory part since there is no direct relation between the two. Both perspectives are though relevant in order to grasp the diffusion of the idea. The first part concerns the praxis diffusion.

4.2.1 Praxis

Possessing *universal* qualities the Lean idea has spread into many industries outside the car manufacturing industry. The concept has, for example, been applied to healthcare, the public sector and other service industries. In addition, it has become an established theme within the

architectural, engineering and construction (AEC) sector where it has been promoted as a means to increase productivity and project performance (e.g. via the EGAN report, DETR, 1998). The promotion of Lean construction has been highly visible in countries such as USA, UK and Denmark. Lean entered construction a couple of years after it had gained momentum in western manufacturing industries. Its application to the built environment was first discussed by Koskela (1992), who investigated what he referred to as 'the new production philosophy and its application to construction (Jørgensen & Emmitt, 2008, 387). Koskela will be returned to soon.

According to Kristiansen et al. (2005,) data from Statistics Denmark showed that the large Danish contractors (defined as having more than 500 employees) had grown at the expense of their medium-sized competitors (defined as having between 100 and 500 employees) with the result that these medium-sized contractors' share of the market almost halved between 1992 and 1999; their turnover dropped from the 24 per cent of the total turnover to 13 per cent. Their share of the total number of employees fell correspondingly from 25 per cent to 16 per cent. A review of the information at the home sites of the largest contractors showed that they had also bought installation firms, building material firms and firms in carpentry and other trades/crafts. In doing so the largest contractors had become much larger, had reduced the market competition and had acquired the means of controlling larger parts of the supply chain.

Simultaneously this development and consolidation also led to adoption of new strategies, ranging from more aggressive marketing to the adoption of management innovations such as lean construction and partnering. Extensive advertising in newspapers and television demonstrated that the large contractors had started to marketing themselves as especially customer oriented with slogans such as *"Forvent lidt mere"* (Expect a little more) (NCC) and Højgaard og Schultz which later merged with Monberg og Thorsen to MT Højgaard had the slogan: "*Bygger på dialog*" (Building on dialogue). Today MT Højgaard emphasises the value of people, both in their corporate logo and approach to management of projects (Kristiansen et al., 2005, p. 507).

The largest Danish owned contracting company (MTH) developed a new concept for construction management based on lean manufacturing principles. Called “TrimByg”, (trim build) it is based on the use of a process-planning tool, the LPS. TrimByg has subsequently been adopted and promoted by the Danish Technological Institute (TI) as “the” way to manage construction projects. In the following two sections the translation of Lean to Lean construction in literature is accounted for. Thereafter the LPS, as it is textually defined is explained, and related to the Lean idea in general. Furthermore, its status as being an MCS is accounted for.

4.2.2. Theory

The transfer of the Lean idea to construction in literature commenced with Koskela (1992), who conceptualised the ideas from the development and experiments of the Just-In-Time production system and quality control in Japan into a new production philosophy in construction. Koskela argued that there were two kinds of phenomena in all production systems: *conversions* and *flows*. While all activities expend cost and consume time, only conversion activities add value to the material or piece of information being transformed into a product. Thus, the improvement of flow activities should primarily focus on their reduction or elimination, whereas conversion activities should be made more efficient. In the design, control and improvement of production systems, both aspects have to be considered. According to Koskela, traditional managerial principles had considered only conversions, or all activities have been treated as though they were value-adding conversions. Due to these traditional managerial principles, flow processes had not been controlled or improved in an orderly fashion. This had led to complex, uncertain and confused flow processes, the expansion of non-value-adding activities and the reduction of output value, according to Koskela (Koskela, 1992, 13).

The new conceptual model that Koskela developed is a synthesis and generalisation of different models suggested in various fields, like the JIT movement (Shingo, 1985) and the quality movement (Pall, 1987). According to Koskela (1992), the output of each conversion is usually variable, to such an extent that a share of the output does not fulfil the implicit or explicit

specification for that conversion and has to be scrapped or reworked. Koskela (1992) used Juran (1988) to emphasise the consequences of variability in output: “about a third of what we do consists of redoing work previously done”. Besides that, the specification for each conversion is imperfect; it only partially reflects the true requirements of the subsequent conversions and the final customer. The impact of this issue concerns lost opportunities to fulfil customer requirements. Thus the task was to develop a model covering all important features of production that were lacking in the conversion model. The new production model was as follows:

‘Production is a flow of material and/or information from raw material to the end product. In this flow, the material is processed (converted), it is inspected, it is waiting or it is moving. These activities are inherently different. Processing represents the conversion aspect of production; inspecting, moving and waiting represent the flow aspect of production. Flow processes can be characterised by time, cost and value. Value refers to the fulfilment of customer requirements. In most cases, only processing activities are value-adding activities. For material flows, processing activities are alterations of shape or substance, assembly and disassembly’ (Koskela, 1992, 14).

Koskela summarised his thoughts of production management into what became the Transformation-Flow-Value (TFV) theory of production. The contribution consisted in the proposition that all three elements are to be managed at simultanaeously. All three views should be integrated and balanced:

The TFV theory of production (Koskela, 2000)

	Transformation view	*Flow view*	*Value generation view*
Conceptualization of production	As a transformation of inputs into outputs	As a flow of material, composed of transformation, inspection, moving and waiting	As a process where value for the customer is created through fulfillment of his requirements
Main principle	Getting production realized efficiently	Elimination of waste (non-value-adding activities)	Elimination of value loss (achieved value in relation to best possible value)
Methods and practices	Work breakdown structure, MRP, Organizational Responsibility Chart	Continuous flow, pull production control, continuous improvement	Methods for requirement capture, Quality Function Deployment
Practical contribution	Taking care of what has to be done	Taking care of that what is unnecessary is done as little as possible	Taking care of that customer requirements are met in the best possible manner
Suggested name for practical application of the view	Task management	Flow management	Value management

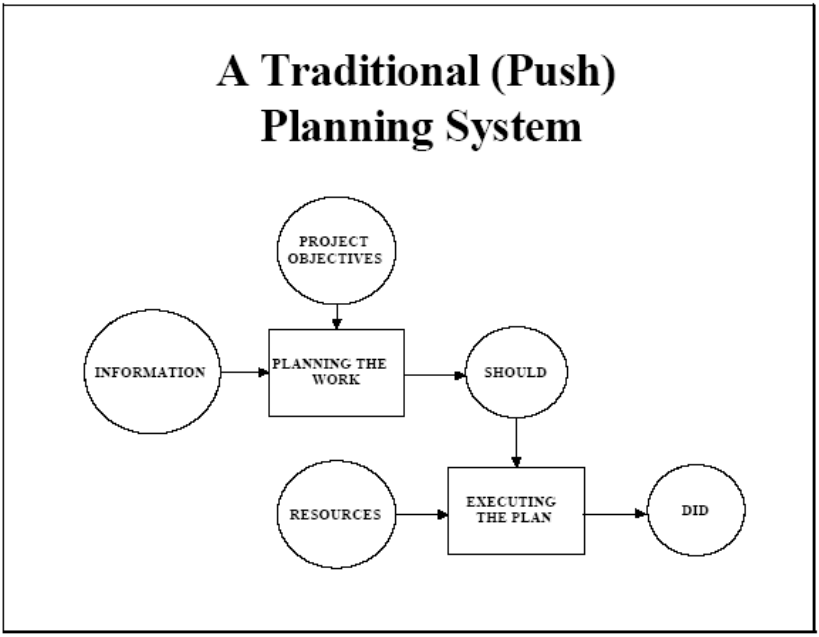
Koskela's paper contributed heavily to the subsequent development of the Lean Construction idea, and his proposition – which was that a neglect of managing flows and narrowing the focus to only conversions had led to complex, uncertain and confused flow processes, non-value-adding activities and a reduction of output value – was adopted by Howell and Ballard (1995). Howell and Ballard (1995) observed that typically only half of the tasks in a weekly plan are realised as planned on site, and the reasons for this 'inefficient' situation are found in Koskela's (1992) propositions. In a series of experimental work, a new approach to production control, called the Last Planner System (LPS), was developed by Ballard (1994, 2000) with the aid of Howell (Ballard & Howell, 1998 and 2003). The LPS was to represent Koskela's (1992) theoretical propositions in practice through its concrete form as a practical tool.

4.3. The Last Planner System, a Management Control System

According to Ballard & Howell (1998), the functions of production management systems are planning and control. Planning establishes goals and a desired sequence of events for achieving those goals. Control causes events to approximate the desired sequence, initiates re-planning when the established sequence is either no longer feasible or no longer desirable, and initiates learning when events fail to conform to the plan (Ballard & Howell, 1998).

Ballard & Howell (1998) argued that when environments are dynamic and the production system is uncertain and variable, reliable planning cannot be performed in detail much before the events being planned. Consequently, deciding what and how much work is to be done next by a design squad or a construction crew is rarely a matter of simply following a master schedule established at the beginning of the project. Ballard therefore took on the propositions of Koskela (1992) about the neglect of flow management that is purportedly built into traditional construction management. Focusing solely on conversions causes the loss of control in construction projects, especially in those characterised by dynamic environments and in which the production system is variable and uncertain.

Below is an illustration of the inefficient planning system as argued by Ballard (2000, 45):



A Traditional (Push) Planning System

How can planning and control be done efficiently in construction processes characterised by dynamic environments and variable production processes? These questions drove the initial research of Ballard (1994) and Howell & Ballard (1995) in the area of production unit level planning and control. They proposed the Last Planner System as a practical planning and control tool that is to correct the deficiencies of traditional construction planning and control. The design of the proposed tool was as follows:

The tool's master plan is designed top-down, but differs from traditional design on the more disaggregate planning levels. The master plan determines what *should* be done in general terms. The aim is to create the best possible situation for an efficient execution of the transformations/conversions. This is done with rolling week plans, made as late as possible, and in which all the flows determining a sound activity are to be highlighted.

An activity can only be included in the week plan if it is sound. An activity is sound only if seven preconditions are fulfilled. These are:

- Previous work finished
- Space available
- Crew available
- Equipment available
- Materials available
- Drawings and information available
- External circumstances – weather, approvals, etc.

If even a single one of these preconditions is not secured and controlled, the activity cannot be executed as planned; this disturbs the ordered flow, uncertainty quickly multiplies and the system

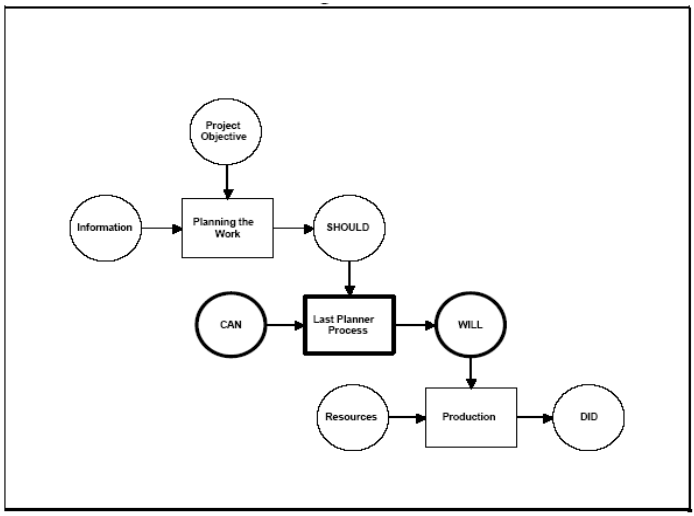
spins out of control. The seven preconditions are therefore to be interpreted as flows that need to be handled with at least the same priority as the flow of conversions.

According to Ballard (1997), the weekly plan is to control this upfront workflow and determine what *will* happen. The participants involved in the weekly planning also differ from traditional construction planning. It is supposed to be the operational staff – the people who are physically closest to the actual construction (the last planners), along with a process manager – who are to conduct the planning and evaluation of the weekly work. This process builds on the explicit premise of mutual commitments about finishing at agreed points in time. The idea of commitment is based on the assumption that efficiency will increase if the tradesmen commit themselves to execute assignments, thereby decreasing that issue of uncertainty. Commitments are proposed as foundational for the Last Planner System, since these are supposed to be mechanisms for responsible behaviour towards the collective.

The use of these rolling week plans is to shield production from upstream uncertainty and variation (Ballard and Howell, 1998). Such shielding assures to a large degree that productive capacity is not wasted by, for example, waiting for or seeking materials. However, because of its short-term nature, shielding cannot avoid under-loading resources when workflow is out of sequence or insufficient in quantity. Therefore a second element of the Last Planner System, the Look-Ahead Plan, is to be applied upstream of weekly work planning to control workflow and to make assignments ready by proactively acquiring the materials and design information needed, and by expediting and monitoring the completion of prerequisite work (Ballard, 1997). In other words, the Look-Ahead Plan is to determine what *can* happen. It determines what kind of activities *can* be executed. It is therefore regarded as a premise for securing sound activities. The weekly planning relies on the *cans* established in the Look-Ahead plan when what *will* be done is to be determined.

All the flows determining a sound activity are to be highlighted, and an activity can only be included in the week plan if it is sound. Besides this it is to serve as a controlling mechanism for the

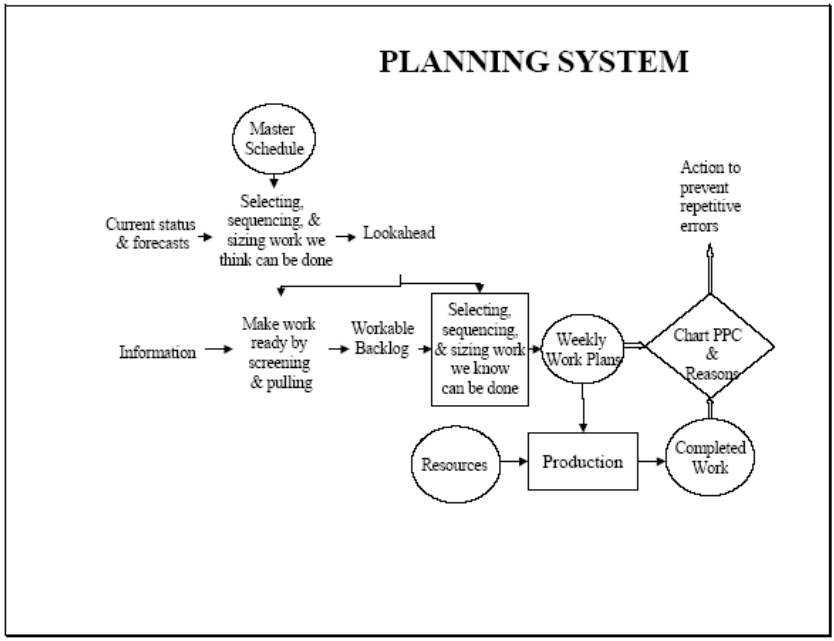
evaluation of last week's performance. Below is the Last Planner Process as illustrated by Ballard (2000, 48):



The Last Planner System

A key measure of the Last Planner system is the Percentage of Planned assignments Completed (PPC). This measure is proposed to ensure immediate learning among the participants and proactively identify and eliminate reasons for 'out of control' situations. The magnitude of failure and the causes of failure to complete planned assignments are to be discussed and reduced or avoided in future. PPC expresses the stability of the workflow, which determines capacity utilisation. The underlying rationale is that a greater reliability of the system leads to a shorter waiting time for a given utilisation of the theoretical capacity of the system. PPC seeks to secure immediate learning among the participants.

The illustration below is a detailed description of the functions of the Master Schedule, the Look-Ahead Plan and the Weekly Work Plans with the PPC-measure included (Ballard, 2000, 39):



Overall, the Last Planner System was proposed to reflect the practical extension of project management that Koskela introduced (1992). This was confirmed in Bertelsen & Koskela (2002). In relation to the issue of dynamic environments and variable work processes, Bertelsen & Koskela (2002) argued that the distribution of the planning process in Last Planner is an expression of delegating decision rights to operational levels (the foremen). At the same time, the short planning horizon is an expression of the construction project as a complex, dynamic system that by its very nature is unpredictable more than a few steps into the future. The Last Planner System was according to Bertelsen & Koskela (2002) to be understood as the essential tool for managing the flow part of Koskela's theory. The notion that the LPS has become largely synonymous with lean construction is supported by Green and May (2005) and Paez et al.(2005) who concluded that daily

huddle meetings and the LPS are essential aspects of lean construction because they deal with exceptions and uncertainty.

The Last Planner system has not been discussed in specific management accounting literature. In the form proposed by Ballard, Howell, Bertelsen and Koskela it does, however, possess qualities that qualify it to be an MCS. In the following part definitions of MCS are discussed and related to the LPS.

There is general consensus in literature that management control refers to the process by which an organization influences its subunits and members to behave in ways that lead to the attainment of organizational objectives (Arrow, 1974; Ouchi, 1977). According to Chenhall (2003) an MCS is to be understood as a term that encompasses, but is also more, than management accounting: Chenhall (2003) defines management accounting (MA) as a "collection of practices such as budgeting or product costing". Management accounting systems (MAS) is the "systematic use of MA to achieve some goal" and MCS, he argues, "is a broader term that encompasses MAS and also includes other controls such as personal and clan controls". He also notes that the term organisational control "is sometimes used to refer to controls built into activities and processes such as statistical quality control, just-in-time management" (p. 129). Organizations that use clan control require trust among their employees. Given minimal direction and standards, employees are assumed to perform well, and they participate in setting standards and designing the control systems.

Merchant and Otley (2007) are in line with Chenhall (2003) and note that broader conceptualizations of control can include factors such as strategic development, strategic control and learning processes, all of which are typically beyond the scope of management accounting. In these conceptualizations 'almost everything in the organisation is included as part of the overall control system' (p. 785).

According to Otley (1999) management control systems provide information that is intended to be useful to managers in performing their jobs and to assist organizations in developing and maintaining viable patterns of behaviour. Any controlled system requires objectives and goals against which its performance can be assessed (Otley and Berry, 1980). According to Otley (1999)

there are a plethora of approaches and techniques currently deployed in practice that have the aim of increasing goal attainment and reducing the consumption of resources, such as continuous improvement, benchmarking, concurrent engineering and target-costing. Such approaches not only involve the technical specification of goals which are required to be attained but are also necessarily concerned with issues of motivation and employee behaviour. (p. 368)

It is in literature generally accepted that cybernetic principles are associated with the concept of control (Arrow, 1964; Daft, 1983; Mintzberg, 1979; Strank, 1983). Green and Welsh (1988) defines cybernetic control as "a process in which a feedback loop is represented by using standards of performance, measuring system performance, comparing that performance to standards, feeding back information about unwanted variances in the systems, and modifying the system's comportment" (p. 289). In organisations a cybernetic system can either be an information system or control system contingent upon how it is used. A cybernetic system would be an information and decision-support system if managers themselves detected unwanted variances and modified their underlying behaviour or activity that influenced the variance (for example in a production process) without anyone else's involvement. However, the linking of behaviour to targets, and the establishing of accountability for variations in performance takes a cybernetic system from being an information system to support decisions, to an MCS (Malmi & Brown, 2008, 292).

Relating these considerations of what constitutes an MCS to the LPS, there are close connotations to the cybernetic principles in the LPS. In order to argue for the cybernetic principles that characterize the LPS it is helpful to go even further and split up control in three types: *Feedforward*, *concurrent* and *feedback* (Samson & Daft, 2008):

Feedforward control focuses on the regulation of inputs (human, material and financial resources that flow into the organization) to ensure that they meet the standards necessary for the transformation process. Feedforward controls allow management to prevent problems rather than having to cure them later.

Concurrent control takes place while an activity is in progress. It involves the regulation of ongoing activities that are part of transformation processes to ensure that they conform to organizational

standards. Since concurrent control involves regulating ongoing tasks, it requires a thorough understanding of the specific tasks involved and their relationship to the desired end product.

Feedback control focuses on the outputs of the organization after transformation is complete.

As already mentioned the LPS can be viewed as an addition to the management of transformations taken care of by traditional contract management according to Ballard and Koskela. The feedback mechanisms constituting transformation management are proposedly not able to handle the uncertainty and dynamism characterizing construction processes. In other words, if there are significant problems at the time the manager receives the information the damage is already done. Additionally, the information received might not be sufficient to address underlying causes of damage.

The LPS proposedly remedies this inefficient situation by adding feedforward and concurrent controls to the feedback control that is represented in contracts and the master schedule (transformation management). In the LPS jargon the contracts and the master schedule are referred to as the *should* of activities (See earlier in this chapter). Summing up, *the contracts* and *the master schedule* are to perform the general feedback mechanisms that, though, according to the propositions by Koskela (1992) and Ballard (2000) are insufficient as stand-alone controls, because they are too delayed to control uncertainty and variation.

The feedforward control, that is to add to the contracts and the master schedule, are proposed to be done by the Look-Ahead Plan. In LPS jargon the Look-Ahead Plan secures the *can* of activities. This plan is to capture the seven prerequisites needed 4-6 weeks into the future of the construction process. Ordering of materials and staffing are two examples of the seven prerequisites that become explicit management objects these 4-6 weeks in advance of their actual utilization. The Look-Ahead Plan therefore serves to prevent uncertainty stemming from these seven prerequisites not being managed systematically. Summing up, *the Look-Ahead plan* and its explicit focus on controlling the *seven prerequisites* constitutes the feedforward mechanism in the LPS.

The concurrent control is performed through the Week Plan and the PPC measure. The idea of Week Plan coupled with the PPC is to ensure that weekly variation and uncertainty similarly caused by the earlier mentioned seven prerequisites is systematically managed. The Week Plan serves to make the status of on-going activities visible to management, and it therefore affords ongoing regulation of work in progress. The Week Plan is to be used for planning and evaluation. All the activities planned to be executed in the preceding week are concurrently evaluated the following week. The PPC measure is to sum up on the status of activities having been (and not having been) executed according to plan. It is therefore a time-based measure and the PPC-measure is to address whether the percentage of activities executed according to plan is rising or declining throughout the construction project. The PPC measure therefore acts as an additional feedback control that compares performance across weeks. It serves to illustrate whether the executing parties are improving or not improving their ability to manage variation and uncertainty; if variation and uncertainty is badly managed then delays in execution of assignments are expected. This will show in the percentage measure. Delays refer to time. Accordingly, time comes to represent an idea of good or bad variation/uncertainty management.

Time as a measure of efficient management is a pivotal part of JIT as discussed earlier. Time as a measure of organisational effectiveness has been discussed in comparison with cost: Stalk and Hout (1990, p. 39) say that 'time as a strategic weapon is money, productivity, quality, and even innovation'. Time is said to be useful in all areas of management, and it may replace other managerial technologies such as cost accounting. Time's major advantage as a management tool is that it forces analysis down to a physical level. . . This physical way of looking at the business gives managers more insight and power in looking for ways to improve results than cost analysis typically can.. . Once a manager sees a layout of where time goes, he or she can start to translate it into cost reduction opportunities. But looking at cost analyses first doesn't often tell anyone where to save time. (Stalk and Hout, 1990, p. 192-193)

Mouritsen & Bekke (1999) interpret Stalk and Hout: Time 'forces analysis down to a physical level' and is preferable to cost accounting, which-as it represents the firm's problems in an abstract mode-mystifies rather than illuminates managerial concerns.

The critique of cost as a guiding measure of organisational effectiveness and the appraisal of non-financial performance measures is also found more generally literature on strategic control systems (e.g. Govindarajan & Gupta, 1985; Bromwich, 1990; Kaplan & Cooper, 1998). According to Ittner & Larcker (1997, 295) a key assumption in the strategic control literature is the need to align specific control practices with the organization's chosen strategy. When quality strategies like Lean are adopted, the strategic control systems should be aligned accordingly (e.g. Juran, 1988; Atkinson et al., 1997 and Wruck & Jensen, 1994). For example, the U.S. Malcolm Baldrige National Quality Award criteria (U.S Department of Commerce) require among other things that financial measures should be supplemented with non-financial indicators focused specifically on customer requirements, customer satisfaction and operational quality results.

The PPC measure takes part in this re-presentation of control that Lean construction advocates. The measure is to lead to discussions of root causes for failures to complete planned assignments in time. It touches upon issues of quality concerning drawings, staff skills, materials, cooperation between trades and so on.

Summing up, *the week plan* and the *PPC measure* constitute the concurrent control mechanism and the PPC measure supports the strategic aspirations in the LPS of controlling construction flow before costs. The LPS can therefore be understood cybernetic system comprising a bundle of control mechanisms, managing variation and uncertainty in various time intervals:

- *The contracts* and *the master schedule* are to perform the general feedback mechanisms
- *The Look-Ahead plan* and its explicit focus on controlling the *seven prerequisites* constitutes the feedforward mechanism
- *The week plan* and the *PPC measure* constitute the concurrent control mechanism

Additionally, the structure of the LPS is closely related to recommendations in literature on delegation of decision rights (e.g. Jensen & Meckling, 1992; Wruck & Jensen, 1994). Jensen and Meckling (1992) refer to Hayek (1945) who argues that centrally planned economic systems cannot

access and utilize valuable bits of diffusely held knowledge. This knowledge he calls 'knowledge of particular circumstances of time and place'. Extending Hayek's analysis, Jensen and Meckling focus on the cost of transferring knowledge which includes both the cost of communicating and of assuring the receiving part can use the knowledge effectively. They part up knowledge in two distinct forms using a cost criterion:

'*Specific knowledge* is knowledge that is costly to transfer among agents and *general knowledge* is knowledge that is inexpensive to transmit. Because specific knowledge is costly to transfer, getting it used in decision-making requires decentralizing many decision rights in both the economy and in firms' (1992, 252).

Recalling from earlier, Ballard (2000) proposes that the participants involved in the weekly planning differ from traditional construction planning. It is supposed to be the operational staff – the people who are physically closest to the actual construction (the last planners), along with a process manager – who are to conduct the planning and evaluation of the weekly work. Ballard therefore proposes that it is the operational staff that possesses specific knowledge on the construction process. The operational staff should therefore also be accorded the rights to control the weekly planning.

According to Jensen and Meckling (1992) such delegation creates a control or agency problem. This problem consists of ensuring the agents exercise their rights in a way that contributes to the organizational objective of maximizing construction flow. To counter this problem Ballard (2000) proposes the idea of *commitment.* The function of commitment is based on the assumption that efficiency will increase, if the tradesmen commit themselves to the project and to execute assignments, thereby decreasing that issue of uncertainty. Commitments are supposed to be mechanisms for responsible behaviour towards the collective. This idea of commitment is in line with Mowday et al. (1982) who define commitment as employees' identification with and acceptance of their organisational goals and values, their willingness to exert considerable effort on behalf of the organisation and their desire to maintain organisational membership.

The idea of commitment is therefore an additional, supportive control to the concurrent control mechanisms (the week plan and the PPC). The idea of commitment is added to the LPS in order to support the aspirations of establishing a strong control tool.

Summing up, it is argued that the LPS consists of a bundle of controls managing different time levels in construction projects. It is argued in this chapter, that the LPS carries close relations to theory of controls and definitions of MCSs. In the following section the identity of the LPS as being a bundle of controls is added to, and it is argued that it can additionally be understood as a *strategy.* This definition and line of reasoning is crucial since the analysis that follows in chapter 6 proposes that this two-sidedness in the LPS becomes a source of durability in the construction project studied in this thesis.

4.4. The Last Planner System; a strategy and a bundle of controls.

Recalling Røvik's (1998) characteristics of management innovations, the LPS definitely carries diffusion qualities, at least in its abstract form: It is an unambiguous win-win solution concerning planning and evaluation leading to a *more profitable construction project* for all the parties involved. By using the LPS it becomes possible explicitly to focus on and manage variability in construction projects. If the LPS is not applied, variability management is neglected, leading to an ineffective and inefficient production process; the very antithesis of flow.

According to Ballard (2000) the LPS is therefore the solution to maximize *flow* by minimizing variability. In addition, a number of other advantages are associated to the LPS by Ballard (2000). *Customer value is enhanced,* since the probability of the project being delivered on time is increased. In addition, *the quality of work is improved,* since there is an explicit focus on measuring and evaluating failures to execute activities according to week plans. Furthermore, the increased flow, the decreased lead time and the proactive work on minimising failures leads to *reduced costs*. Finally, the ideal of basing the planning procedure on commitments between the trades, not between trades and project management, is to *increase feelings of personal responsibility* and at the same time *decrease adversarial behavior*.

In this thesis it is argued that the LPS can be viewed as both a *strategy* as well as a *bundle of controls*. The strategy consists of maximizing *flow* through management of variability and consequently an *enhancement of customer value, improvement of quality* and *reduction of costs.* It is argued that it is a strategic quality (derived from the Greek word *strategos*, which roughly translates as *general)*, because the idea maximizing flow by reducing variability is a general goal of Lean Construction. Additionally, the controls accounted for all have a range of sub goals that are to secure the strategy in being achieved. There is therefore a clear relation between the controls and the strategy. The bundle of controls consists of the concrete mechanisms (feedback, feedforward, concurrent) discussed in the previous section:

The feedback mechanisms are the *contracts* and the *master schedule*. The feedforward mechanism is the *Look-Ahead plan* and its explicit focus on controlling the *seven prerequisites*. *The week plan* and the *PPC measure* constitute the concurrent control mechanism. Additionally, the mechanism of *commitment* is to support the week plan and the PPC measure in enforcing the concurrent control. These are the concrete tools that represent the feedforward, concurrent and feedback loops that are meant to support the strategic goal of maximizing production flow by minimizing variability.

Contracts act only as *a priori* frames for establishing the connections between the parties executing the construction project. *The three-plan structure* forms a basis for variability/flow management. The Master Plan determines the overall milestones to which the construction project should conform. The Look-Ahead Plan is to be activated in relation to what can be executed within a 4-6 week time frame. This is where the basic *soundness* of activities is to be discussed and consolidated. The Week Plan secures the will of activities, and there is to be a screening for potential upcoming failures. In addition, the *PPC* is to be used as the measure for evaluating the past week's performance, making failure prevention an explicit management objective. Work commitments, which are agreements between trades, are to be based on the concept of soundness.

This way of parting the LPS into a strategy and a bundle of controls is similar to the maneuver made by Hines et al. (2004) on Lean, mentioned in chapter 4, section 1. Separating strategic

perspectives and operational tools, Hines et al. (2004) subsumes the operational tools (e.g. SMED, Kanban) to the strategic perspective of focusing on customer value: According to him, the customer-centered strategic thinking applies everywhere, the shop-floor tools do not. Any concept that provides customer value can be in line with a lean strategy, even if lean production tools on the shop-floor, such as kanban, level scheduling, or takt time are not used.

In the forthcoming analysis in this thesis it is argued that the two-sided structure of being both a strategy and a bundle of controls, increased the durability of the LPS in the particular construction project. Not always because the two parts complemented each other but more importantly because they discretely got separated and while the strategy selectively remained strong.

For the moment the discussion on the LPS as being a strategy and a bundle of controls will rest, and be returned to in the first part of the analysis. In the following chapter the method applied in the thesis is accounted for. The chapter offers insight into how the field study has taken place, and additionally how it relates to the approach applied in the thesis.

Chapter 5 - Method

As mentioned in the introduction a longitudinal case study organized this thesis' inquiry into MCS durability. The research questions and the contribution of this thesis are, as already explained, theoretically informed by strings from Actor Network Theory that have devoted special attention to exploring the identity of fluid objects. In this chapter, it will be outlined how the empirics has been approached. The **first section** discusses the chosen method in the thesis, the ethnographic case study, and argues for its relevance for the research approach. **Section 2** accounts for the data collection illustrating the total interviews and observations in a timeline. **Section 3** covers the critique from post-positivist literature on using the notions of validity, reliability and generalizability to evaluate method. The section concludes by arguing that it is more appropriate to use the notion of *convincingness* (Golden-Biddle and Locke, 1993) to evaluate on the method applied in this thesis. Accordingly in **section 4** the method will be discussed in relation to convincingness.

5.1. An ethnographic case study

According to Silverman (2000) the research problem and the methodology in a study are closely connected. The research problem, and thus the object of study, arises from the researcher's approach to the world, and the research problem affects the choice of the appropriate research methods to be used to provide answers. The approach of this project is (After) Actor Network Theory (ANT). Like any other approach it ramifies methods that qualify for scientific knowledge. ANT was in the early 1980's applied as a method for dismantling the supposedly scientific objective method conducted in natural sciences. The principle of symmetry, also discussed in the approach section, became a cornerstone in ANT in order to steer free of dualisms (e.g. subject vs. object, nature vs. society) found in contemporary social theory (Law, 2007). The methodological consequence of this is expressed in the following proposition:

'Instead of opposing the individual level to the mass, or agency to structure, we simply follow how a given element becomes strategic through the number of connections it commands, and how it loses its importance when losing connections' (Latour 1991, p. 372)

Latour proposes a number of directives that should discipline the data collection process. Latour grants some significance to the analysis of discourse but is critical of an extreme privileging of the researchers' interpretations (Latour, 1993). Instead Latour's emphasis on the social is summed up in his attention to "following the actors" and seeing what they do rather than what they say. Latour (1987, p. 258) offers seven guidelines for studying 'the fabrication of technical artifacts':

- We study science in action and not ready made science or technology; to do so, we either arrive before the facts and machines are black boxed or we follow the controversies that reopen them.

- To determine the objectivity or subjectivity of a claim, the efficiency or perfection of a mechanism, we do not look for their intrinsic qualities but at all the transformations they undergo later in the hands of others.

- Since the settlement of a controversy is the cause of Nature's representation, not its consequence, we can never use this consequence, Nature, to explain how and why a controversy has been settled.

- Since the settlement of a controversy is the cause of Society's stability, we cannot use Society to explain how and why a controversy has been settled. We should consider symmetrically the efforts to enroll human and non-human resources.

- We have to be as undecided as the various actors we follow as to what techno science is made of; every time an inside/outside divide is built, we should study the two sides simultaneously and make the list, no matter how long and heterogeneous, of those who do the work.

- Confronted with the accusation of irrationality, we look neither at what rule of logic has been broken, nor at what structure of society could explain the distortion, but to the angle and direction of the observer's displacement, and to the length of the network thus being built.

- Before attributing any special quality to the mind or to the method of people, let us examine first the many ways through which inscriptions are gathered, combined, tied together and sent back. Only if there is something unexplained once the networks have been studied shall we start to speak of cognitive factors.

Rule 2 states that in determining the "objectivity or subjectivity of a claim" one should look to trace "all the transformations they undergo later in the hands of others" (Latour, 1987, p. 258). As a result of rule 2 it becomes essential to "follow actors" around the organisation in order to attempt to establish the transformations which are taking place. Only in this way is it possible for the research process to provide evidence of the interactions among human actors and technological actants. These interactions provide contributions, conscious and unconscious, to the network that forms around the system implementation.

According to Garson (2002) ANT may be seen as a subtype of grounded theory insofar as it seeks to assess the semiotic environment using *ethnographic methods* focused on meanings as defined by the actors themselves, rather than using predefined behavioral methods of data collection. ANT may also be seen as a subtype of situational theory, insofar as social interactions are interpreted as determined by networks as situational contexts. Concerning the notion of ethnographic methods, the notion of ethnography is based on a curiosity about others, about how people (or non humans in an ANT perspective) construct their world. Wolcott (1999) defines the purpose of ethnography as:

'... to describe what the people in some particular place or status ordinarily do, and the meanings they ascribe to what they do, under ordinary or particular circumstances, presenting that description in a manner that draws attention to regularities that implicate cultural processes. One can do ethnography anywhere, anytime and of virtually anything, as long as human social behaviour is involved (Wolcott, 1999, p. 68).

ANT is ethnographic in that it is occupied with particular places and ordinary everyday activities. The approach does, however, grant more agency to non-humans than what is proposed above by Wolcott. Non-humans are also to be viewed as actors in their own right and not just in the form of being artifacts disciplined by human intentions. Ethnography in organisations points to qualitatively-oriented research methods, in particular the case study (Ahrens & Dent, 1998; Modell, 2005, Scapens, 1990). According to Yin (1994), a case study is defined as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (ibid. p.13). The case study is a research strategy that focuses on understanding the dynamics present within single settings, and it can be either single or multiple cases, and numerous levels of analysis. According to Scapens (1990) case studies offer the possibility of understanding the nature of management accounting in practice; both in terms of the techniques, procedures, systems, etc. which are used and the way they are used.

According to Mitchell (1983) and Yin (1989) the case study method has six major attributes. First, a case study investigates a *contemporary phenomenon*. Normally a significant attribute of case study research is the examination of a social situation as it unfolds. Second, a simple narrative account of any contemporary phenomenon examined should be of *theoretical significance.* This does not mean that a case study must always be based on a prior theory, only that it should be concerned with a subject of research interest. Third, a case study method involves the *detailed examination* of the phenomenon *within its real-life context.* The aim is to provide depth of analysis, which includes not only the phenomenon itself but also the context in which it is located. This often involves a trade-off against breadth of analysis. Fourth, this recognition of context involves more than just the specification of antecedent and moderating variables, but the recognition that any phenomenon is

embedded in its context. Fifth, the detailed examination of the phenomenon and its context usually involves *longitudinal analysis.* The concern with the unfolding of a social situation leads to an emphasis on the phenomenon in process, and thus the explicit attention to the time dimension in case study method. Finally, case study research usually makes use of *multiple sources* of data. There is no prior fixed commitment to any particular form of data collection or analysis. However, the commitment to depth of analysis usually means that qualitative methods dominate.

The case study is, though, not necessarily equal to ethnography. According to Yin (2003) the case study strategy should not be confused with 'qualitative research' (e.g. Denzin & Lincoln, 1994). Some qualitative research follows ethnographic methods and seeks to satisfy two conditions: (a) the use of close-up, detailed observation of the natural world by the investigator and (b) the attempt to avoid prior commitment to any theoretical model (e.g. Jacob, 1989). However, the ethnographic research does not always produce case studies, nor are case studies limited to these two conditions. Instead, case studies can be based on any mix of quantitative and qualitative evidence.

The above considerations position the method applied in thesis as an *ethnographic case study.* The objective in this thesis is to be able to capture the existence/performance of the LPS and its constituting elements throughout potentially many, various and unforeseeable organisational instances in an exploratory fashion. The qualitative research perspective is therefore arguably relevant since it emphasizes the investigation of processes in the setting studied. Using the ethnographic case study strategy carries with it some advantages and disadvantages. The advantage consists of the depth and flexibility of analysis of a social situation that it makes possible. By concentrating research effort on the detailed study of a specified occurrence of a phenomenon, the analysis can pay attention to context, consider a large range of variables simultaneously as they unfold in the situation, adapt the research design as understanding of both the questions and answers develop, and thereby provide a rich explanation of the subject of interest.

The use of case study method is though, also subject to common criticism concerning issues of validity. Case studies are argued to be hard to replicate, provide no comparative data for single case

designs or data that may be difficult to compare in multiplied case designs. These concerns are enhanced by the possibility of research bias, which is particularly argued to be relevant for qualitative data (e.g. Duncan, 1979). The methodological issues of validity, reliability and generalizability are thoroughly discussed in section 3. First, though, it is considered appropriate to outline how the particular data collection process has taken place. In the following section the data collection process is therefore outlined, in order to discuss issues of validity, reliability and generalizability in section 3 and 4.

5.2. The data collection

The purpose of grasping interaction between actors, their points of view and the richness of the world renders techniques such as participant observation, interviewing, attending meetings and investigating documents for data capture as appropriate (Bate, 1997). All of these techniques have been used in the field study. Particular access to the field was obtained through the chief production officer (CPO) of the organisation, who permitted participation in the everyday activities in the renovation project mentioned earlier. As the author became connected to the project managers in the specific renovation project it was agreed to observe the weekly meetings and interview the consultants and project managers on an ongoing basis; if the foremen representing the subcontractors could be convinced to participate in interviews, the author was welcome to do that as well. Besides that, access was granted to the contracts that were established between the main contractor and the subcontractors. The actual data-collection process was mainly done through participant observation at the weekly meetings. In total, 20 weekly meetings with a duration of approximately one hour each were observed throughout the renovation project:

Date	Meetings
March 7, 2006	2. Process meeting
March 22, 2006	3. Process meeting
March 29, 2006	Weekly meeting

April 20, 2006	Weekly meeting
May 4, 2006	Weekly meeting
May 11, 2006	Weekly meeting
May 21, 2006	Weekly meeting
June 1, 2006	Weekly meeting
June 15, 2006	Internal workshop
June 18, 2006	Weekly meeting
August 24, 2006	Weekly meeting
September 7, 2006	Weekly meeting
October 5, 2006	Weekly meeting
October 12, 2006	Weekly meeting
October 19, 2006	Weekly meeting
October 26, 2006	Weekly meeting
November 2, 2006	Weekly meeting
November 9, 2006	Weekly meeting
November 16, 2006	Weekly meeting
November 30, 2006	Weekly meeting
December 7, 2006	Weekly meeting

Additionally, six semi-structured interviews were conducted with construction management, project management, consultants and foremen:

Date	Interview

May 4, 2006	Interview with consultant and project management
May 10, 2006	Interview with construction management and consultant
August 24, 2006	Interview with consultant and project management
November 19, 2006	Interview with plumber foreman
November 22, 2006	Interview with painter foreman
November 24, 2006	Interview with electrician foreman

All meetings and interviews were tape-recorded and transcribed in full in order to be able to retain the ability to go back to already-analysed data to detect issues of durability that were missed earlier. The focus in the data tape recording the meetings was in the beginning accompanied by a couple of questions from the participants about the objectives of this activity. However, it did not appear to have any effect on the meetings, since it was never mentioned again in the rest of the meetings.

5.3. Validity, reliability and generalizability in a post-positivist perspective.

Relating the data collection process and the use of data in the forthcoming analysis to issues of validity, reliability and generalizability, there is much debate in accounting literature of how this is to be done. Within the post-positivist stream the notion of authoring the field in ways that "reliably" and "validly" mirror practice is questioned (Madill *et al.*, 2000; Maxwell, 1992; Stiles, 1993). According to Madill et al. (2000) the notions of validity, reliability and generalizability lend themselves to a realist, scientific epistemology. Baxter & Chua (2008) argue that whilst the authoring of such "scientific maxims" may be appropriate within the context of so-called mainstream accounting research in which these norms have been "institutionalised" (Abernethy *et al.*, 1999, p. 24), much qualitative management accounting field research does not ascribe to the realist epistemology of the mainstream. According to Maxwell (1992) this raises the issue as to how such research, achieves its narrative *convincingness*.

The post-positivist perspective applied in this thesis renders the use of the criteria of *convincingness* relevant. This notion to evaluate upon the method is therefore used in this thesis. Golden-Biddle and Locke (1993) characterise "convincingness" in terms of three dimensions, which they refer to as authenticity, plausibility, and criticality. According to Baxter & Chua (2008) the first of these dimensions – authenticity – refers to the authoring of the so-called "been there" quality of field research (Geertz, 1988). A convincing text will provide some form of written assurance as to both the field researcher's presence in and understanding of the field (Golden-Biddle and Locke, 1993). Authenticity is about the inscription of ethnographic authority (Marcus and Cushman, 1982), which often involves some form of "calculative" reckoning narrating the number of days/months/years spent in the field, the number and type of informants and the quantum of data collected (Briers and Chua, 2001).

Plausibility, the second dimension, is concerned with whether (or not) renditions of the field make sense. Does an account of the field seem credible, given what readers know about their world? A text that persuades in terms of its plausibility has attained a form of literary authority referred to as vraisemblance (Atkinson, 1990, p. 39). Criticality, the third dimension of "convincingness", is concerned with the imaginative possibilities that field research may provoke (Golden-Biddle and Locke, 1993). Can readers configure a larger and more enduring theoretical referent in the field (White, 1987)? Is the general well embedded and articulated in our accounts of the local (Ahrens and Chapman, 2006)? Do our accounts of the field "speak to our human and organizational conditions of existence in ways that we find useful and desirable" (Clegg, 2006, p. 861)?

In the next section the data collection and the analysis is evaluated according to the three criteria on *convincingness* given above.

5.4. The data collection and the analysis in relation to convincingness.

5.4.1. Authenticity

This concerns the written assurance as to both the field researcher's presence in and understanding of the field. Firstly, the field study was conducted throughout a full construction project over a period of 10 months. In that relation, it was possible to follow the trajectory of the LPS from start to finish in a particular context. Secondly, the mix of data (participant observation, interviews and documents) was collected in order gain a comprehensive insight to the performance of the LPS. Especially, a triangulation between observations and interviews was done in order to understand the LPS's ability to align itself to differing practice circumstances, and to check whether perceived observations where in accordance with the participants' accounts of what took place.

Concerning the interviews the strategy was to remain technical in order to avoid any moral issues that could impede the researcher/practitioner relationship, and to avoid bias: Alvesson (2003) warns against a romantic view of the interview in which the interviewer assumes that the interviewee is mostly a competent and moral truth teller, acting in the service of science and producing the data needed to reveal his or her "interior" (i.e., experiences, feelings, values) or the "facts" of the organisation (p. 14). Alvesson proposes issues such as promotional activities, identity work, cultural scripts and political actions as obstacles to the validity of the romantic view. Kreiner & Mouritsen (2005) mention five reasons for not treating the interviewee's answers as final and privileged knowledge about the world: *ignorance*, *tacitness, boundedness, institutionalisation* and *opportunism.* Thus, interviews did definitely not, and should definitely not, get written off as valid information. On the contrary, the above insights on interviews were considered informative to the construction of the ANT account in this thesis. For example, issues of institutionalisation were used proactively to inquire into network actors that might have stayed hidden in an interview that was not reflective of institutional influence. Since the phenomenon under study here was an MCS – a non-human – it did not have a voice in itself, and obviously one could not interview the MCS. Instead it was chosen to go where the technology was expected to perform or to be performed. It was chosen primarily to observe these spaces (in meetings) in order to see its performance *in situ*, and much less

in *ex-post* accounts of performance (interviews). Interviews were therefore primarily used to triangulate observations.

This choice of method is in line with Latour in his proposition that one should follow actors in the making. Granting primacy to observations of the technology *in situ* avoided situations of having to 'believe' interviewee accounts of what did and did not happen. This, however, also carried a risk. The heavy reliance on observations, might have restricted the inflow of information from humans about spaces where the MCS also performed. This potential risk in the chosen data collection method might in this thesis have lead to an incomplete analysis of relations and connections concerning the identity of the LPS. In particular, three areas could have been of interest were left out of the investigation process:

1) Day-to-day communication between subcontractors concerning commitments made during the weekly meetings. Observing the physical execution of activities in order to compare plans directly with their execution instead of observing accounts of execution in the weekly meetings. Interesting management issues concerning the disciplining effect of the LPS were therefore potentially lost on the way from execution to accounts of execution done in the meetings.

2) Encounters between end-users and trades in terms of work procedures.

3) Contract re-negotiations and compensation negotiations for extra work.

Observing these spaces could have added to the account of the identity of the LPS offered in this thesis. Concerning this *incompleteness* in the data collection method it is relevant recall Latour's fifth principle: We have to be as undecided as the various actors we follow as to what techno science is made of; every time an inside/outside divide is built, we should study the two sides simultaneously and make the list, no matter how long and heterogeneous, of those who do the work.

This states a question of the endlessness of this list. Miller (1997) suggests that it is unrealistic to make this list – that the researcher would have no idea where to stop. This is a powerful argument

but one that Latour (1996) appears not to be concerned over: In any qualitative study it is possible to miss the point. The researcher may fail to complete the hermeneutic circle and never arrive at an empathetic understanding of the "native's" point of view (Alvesson and Deetz, 2000). Similarly with ANT it is possible that the researcher fails to fathom the network and may then provide an incomplete or misleading research story. However, according to Lee and Hassard (1999) this is not a problem of ANT alone but of all research. One could argue that ANT's emphasis on "empirical" understanding, its regard for variety of evidence and its networky character might minimise such partial story telling. ANT has attractions as a research strategy such as those which Lee and Hassard note but like other qualitative research approaches its deployment requires the use of judgment and human skill. The combination of limited human capacities and the complexity of any real world situation ensure that any research activity is necessarily frail and always subject to possible errors of interpretation and comprehension.

Summing up, it is acknowledged that the field study could have been even more investigative in terms of looking for spaces of LPS performance. This is certainly viewed as a substantive learning point concerning future research.

5.4.2. Plausibility

Plausibility is concerned with whether the renditions of the field make sense. The accounts of reconfigurations in the LPS as it gets enmeshed with construction practice have been evaluated by internally for their sensibility. Are the accounts 'overdone' in order to fit theory, for example? Arguing that this is not the case, the ANT approach exactly proposes the researcher to embrace the seemingly mundane. The mundane does, however, tend to be read as highly theoretical in ANT accounts, which might be problematic, when it comes to convincing the reader of its plausibility. This is more a question of writing skills than plausibility.

The thesis is concerned MCS durability, and a number of episodes of separation and addition in the MCS are argued to constitute its durability. The critical reader could argue that some of the episodes that are accounted for in the analysis do not have a relation to durability. This doubt is

acknowledged. The contribution of the thesis, however, resides in the proposition that there is no single, particular reason for its durability. Durability is an effect of multiple instances in different spaces and times. It is therefore the sum of the findings concerning durability that constitutes the final argument. The multiplicity naturally obscures the *proof* of what led to what. The third criteria, criticality, elaborates on the *proof* issue.

5.4.3. Criticality

Criticality concerns the questions: Can readers configure a larger and more enduring theoretical referent in the field (White, 1987)? Is the general well embedded and articulated in our accounts of the local (Ahrens and Chapman, 2006)? Do our accounts of the field "speak to our human and organizational conditions of existence in ways that we find useful and desirable" (Clegg, 2006, p. 861)?

Referring to the discussion above, the message to ANT researchers from Latour is that a 'complete' data collection process should be evaluated upon the criteria of whether there is enough data to account for interesting processes of translation. This is supported by Czarniawska (1999) who argues for a performative criteria, evaluating not the text per se, but describing what the text does to the reader. It is, however, important for the researcher to be aware that it takes time and resources to gain fruitful insight into translation processes. It takes effort to build up an understanding of details and dynamism in translation processes.

This thesis offers a very detailed and hopefully informative analysis of how two types of reconfigurations in an MCS are related to durability. The novelty and the contribution of the thesis does not consist in the particular separations and additions that are accounted for individually in the analysis. The contribution consists in the totality of the separations and additions, and the consequences for durability, and diffusion qualities of MCSs in general. There is therefore hopefully a clear general theoretical referent embedded in the analysis and conclusions. These

comments on criticality conclude the chapter on method. In the following two chapters the analysis is carried through.

Part II - Analysis

In the preceding chapters, the positioning, contribution, approach and method of this thesis have been accounted for. In the forthcoming two chapters, the analysis of the field, is to build the argument that the LPS in the particular renovation project became durable and established itself because it managed to align itself with construction practice through 1) *selections and separations within the LPS identity of planning and evaluation* and, through 2) *additions of identities to the LPS* other to the identity of planning and evaluation.

The analysis is accordingly parted into two chapters, each focusing on one of the two types of ability. The enactments of the two types of ability took place across different spaces and times, though not in a chronological order. This underlines the a-centered and non-linear approach applied to the study of the LPS in this thesis. The analysis in chapter 6 and 7 serves to answer the research questions in chapter 8.

Chapter 6 – Analysis, Part I: Selections and separations within the LPS identity of planning and evaluation

Chapter 6 consists of the first part (of two) of the analysis. In this part the selections and separations of the strategy from the bundle of controls concerning planning and evaluation is accounted for. Chapter 6 is divided into 6 sections. **Section 1** accounts for the structure of the analysis. **Sections 2-5** account for the selections and separations that took place between the strategy and the controls in relation to planning and evaluation. In **section 6** the preceding sections are concluded upon. The structure will be further elaborated in the following section.

6.1. Structure of analysis, part I

Referring to chapter 4, section 4 the LPS can be viewed as both a *strategy* as well as a *bundle of controls*. Abstractly, the strategy consists of maximizing *flow* through management of variability and consequently this leads to *enhancement of customer value, improvement of quality* and

reduction of costs. The bundle of controls consists of the concrete feedback, feedforward and concurrent controls:

- *The contracts* and *the master schedule* are to perform the general feedback mechanisms
- *The Look-Ahead Plan* and its explicit focus on controlling the *seven prerequisites* constitutes the feedforward mechanism
- *The week plan* and the *PPC measure* constitute the concurrent control mechanism. The notion of commitment is to strengthen the performance of this concurrent control mechanism

In the forthcoming analysis in this thesis it will be argued that the selection and separations of strategy from controls in episodes of planning and evaluation increased the durability of the LPS in the particular field study. It is argued that the discrete de-coupling and selection between the two strengthened the durability of the LPS. In literature the strategy and the controls reflect a harmonic LPS; the strategy is only attainable if the controls are used. This order did not, however, remain stable as the LPS travelled to construction practice. Controls, as it turned out, were reconfigured or even dismissed because they did not remain relevant in the local. In spite of this, the participants actually found the strategy in the LPS relevant and achievable, and the LPS therefore remained strong.

The selection and separation of the strategy from the controls was uncomplicated to the existence of the LPS, since the renovation project was still considered *Lean* by the participants. The LPS therefore managed to keep the idea of Lean intact for the involved parties (management and the managed) even though there were separations and translations of LPS parts.

The structure of the analysis of this part will in particular be as follows:

- Section 2 accounts for the introduction of the LPS to the executing parties in the renovation project. The section to explain how the LPS was communicated and inserted initially.

- Section 3, 4 and 5 serve to construct and support the proposition of selections and separations of *strategy from the bundle of controls* in the LPS in episodes of planning and evaluation. The sections are structured according to the three types of controls that the LPS is argued to consist of; feedback, feedforward and concurrent. Section 3 discusses selections and separations from the *feedback* controls and the strategy. Section 4 discusses selections and separations from the *feedforward* controls and the strategy, and section 5 discusses selections and separations from the *concurrent* controls and the strategy. Structuring the analysis in this manner is done in order to provide a comprehensive account of the *how* of selection and separation between the strategy and the bundle of controls.

In the following section it is explained how the involved executing parties met up the first time and got acquainted with the LPS:

6.2. LPS arrival at the construction scene.

The Last Planner System was inserted into a renovation project taking place in the outskirts of Copenhagen by the project's main contractor with the assistance of an external consultancy company. The LPS was introduced as a mandatory part of the renovation project through the official contracts between the main contractor and the subcontractors. The specific wording was interesting, as this influenced what contractual issues – in terms of general use of the Last Planner System – could and could not be raised by the participants:

'Planning of work is done by the principles of Lean Construction. The subcontractor participates with a foreman, who is to control and participate in production through weekly planning meetings. In addition, the conductor and foreman are to participate in a 1-day workshop as well as a 1-day process planning ahead of the beginning of production' (plumber contract)

The principles of Lean Construction were not further elaborated on in the contract, meaning that the formal classification of what was or was not lean remained rather vague. The only obvious change from traditional construction management, apart from the two planning days, was the systematised weekly meetings and that the foremen were obliged to be present. In that relation the insertion of the LPS limited the responsibility and role of conductors. Besides this, it was obvious that the Last Planner System was to endure throughout the lifetime of the renovation project. The Last Planner System was not thoroughly aligned with the contractually related institutions, meaning that formal penalties for not using the Look-Ahead plan or securing a sound activity were not established. The consequences of dismissing the Last Planner System were not known; they were not formally and explicitly specified.

An introductory document was also sent out to all the subcontractors, consisting of demolition workers, bricklayers, plumbers, electricians and painters. This document elaborated on the Lean Construction idea:

‘The idea is in general that we collectively develop a master plan, in which the interdependencies of the different activities are discussed. On the basis of this master plan, a rolling 8-week look-ahead plan and weekly plans are prepared. The look-ahead plan and week plans are discussed every week in a planning meeting, in which the foremen, along with management, agree on the coming week’s production. The general purpose is to achieve as optimal a solution as possible for everybody’.

‘We have had very positive experiences using the principles of Lean Construction. Involvement of the subcontractors in the planning and evaluation process through a rolling activity plan increases focus on the idea that production can be done appropriately for everybody. Involving the subcontractors in planning increases the opportunity for subcontractors to optimise their own activities.’

This document added substance to the Lean Construction issue stated in the contract. Now the Look-Ahead Plan was also introduced as part of Lean Construction, and it was also given the purpose of adding value to everybody collectively, as well as maximising individual compensation. The legal enforcement was not strengthened, but an appealing offer was made to the subcontractors through clauses that provided for the possibility of optimising their own contracts.

The workshop

A week after this document was sent out the workshop mentioned in the contract was held. There were two consultants present, along with two project managers and the subcontractor representatives, as specified in the contract. The meeting was composed of two sessions, each with their own theme. The first session was a presentation of the Last Planner System given by the consultants. The first part of the presentation consisted in an argument for maximizing production flow and decreasing variability. Following this part the structure of the LPS was specified concerning the Master Schedule, Look-Ahead-Plan and Week Plan. The Master Schedule was:

'…the general agreement between the subcontractors on how to execute the project regarding sequence and use of allocated time. The Master Schedule is to determine what *should* happen.' (Slide 4, consultancy PowerPoint)

The Look-Ahead Plan was explained as:

'…the actual production control: as a plan, it is a rolling window in the Master Schedule. The width of the window varies according to the specific project, but normally 5-8 weeks are suitable. The Look-Ahead Plan is the subcontractors' agreement about how production can take place in the forthcoming weeks, and it is the tool for controlling logistics of the construction project. The Look-Ahead Plan is to determine what *can* happen (Slide 6, consultancy PowerPoint)

‘The Look-Ahead Plan is to decide the workflow, match workload with capacity, disseminate the milestones from the Master Schedule as activities and uphold a buffer of work with sound activities.’ (Slide 8, consultancy PowerPoint)

Finally, the Week Plan was introduced as:

‘…the most detailed of the time plans. Production is to be disciplined according to this plan. The reliability of the plan is increased only by letting sound activities into the plan (activities for which there are no known obstacles). In this way production is safeguarded against uncertainties stemming from activities further back in the chain of activities.

‘The Week Plan is produced by the participants’ selection of activities that *can* be executed according to the information from the Look-Ahead Plan. The Week Plan concentrates on the most specific level of planning directly before the execution of the activity.’ (Slide 9, consultancy PowerPoint).

In addition to the aforementioned propositions about the functioning of LPS, it was proposed by the consultants that the weekly meetings were to last no more than one hour. This limit was set in order to retain subcontractors’ motivation towards LPS, partly in relation to attending meetings and partly to contribute actively in the meetings.

The second session was about designing the renovation process. Post-It notes in different colours were handed out to the participants, and each trade got its own colour. Now it was the job of each trade to write down all its activities, put them on a whiteboard and combine them with the activities of the other trades. The rationale behind this process of constructing the Master Schedule was as follows (Slide 5, consultancy PowerPoint):

‘The Master Schedule can be constructed in several ways, but what is important is that the subcontractors themselves participate actively and collectively. This is because the schedule is to function as a mutual agreement between the subcontractors regarding the construction project.

‘Using Post-It notes in different colours and possibly with different pens is a good method. During planning each subcontractor writes down his/hers activities with own colour and places the notes in the correct sequence on the whiteboard. Each individual therefore gets his/her own fingerprints on the plan, and there is a physical effect in that one has to write, place, move and draw connections.’

The workshop took place in a friendly atmosphere, and the process design was settled after a few hours. Initially it was decided that the participants were to make Post-It notes each representing a single activity, and the participants were only allowed to place and move their own post-it notes on the whiteboard (07-03-06-uge10, p. 1). After this exercise the production sequences of a bathroom were presented by one of the project managers on the basis of the post-it notes that were placed on the white board. However, there were definitely restrictions on the LPS ideal of planning towards the uninterrupted production flow: The contracts that in LPS literature are proposed to act as mere feedback mechanisms creating broad frames for input and controlling final output influenced the particular planning of input. This influence troubled the idea of planning towards the uninterrupted production flow. In the following section 3 this will be discussed thoroughly.

6.3. The feedback controls and the strategy.

In this particular input planning process that took place, the contracts were already settled, and in these contracts (e.g. bricklayer, contract) the scope of the activities that the trades were to execute were already consolidated to such a specific degree that it complicated project management’s ideal of planning towards uninterrupted construction flow:

Project manager: If anybody has forgotten anything or if anybody has comments on the chosen sequence, then just speak up.

Let us begin with the notification procedure. We are obliged to notify the user five work days before we commence doing the bathroom, before even the temporary toilet is installed. In this way they also have five work days to hand over the keys. Alright, then the first thing to do, is to cover floors in the hall and all entrance paths. In addition we are to install the temporary toilet before we even enter the bathroom. After this the plumber has written that he is to dismount. And so has the electrician. At the same instance the plumber would like to install the cistern, meaning that he has to approach the bathroom through the kitchen.

Chief Manager: Does he dismount the sheet in the kitchen himself then?

Project manager: No.

Chief Manager: Oh well, then they have forgotten to write down an activity.

Project manager: That activity is our responsibility at the moment. We have to remove the sheet in order to gain access to the ventilation duct. There is also an issue with a lamp in there, no?

Plumber: There is a fluorescent tube hanging in there. I think it was impossible to dismount the sheet before the fluorescent tube was dismounted.

Chief manager: Folks, the problem is that if seven different trades have to be involved just to get things prepared, it is overdone. I mean just to get things ready! In my perspective it is not necessary to… The smartest thing to do is to place the activities where they are the most appropriate. If it was the smartest thing that the electrician dismounted the sheet now that he was already there to dismount the fluorescent tube… I mean, could we please, put economy aside for a little while and say, if we are to do this right, how are we to do it? What is the smartest thing to do?

(07-03-06-week 10, p. 2).

It quickly became evident that the reading revealed activities that were not within the frame of the contracts but were still mandatory for the renovation process to be executed. Additionally, it became evident that the contracts played more than a mere facilitating role in discussing and understanding production flow. The contract became more than mere frames within which the other LPS controls could function and maximize production flow. In order to reduce the total lead time and thereby increase production flow, some activities had to be transferred from one trade to another. If this was not done, the production process would risk becoming subject to variation because more trades had to execute activities at the same time and place, leading to increased

coordination needs as a consequence of increased interdependency. But who was to perform the extra activities and take on that extra burden that was not included in the contract? The dilemma between compensation and production flow was in this situation solved by letting the contractual consolidated compensation become variable. In other words, extra compensation was inserted on top of the contractually agreed compensation.

The episode was followed by a number of similar situations, and they involved a reconfiguration in the functionality of contracts from their abstractly proposed function in LPS literature – whereby they were to act as mere frames to construction-process planning, and only control final output – to a situation in which they would potentially de-stabilise the construction management's idea of maximizing production flow if they were not re-negotiated. The abstractly proposed function of contracts as feedback controls merely creating appropriate frames for concurrent planning was therefore troubled in practice. The contracts had to be made ex-post planning instead of ex-ante planning in order to be in accordance with the strategy of maximizing production flow.

The above example demonstrates a reconfiguration of one of the feedback controls in the LPS proposed by Ballard. The reconfiguration takes place because information about the construction process that was not present at the time of contracting now arises as a consequence of field experience. This new information calls for additional and re-arranged activities. However, as the episode demonstrates, new information about the production process is, in itself not necessarily strong enough to change activities and sequences between activities. The contracts also condition advantages and disadvantages to the parties involved concerning activities and sequences of activities. New information is not freely to be applied in construction planning, but conditioned by factors of compensation. In the specific episode, a variable-compensation provision is added to the contracts, a solution that all parties (both management and the managed) can accept and which will maximize overall production flow. It is therefore an uncomplicated translation to the LPS as well, since the ideal is upheld, though the function of contracts as mere feedback mechanisms is changed. The episode is an example of selection and separation, where the chief manager enacts the strategy in the LPS and simultaneously overrides the control. The LPS becomes in this episode a strategy disciplining and translating the control.

As the above episode continues the strategy in the LPS is discretely further narrowed: In chapter 4, section 4 it was explained that the strategy comprises a maximization of production flow which automatically will lead to increased customer value. As the above episode continues increased customer value was, however, troubled by the behavioural effects of the contracts:

A short recapitulation of the situation: the lamp in the kitchen had to be removed because the plumber had to dismantle a sheet behind the lamp in order to access a ventilation duct. The discussion then centered on whether the electrician was to move the lamp, let the plumber do his job and then return to reinstall the lamp, or whether the plumber could dismantle the lamp himself and reinstall it himself:

Project manager: Then we will simply have to do it like this: the electrician enters and dismounts the fluorescent tube before the plumber arrives, and then he dismounts the sheet at the same time.

Painter: Doesn't that lamp have to be removed completely so it is not lying around on the kitchen table? It is somewhat dangerous to have it lying on the table. You know it is close to children and water, etc.

Chief manager: Would it be possible to hang it or attach it to something? Are there any kitchen cabinets or something?

Plumber: We can probably mount it on top of a kitchen cabinet with some screws, though it leaves behind some holes in the cabinet.

Painter: It is obvious that it has to be attached somewhere, so we cannot avoid making holes no matter what we do.

Chief manager: I would like to say, I do not think it is a legal claim that there has to be light. During the weeks we are renovating their bathrooms, people have to use a table lamp and place it on the kitchen table. We could defend it and say that we do not need light. We are allowed to switch it off and dismount it. You know, it is about creating flow.

(07-03-06, week 10, p. 3).

The participants finally agreed that the electrician would dismantle the lamp and the plumber would then dismantle the sheet to access the ventilation duct. This solution involved the elimination of an activity (the lamp's reinstallation). Customer value became equal to contractual claims, disconnecting customer value to having a secured light in the kitchen. In the contractual claims, light in the kitchen during the ongoing renovation process was not included as a condition. It was evident in the example that it might be an issue for the customer, who was equivalent to the end user here, but that possibility was left out of the solution, since it troubled the maximization of the production flow according to the chief manager. It was, in the episode, not possible to maximize customer value (having light in the kitchen during the renovation process) and maximize construction flow concomitantly. If light in the kitchen was necessary, the electrician has to return and reinstall the lamp. This would increase interdependency and demand extra resources from the electrician – resources that the electrician could use elsewhere, maximizing production flow. This was what the chief manager reflected on.

Returning to the status of the LPS, it was not a problem though, for the existence of the LPS in the project that customer value was restricted. The solution of restricting customer value was taken in order to maximize flow. Additionally, the absence of the end user at the meeting made it irrelevant for the participants to discuss whether the solution of restricting end-user interference was lean or not. The solution was unproblematic. No one objected to the restriction of customer value, since the solution was in the interest of all parties present; it was about flow.

Later on in the renovation project another episode added weight to the restriction of customer value in order to comply with flow. This episode had to do with fixtures: The end users often brought their own fixtures to the bathroom, asking the trades to fit up the bathroom with these instead of the standard fixtures proposed in the drawings. This presented problems to the trades:

Daily project manager: Alright. Then we have apartments number 9, 11, 13 and 15. How is the mounting of the toilets progressing over there?

Plumber: We have only completed numbers 9 and 11.

Daily project manager: You have completed them totally?

Plumber: Well, I have a question for number 11. This is where we are to install all kinds of strange stuff. Some stuff the customers have brought themselves.

Daily project manager: That is not something you have to do!

Plumber: No, that is something we have promised to do. I mean when they have their own holder for toilet paper and stuff, then we install it.

Daily project manager: Yes, if it is something that corresponds to the contractually chosen items.

Plumber: And they are free to decide where to place the items too. Then there is a customer who prefers a hook placed in one of the troublesome tiles. That makes drilling pretty problematic.

Bricklayer: We should say no to that. Honestly, chief!

Plumber: What do we do there? And who is to pay for the time?

Daily project manager: We do not drill in those tiles over there now.

Plumber: But Peter smashed up a tile yesterday, working in a part of the bathroom where we had actually no business to do. We were not supposed to drill there according to the drawings.

Daily project manager: No, that is correct.

Plumber: And now time passes by, because we have to go back and replace the hook. In addition, the bricklayer also has to re-enter the room and change the tile.

Daily project manager: Alright, then we well make the rule that in the rest of the terraced houses we will only install standard fixtures. There we will not install personal items since it was not part of the agreement.

Bricklayer: Yes, it is not clever to add any extra costs to it. I truly understand that.

(file 34, 2)

Clearly, the end user was again restricted. In order to comply with the contractual incentives that made time a money issue supported by a maximization of production flow, customising the bathroom with non-standard fixtures became an unattractive proposition to the trades.

The three episodes discussed above illustrate how the abstractly proposed order within the strategy and between the strategy and the feedback controls (the contracts) fall apart. This was, though, not problematic to the future existence of the LPS in the renovation project. In the first episode the enaction of the strategy by the chief manager rendered the contracts inappropriate: It was not possible to maximize flow when the contracts were settled. The contracts that were meant to be mere frames for the general construction process only controlling final output evidently influenced the planning of input. The contracts therefore became more than mere feedback controls, and they came to act against the chief manager's aspiration of maximizing flow. The contracts therefore had to be unsettled, in order to fit the flow ideal. This was obviously not a problem to the strategic enactment of the LPS since the flow ideal remained intact. The strategy of flow therefore in this episode attained a function of re-arranging the contracts.

In the second and third episodes the ordered relationship between a maximization of production flow and customer value got disordered. The solution was again unproblematic to the LPS, as customer value was pragmatically separated from the LPS. It was in the interest to everybody present at the meeting to maximize flow. Summing up, the above episodes demonstrate that the unambiguous relationship between the strategy and the feedback controls proposed by Ballard gets troubled in the particular renovation project. There are more issues at stake in practice than proposed in the LPS. This was in the particular field study, interestingly, not a problem to the existence of the LPS, since the participants enacted the LPS pretty pragmatically, selecting (parts of) the strategy and separating it from its controls.

The following two sections support the above argument that the LPS was enacted and selected as a strategy getting separated from its controls in order to comply with local circumstances. In this section, the *feedback controls* was accounted for. In the following two sections the *feedforward controls* and the *concurrent controls* will be discussed in order to thoroughly account for the selections and separations that take place between the strategy and the controls. In the forthcoming section the focus is on the *feedforward controls*.

6.4. The feedforward controls and the strategy.

Referring to the explanation of the LPS in chapter 4 - section 3, the feedforward control is the *Look-Ahead Plan* and it is to add to the contracts and the master schedule. In LPS jargon the Look-Ahead Plan secures the *can* of activities. This plan is to capture the seven prerequisites (previous work finished, space available, crew available, equipment available, materials available, drawings and information available., external circumstances) needed 4-6 weeks into the future of the construction process. The Look-Ahead Plan is therefore to prevent uncertainty stemming from these seven prerequisites not being managed systematically.

As the renovation project commenced and the weekly meetings were initiated, the proposition of the Look-Ahead Plan as controlling the *can* of activities was gradually dismissed in the weekly planning meetings. It turned out that the Look-Ahead Plan as a feedforward control was more enacted as a liability than an asset by the participants involved. As the weekly LPS meetings commenced, the Look-Ahead Plan was rarely brought to the fore by project management. This happened, though, against the recommendations from both construction management and the consultants forwarded at the third preparatory session. The recommendations were as follows:

Consultant: What we also have to try here from the beginning is to activate this Look-Ahead Plan so it becomes a natural part of the renovation project. The Look-Ahead Plan is the one where you look five to six weeks into the renovation project and agree on what will be the most appropriate things for you to do.

Chief manager: So, with this one we can discuss what we are to do in five weeks' time. Are we in control, do we have the necessary information and machinery to commence according to plan or a week earlier?

Consultant: Yes. Do we need extra materials or machinery and the like? It could also be the case that information from the architect or the engineer or whoever it might be is needed. It could also be information from the project managers concerning five-week notifications.

(3. project meeting, p.1)

This recommendation was repeated by the consultant at the first weekly meeting that was held two weeks after the third preparatory meeting:

Consultant: This is a week plan. What we have to incorporate into the week plan is the Look-Ahead Plan. We will have to do this for our next meeting. The Look-Ahead Plan is the tool we use to activate our longer time perspective. Do you remember the circle with the sound activities around it? This is where we use it. The week plan is to activate our one-week perspective and the Look-Ahead plan is to link our one-week plan with a longer-term perspective. This is where we look five to six weeks, or however far you choose, in advance into the renovation project. It is alright that you try to customise it a bit, because you might need something additional. But let us try.

(Week 13 – file no. 11, p. 2)

The following week the consultant was not present and the Look-Ahead Plan was not discussed in the meeting. A month later, when the consultant returned, she urged the participants to use the Look-Ahead Plan. There was, however, an indication that the consultant was loosening her recommendation about how to use it:

Consultant: So, what you can say about this Look-Ahead Plan is that it is obviously essential that you look at it, so you have the things you need. Now, I can see on the Look-Ahead Plan that you (daily project manager red.) mailed out to the participants…It says, door steps not delivered…You have to use it to make sure that you have the stuff you need to be able to commence your activities on the planned week. And if you haven't it is important, when you attend the meeting, to inform the collective that you are not ready because something is missing or in the way. In this manner you remain on the forefront. The Look-Ahead Plan is in any case a great tool for oneself so you have the things you need when you are to commence your activities. Because then you know when something is scheduled to begin and you know whether you have everything or something is complicating the commencement of an activity according to plan. Then there is time to get these

issues settled so the renovation process does not suffer any pauses. So, maybe this plan should be the first discussion object in your meetings. Does anybody have anything to put into the plan now? You do not have to systematically run through all the elements. However, it would be a good idea to spend five minutes asking everybody if there is something to discuss.

(Week 18 – file no. 16, p. 16)

After this meeting the consultant did not bring up the Look-Ahead Plan at the weekly meetings again, and neither did the daily project manager. Still, the Look-Ahead Plan had a physical substance in paper form at the meetings. Along with the weekly plans it was delivered either by e-mail or in person to all the participants after its consolidation at the weekly meetings. The meetings, however, were structured by the weekly plans that were projected electronically onto a whiteboard. The Look-Ahead Plan was not projected, and there were no explicit relations between this plan and the *'can'* aspect of activities. The Look-Ahead Plan was troubled because of a number of incoming propositions:

First of all, the activity illustration became a problem in the renovation project because of the range of activities that found its way into the plan. If all activities that were to be executed in the renovation project for the next five weeks had been included, the list would have become very long. As the size of the list increased, so would the time spent going through it. This would not in itself be a problem if time was not a constraining factor, but it was. Both the Week Plan and the explicitly proposed objective of keeping the duration of meetings under one hour from the consultants had to be maintained, so time was not unlimited. These considerations constituted strong arguments against the Look-Ahead Plan.

This was not the only problem faced by the Look-Ahead Plan: it was also argued that the project's modest complexity did not warrant a full-scale Look-Ahead Plan. Complexity was challenged. This made the Look-Ahead Plan an even less attractive option. How could it be efficient to use time for discussing material purchases, information, space and so on weeks in advance if the construction

process was not uncertain and variable? According to the project manager, this specific renovation project was not particularly complex:

Daily project manager: There are a number of areas where some issues cannot be predicted, but in general this renovation project consists of repetitive production processes.

(file 16, part 2)

The repetitiveness consisted in the fact that it was 200 roughly similar bathrooms that were to be renovated. Though the renovation project was not considered complex enough for the Look-Ahead Plan to be relevant, there were numerous local episodes of variability and uncertainty that potentially could have been managed through the Look-Ahead Plan. Weighty examples are change of suppliers, change of craftsmen, customisation issues as discussed earlier, errors and sick leave and that constantly introduced uncertainties and variability throughout the production process. Another factor of uncertainty was related to learning:

Due to the limited knowledge of the production process, duration times varied greatly at the beginning of the renovation project. As the renovation project progressed, the trades learned more about the duration of the specific activities, aligning planning with execution. However, alongside their learning of the duration time of the specific activities, they also learned incrementally to execute the activities faster. This issue very often acted as an additional force to throw the renovation process out of synchronisation. Some activities enjoyed more improvement than others, increasing the peer pressure on trades executing bottleneck activities to work faster. This nurtured conflicts between trades, which became apparent at the weekly meetings.

Other issues of uncertainty related to the physical differences in the bathrooms. The bathrooms were not all placed in the same type of house:

Daily project manager: What I am also uncertain about is whether we are to make two separate process plans, one for the terraced houses and one for the apartments. Or are they sufficiently similar to just make a single process plan? I know there are issues of ventilation and issues of electricity that vary.

(Week 10, 07-03-06, page 1)

They ended up making one single plan covering both the apartments and the terraced houses. The two types of houses, however, came to act as a constant factor of variability throughout the renovation project:

Interviewer: The trades discuss the tall and small buildings, what is it about the differences?

Daily project manager: The main difference is that with the small buildings the plumber has to go down into the cellar and install drains and pipes. In the tall buildings he can walk directly into the utility room, where there is much more space for installation, visibility and movement. For the bricklayer the problem is the opposite. In the tall buildings he has to walk up the stairs with tiles, bricks and cement, whereas with the small buildings he can walk right in with his wagon. These differences make the trades work constantly out of synchronisation.

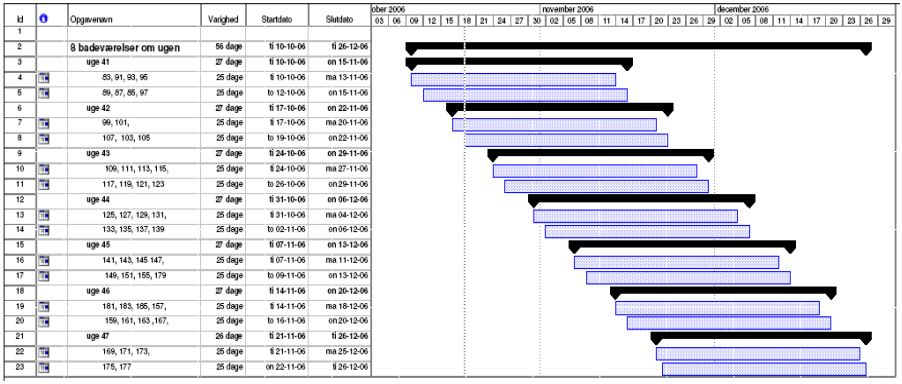
(interview, daily project manager)

All the above factors repeatedly turned up at the weekly meetings, however, the firm belief that the renovation was repetitive and predictable into the coming 4-6 weeks made the Look-Ahead Plan look inappropriate. Different issues of uncertainty and variability often arose, but they never stimulated a legitimacy of the Look-Ahead Plan. In order to make the Look-Ahead Plan easier to handle, the activities were removed from the Look Ahead Plan and replaced by the bathrooms listed by their respective apartment number. In other words, the Plan became more aggregated, in that activities were summarized into bathrooms. This made a difference to the identity the Look-Ahead Plan. First of all it made possible a complete overview of the next five weeks of production on a

single page. The overview was eased. Initially the Look Ahead Plan at least comprised 5 pages. Below is an illustration of the Look-Ahead Plan showing what it became.

= Look-Ahead Plan Description of activity			Contact: J Email: —— Phone: —— Fax: ——							Week: 28 S----------									
										Flow Analysis									
		Bathrooms	Responsible	Week 26	Week 27	Week 28	Week 29	Week 30	Week 31	**Previous wrok**	**Space**	**Crew**	**Equipment**	**Materials**	**Drawings & Informatio**	**External**	Explanation to hindrance	Responsible
		Bloc 26																
		216															Not delivered	
		214															Not delivered	
		212															Not delivered	
		210															Not delivered	
		208															Not delivered	
		Bloc 25																
		202															Not delivered	
		204															Not delivered	
		206															Not delivered	
		Bloc 23 - 6 apartments																
		200																
		198																
		196		x														
		194		x														
		Bloc 24 - 4 and 6 apartments																
		195		x	x													
		197, ground floor		x	x													
		197, 1. floor		x	x	x												
		199		x	x	x												
		201		x	x	x	x			x							Test bathroom to be remade	
		203, Ground floor		x	x	x	x			x							Test bathroom to be remade	
		203, 1. floor		x	x	x	x											
		205		x	x	x	x	x										
		207, Ground floor		x	x	x	x	x										
		207, 1. floor						x	x								4 departments	
		209						x	x								2 departments	
		211						x	x									
		213							x									
		215																

A general overview was, though, also offered by another device, the Gantt chart (illustrated below. Note: in Danish, not translatable) illustrating general project progress, which soon made the Look-Ahead Plan a weak alternative to the Gantt chart. The Gantt chart continually informed the participants about the time perspective concerning the commencement and finalisation of apartments 5-10 weeks in advance. That was not its only strength: its illustrations were also better suited than the Look-Ahead Plan for establishing a general overview of the progression in a very short time. In addition, it extended future views by months compared to the Look-Ahead Plan.



Id	Opgavenavn	Varighed	Startdato	Slutdato
1				
2	8 badeværelser om ugen	56 dage	ti 10-10-06	ti 26-12-06
3	uge 41	27 dage	ti 10-10-06	on 15-11-06
4	83, 91, 93, 95	25 dage	ti 10-10-06	ma 13-11-06
5	89, 87, 85, 97	25 dage	to 12-10-06	on 15-11-06
6	uge 42	27 dage	ti 17-10-06	on 22-11-06
7	99, 101,	25 dage	ti 17-10-06	ma 20-11-06
8	107, 103, 105	25 dage	to 19-10-06	on 22-11-06
9	uge 43	27 dage	ti 24-10-06	on 29-11-06
10	109, 111, 113, 115,	25 dage	ti 24-10-06	ma 27-11-06
11	117, 119, 121, 123	25 dage	to 26-10-06	on 29-11-06
12	uge 44	27 dage	ti 31-10-06	on 06-12-06
13	125, 127, 129, 131,	25 dage	ti 31-10-06	ma 04-12-06
14	133, 135, 137, 139	25 dage	to 02-11-06	on 06-12-06
15	uge 45	27 dage	ti 07-11-06	on 13-12-06
16	141, 143, 145 147,	25 dage	ti 07-11-06	ma 11-12-06
17	149, 151, 155, 179	25 dage	to 09-11-06	on 13-12-06
18	uge 46	27 dage	ti 14-11-06	on 20-12-06
19	181, 183, 185, 157,	25 dage	ti 14-11-06	ma 18-12-06
20	159, 161, 163 ,167,	25 dage	to 16-11-06	on 20-12-06
21	uge 47	26 dage	ti 21-11-06	ti 26-12-06
22	169, 171, 173,	25 dage	ti 21-11-06	ma 25-12-06
23	175, 177	25 dage	on 22-11-06	ti 26-12-06

Bricklayer: Why do we keep getting these Look-Ahead Plans when this chart (Gantt red.) is much better to get an overview to the next weeks?

Project manager: Well, it is alright for me if we use this instead. That is not a problem for me.

(file 16, part 2)

There is yet another issue that influenced the demise of the Look-Ahead Plan. In the project a great part of the preconditions were not unambiguously ordered by construction management or even by the subcontractors' foremen. Materials acquisition and issues of staffing up and down were not controlled by, but only influenced, by the foremen present at the weekly meetings. This meant that the forum was not in control of ordering preconditions five weeks ahead. There were a lot of actors outside this forum that played a role in this ordering.

To sum up, a variation of considerations made the Look-Ahead Plan as a feedforward control irrelevant to planning:

In order to keep the trades motivated to participate in the weekly LPS meetings, a 1-hour time limit was prescribed by the consultants, making the Look-Ahead Plan a competitor instead of a prerequisite to the Week Plan. In addition, the Look-Ahead Plan did not achieve the competence of managing complexity, since the project was not viewed as complex, although a lot of variability and uncertainty did emerge in the project. Issues of variations and uncertainty potentially to be handled by a feedforward control did not therefore automatically attach themselves to the Look-Ahead Plan. An effort to make it easier to handle, made the Look-Ahead Plan even more irrelevant, since the Gantt chart came to over perform it. In addition, a great part of the decision competences to order preconditions in the quest of securing sound activities was allocated to actors that did not participate in the meetings. These issues rendered the Look-Ahead Plan an inefficient control. In other words, the Look-Ahead Plan became a waste of precious time, a non-lean element to the participants:

Interviewer: What is happening to the Look-Ahead Plan? I haven't seen it in use at the recent meetings?

Project manager: Well, we didn't feel that it helped us in the planning. I used a lot of time to prepare it and list activities, but it wasn't really helpful. It definitely did not increase flow.

(week 24 – page 8)

The case of the Look-Ahead Plan illustrated that the feedforward control was not enacted as Lean, and eventually it had to go. This is yet another episode of selection and separation where the control was in opposition to the strategy of maximizing flow, which, thus, remained strong. It is also an example of an unproblematic selection, since neither the trades nor project management were seemingly interested in maintaining the Look-Ahead plan, but they were interested in flow. In that sense, the idea of being Lean remained strong.

Having accounted for the feedforward control and the relation to the strategy, the analysis turns to the last control (the concurrent control) in the LPS, namely the week plan. As with the other two

types of control discussed in the two preceding chapters, episodes of separation also took place with this control and the strategy.

6.5. Separating the concurrent controls and the strategy.

In this section the Week Plan, the PPC measure and the mechanism of commitment that in concert constitute the concurrent control in the LPS and their performance in the renovation project is discussed.

To recapitulate on the concurrent control (chapter 4 – section 3), this control is by LPS literature proposedly performed through the Week Plan and the PPC measure. The idea of the Week Plan coupled with the PPC is to ensure that weekly variation and uncertainty caused by the earlier mentioned seven prerequisites is systematically managed. The Week Plan serves to make the status of on-going activities visible to management, and it therefore affords ongoing regulation of work in progress. All the activities planned to be executed in the preceding week are concurrently evaluated the following week. The PPC measure is to sum up on the status of activities having been (and not having been) executed according to plan. Additionally, the commitment mechanism adds to the concurrent control mechanisms (the week plan and the PPC); based on the assumption that efficiency will increase if the tradesmen commit themselves to the project and to execute assignments, thereby decreasing that issue of uncertainty.

The section will be parted into three subsections that in concert account for the performance of the concurrent control in the LPS.

6.5.1. The Week Plan

Returning to the renovation project and the preceding section, the dismissal of the Look-Ahead Plan did in the project not lead to a dismissal of the functionalities of the LPS Week Plan. The Week Plan maintained its existence during the entire renovation project. Though it remained a central device for facilitating discussions in weekly LPS meetings throughout the entire project, the Week Plan changed in several ways from its textual proposition during the course of the renovation

project. As the project progressed, the week plan developed into a 15-page spreadsheet, each page with its own apartment/staircase number. Initially it was only a few pages, but as the number of apartments in renovation increased, so did the time required for the evaluation of progress. The time limit (1-hour maximum for each meeting), however, was still an important consideration to project management. Something therefore had to be changed about the two-part structure of the weekly meetings in order to comply with the time limit. The time-consuming element of going through the activities in all 15 pages was partly minimised by merging distinctly stated activities:

Plumber 1: Instead of splitting up the process into 700 distinct activities why don't we try to merge the activities together?

Project manager: Alright, J, then you do that. These three activities you see there just merge them together into one activity. You just go ahead and do that. That is no problem.

Plumber 1: There is no idea in using unnecessary space for that.

Project manager: Covering walking areas and placement of temporary toilets could also be boiled down to only one.

Plumber 1: If you are to finish it, I have a suggestion, but I don't know if it is ours. Oh yes, it says 'plumber'. The two activities 'mounting of fixtures' and 'mounting of sanitation'.

Project manager: That can also be merged together.

Plumber 1: That is only one suggestion.

Daily project manager: Yes, and H. now you will have to correct me. Jointing of walls and floor tiles can also be boiled down to one activity, so that you joint it all at once.

Bricklayer: Yes we joint it all at the same time.

Electrician: I also have one. 'Dismounting of sheet in the kitchen' can be merged with 'dismounting of sheet and lamp in the kitchen'.

Daily manager: Yes, that is easier.

Demolition foreman: Maybe we could also merge 'removal of wallpaper' and 'demolition of concrete floor'.

Project manager: If there is anybody else, then please contribute! The same with Rengo… (The merging of activities continues).

(Week 13 – file 11, p. 19)

Thus, merging activities reduced the specificity of information transferred to project management. If variation in activities arose, it became more difficult to trace the causes of variation since 'single activities' became reconfigured to 'bundles of activities'. Though the information on the spreadsheets was reduced with the above solution, it was still very time-consuming to go through the spreadsheets.

Project manager: We will have to do something about this process. It takes too much time to run through the spreadsheets, when we first have to go through last week's performance and thereafter plan for the next week.

Plumber: I agree. And we are not interested in sitting here with our hands in our pockets.

(Week 19 – page 1)

These two separate parts – the evaluation of last week's performance and planning for the coming week's performance – were therefore integrated. This solution had consequences for the performance of the weekly meeting. One of the original two separate parts had to be released from some of its duties in order for the meeting to be concluded within the one-hour limit. This issue was not problematic for the trades; in fact, it seemed convenient. Integrating the evaluation of the past weekly assignments with the seven flows proved awkward. The assignments that were not executed were seldom discussed in a root-cause perspective. Instead, the discussion of causes of non-executed assignments was to a great extent overtaken by a discussion of when in the near future they could be executed. In other words, the evaluation of the past was transformed into planning for the future:

Daily project manager: Yes, apartment number 210. Is 'mounting of sanitation' executed?

Plumber: It is executed.

Daily project manager: And electricity?

Electrician: Finished.

Daily project manager: What about the switchboards?

Electrician: We will do them today!

Daily project manager: And apartment number 208, wall tiles?

Bricklayer: He is finished.

Daily project manager: And fixtures?

Plumber: We will finish that today.

Daily project manager: And then what do we have? We have the electrician.

Electrician: Well, there are three apartments that we haven't yet completed. We will finish them tomorrow.

Daily project manager: And the switchboards?

Electrician: We haven't mounted those. That will have to wait until next week.

Daily project manager: Will you take them Monday then?

Electrician: If it is notified, then yes.

Daily project manager: Can it be Monday then?

Electrician: Yes, then we will be finished on Tuesday.

(file 45, page 2)

The example demonstrated that any kind of root-cause discussion was taken out of the concurrent control process, speeding up the process of running through the apartments, and at the same time aborting any potential discussion of elements potentially troubling the production process. Accordingly, the original second part about settling and committing to assignments for the coming week became the overarching part of the meeting. The LPS propositions about the evaluation part were to a great extent disconnected from the weekly LPS meeting, and evaluation drifted partly into

facilitating agreements on the future. The limit on time set by management in order to preserve motivation to participate in meetings restricted the potential for evaluation:

Project manager: It is an important element in the LPS to keep the foremen motivated, just as the consultant said. This is partly done by using no more than 1 hour at the meetings.

(Interview project manager)

Concerning the making of agreements for future execution the consultant supported the abstract propositions in the LPS. According to the abstract propositions the procedure for project managers is to *ask* the trades instead of *dictating* to the trades what assignments to be executed in the coming week. This will according to the propositions increase the likelihood of compliance. In the following episode, the planning procedure was taking place for the subsequent week:

Project manager: Moulding. You mould in those apartments today and tomorrow!

Bricklayer: Yes.

Consultant: Then the tactic is to say: "When can you mould?" Then it is not you as a project manager who sits there and dictates the days for execution.

Project manager: Yes, alright.

Consultant: Because if you don't do it like that then in two days, when he returns, and he has not done what you dictated, you will get the response that it was your idea, not his.

Project manager: Ok yes, we will have to think differently than we usually do.

Consultant: Yes, exactly. Then it is not you who gets torn apart.

Project manager: How many days do you use for moulding?

Bricklayer: Well, now we will have to get some experience with it. Hopefully it can run more smoothly in the future than it has done up until now. It has not been running very well up until now, I don't think so. But…I can say…two rooms, or three rooms will be done today.

Project manager: Meaning? When are you finished moulding the four bathrooms?

Bricklayer: Tomorrow.

Project manager: Did I ask you correctly?

Bricklayer: Yes.

(Week 13 –file no. 11, p.8)

The method of asking instead of dictating was perfectly in line with the LPS propositions. Though this method generally secured a stronger commitment to the activities planned and a friendly atmosphere at the following meetings, the method was taken out of use occasionally. The method of asking occasionally appeared too risky for project management to use. Concerns about a 5-week maximum lead time for the completion of each bathroom made the method of asking insufficient in specific situations:

Daily project manager: We are running very tight at the moment.

Electrician: That is not very good.

Daily project manager: No, exactly. That is not very good. Well, then we have these following apartment numbers 73, 75, 77 and 79.

Plumber: The bricklayer has promised us that we will get them all at once in a couple of days.

Electrician: So we will.

Daily project manager: It will already be tomorrow!

Plumber: But we do not want them tomorrow, we have other things to do.

Daily project manager: Well, you *will* get them tomorrow. And on Tuesday you pass them on to the next trade.

Plumber: Well, we will not go in. We do not have time for it.

Daily project manager: You will have an extra man on the job tomorrow.

Plumber: Do they really need to be finished on Tuesday?

Daily project manager: Yes, they have to be finished on Tuesday.

Electrician: Think about the bricklayers. They cannot deliver those four apartments that soon.

Daily project manager: No, but…

Plumber: No, it is pretty inappropriate that we only get two days for four apartments.

Daily project manager: I agree, but that is our situation.

(file 44, p. 4)

The 5-week maximum duration time and a fine that would follow from not adhering to this proposition therefore put a limit to the LPS aspiration of asking instead of dictating. The contract that the main contractor, who was represented by the project managers, had made with the building owner stated that if the renovation of any bathroom exceeded 5 weeks, the main contractor would have to pay a fine to the building owner for the delay. The 5-week maximum lead time for completing the bathrooms was, though, not a significant priority for the trades. They were not financially penalized for going over the 5-week lead time. The trades prioritised their activities according to where to execute the most in the least possible time, which was not always in line with project management's objectives.

Summing up, the LPS proposition about the evaluation part was to a great extent disconnected from the weekly LPS meeting and evaluation changed partly into facilitating agreements on the future. The limit on time set by management in order to preserve motivation to participate in meetings restricted evaluation. Though part of the concurrent control tool was therefore dismissed, this happened, so to say, in the name of the LPS aspirations. The notion of motivation was an additional strategic device introduced by the consultants to strengthen the LPS, and this was used as an argument to restrict the evaluation part of the concurrent control. This selection and separation was therefore again unproblematic to the LPS as a strategy.

Additionally, the above illustrated that the method of asking was often dispensed with in order to finish up the renovation of particular bathrooms; a controversy between the strategy of maximizing flow and the notion of letting the trades do the planning in order to strengthen the week plan as an effective concurrent control. In this relation, there was another separation between the two aspirations, where enactments and selection of the strategy came to discipline and dismiss the control.

The downplay of the evaluation part obviously had consequences for the enactment of the PPC measure as a supportive element in the concurrent control. This is elaborated upon in the following part.

6.5.2. The PPC

It is specific kinds of failures that are proposed in the Last Planner System to perform the evaluation part of the weekly planning meeting. Activities that are not executed according to plan on the day of the meeting are failures, reflected in the measure of PPC. According to Ballard (2000) the PPC measure is to act as an additional feedback control to the concurrent control that compares performance across weeks. It serves to illustrate whether the executing parties are improving or not improving their ability to manage variation and uncertainty across weeks; if variation and uncertainty is badly managed then delays in execution of assignments are expected.

The PPC, however, in the renovation project turned out to pose an antidote to enactions of flow. According to the propositions in the Last Planner System, the PPC was to control identifications and discussions on failures and non-failures. In practice, a number of competing elements did though interfere with the PPC in representing discussions of failures: Drawings, classifications of quality, defects and contracts also played their roles in distinguishing between failures and non-failures. The following definition of defects was derived from the contract between the main

contractor and the subcontractors and it came to compete with failures (as defined by the PPC) for attention:

‘Defects that are ascertained at the inspection round, and that can be related to activities included in this contract, are to be fixed as part of the contract. The defects are to be pointed out by construction management within 2 weeks after the handover’ (bricklayer contract)

The definition of failures to be addressed in the weekly meetings was therefore embellished with elements from the contract. At the same time, the detection of defects was made a management issue. The detection was informed partly by the contractual specification of activities and partly by the documents comprising the technical calculations and standards referred to in the contract:

‘The bricklayer team is obliged to execute the bricklayer activities according to current description of 13.06.2006 and correctional letter 1 - 2 – 3, drawings according to drawings list of 13.06.2006 and the civil engineer drawing of 22.03.2006.’

Below is an example of the defect list:

‘Going over the apartments with the building owner the following is noted:

Generally:

Painter – Passage between tiles and other walls is to be sealed with joint

Electrian – Clean-up after installation of switch boards.

Apt. No. 212 – 1

Plumber - Shower rod loose

Apt. No. 214

Plumber – Creak to be mounted near mirror

Electrician – Cable tray to be closed

Bricklayer – Broken tiles to be changed

Plumber – Toilet raised

Bricklayer – Tile to be changed, red mark

Bricklayer - Repair of wall after electrician

Painter – Repair of wall in the hall

Apt. No. 216

Painter – Close hole in the ceiling, repair next to the door

Bricklayer – Change tiles, reed mark.

As you can see I have made it easy for you and I have accorded the defects to the respective trades. Please repair the above mentioned and report back when completed, so we can finish block 26.

Kind regards, J'

The PPC did not perform the quality standards of the contracts, and therefore the add-on concerning defects was inserted. The PPC in the Last Planner System did not possess any defect-tracking and rectification procedure related to failures in conformance to letters and drawings. The type of failure that could be tracked by using the seven preconditions as a control tool would only detect activities not executed according to the week plan. Accordingly, the contracts and drawings added to the notion of failures handled by the PPC. Drawings and contracts were performed by an inspection round carried through by the building owner, the project manager and a defect list. As the bathrooms were completed, the building owner and the project manager examined each of them and noted defects according to drawings, classifications and contracts.

However, as the defect list added to the PPC proposition of failures, it concomitantly replaced the urgency of using the seven preconditions to evaluate assignments and instigate root-cause analyses. Additionally, it was not clear what the effects would be to whom and how if the PPC score was low. Financially, neither project management nor the trades would be directly punished by a low PPC score but they would be punished by defects according to the contractual agreements, since this would potentially lead to contractual compensation to the building owner. The defect list therefore took away the urgency of the PPC.

The PPC measure was finally removed completely from the LPS in the construction project, as it did not bring any visible consequences to the participants. Instead, it achieved a status of being irrelevant. It didn't, though, have any detrimental effect to the enactment of LPS as a strategy:

Interviewer: Why haven't you used the PPC measure at the recent meetings?

Project manager: It is because there is no need. We have the defect list to assure things are done.

Interviewer: But don't you think it is relevant?

Project manager: It is difficult to see how it would help. The foremen really don't care, and see it as waste of time. If it is a waste of time, I do not see as very Lean.

(daily project manager interview)

The case with the PPC again witnesses of a situation where a control in the LPS is in opposition to the enactment of the strategy in Lean. In the following and last part of this section the focus turns to the mechanism of commitment, which similarly faced incongruencies with enactments of the strategy in the renovation project.

6.5.3. Commitment

Referring to chapter 4 – section 3 the mechanism of commitment is to ensure that the trades exercise their rights to participate in planning in a way that contributes to the overall objective of maximizing construction flow. The function of commitment is based on the assumption that efficiency will increase if the tradesmen commit themselves to the project and to execute assignments, thereby decreasing that issue of uncertainty. When they 'commit themselves to the project' they are to identify with and accept the project goals and values, and they are to be willing to exert considerable effort on behalf of the project.

In the renovation project the trades at each weekly meeting made a lot of commitments to execute activities. Activities that were committed to were checked at the weekly meetings. As the following week progressed, there were, however, activities that were executed even though they were not checked as activities to be executed at the weekly meetings. These 'unchecked' activities were executed because the trades had succeeded in executing checked activities faster than they had projected at the weekly meetings. However, time was still money for the trades, and idleness was never an option for them. They therefore proceeded with executing activities that were not planned. No rule of committing to refrain from executing unchecked activities was established, and this occasionally lead to conflicts between the trades. The conflicts arose because the faster trades put pressure on the linked trades to speed up or change their planned activities:

Daily project manager: I will need to ask the bricklayer if he does two or three bathrooms. If he does nine bathrooms a week and he only projects eight at our weekly meetings then things do not fit together.

Electrician: No, because he will take nine a week if he takes three at a time. It is the same issue concerning under-floor heating and isolation. According to the plan I am supposed to be two apartments ahead of him, but I never am. As soon as I have done these activities, he enters immediately to continue isolation, and then he urges me to complete the electrical installation in the floors, so he can begin moulding the floors right away. This continually destroys my flow.

(no. 41, p.8)

And further:

Electrician: And I do know very well that the bricklayer promises to you and me at these meetings to do only two a day. Then when it comes to practice he is right behind my arse, and calls me all sorts of things because I do not do what he tells me to, because it differs from our collectively agreed-upon plan. I really can't be as flexible as he demands of me.

(no. 41, p. 9)

This particular conflict was due to the fact that a day's work fitted with moulding three bathrooms, and moulding three bathrooms would obviously yield higher compensation than moulding two bathrooms. The contractual form made idleness an unattractive option for the trades. However, executing activities that were not committed to was very welcome, as long as it did not create any trouble for the linked trades:

Daily project manager: And did you paint in that apartment, painter?

Painter: Yes.

Daily project manager: Alright, you have been ahead of planned time there I see.

Painter: Yes, we are actually finished all the way to number 101.

Daily project manager: Wow, now I will have to catch up here in the planning…

Electrician: Is it going too fast for you?! Hehe…

(no. 43, p. 5)

Referring to the above two episodes, the mechanism of commitment to maintain compliance was not really enacted in the renovation project. This omission at certain instances led to conflicts between the trades as the unplanned executions interfered with personal schedules and priorities. At other instances, though, it led to recognition between the trades and project management in the collective evaluation and planning process when the execution was not a problem to the other trades. The two episodes demonstrate that project management prioritised the trades over the plans, separating the mechanism of commitment from its potential of being a concurrent control. This prioritization, though, took place according to enacted strategies of flow. The first episode illustrated the electrician's enactment of the notion of flow. This notion was often used in these situations by both the trades and project management, and demonstrated that the LPS was also in these situations strong as a strategy, though in a somewhat pragmatic perspective.

Summing up on the concurrent control tools; elements in the Week Plan, the supporting PPC measure and the mechanism of commitment did to a great extent get separated from the renovation project. Strategic elements of the LPS did though continually get enacted by the participants:

- Concerning the *Week Plan* the evaluation part was to a great extent disconnected from the weekly LPS meeting and evaluation changed partly into facilitating agreements on the future. The limit on time set by management in order to preserve motivation to participate in meetings restricted evaluation. Though part of the concurrent control tool was therefore dismissed, this happened in the name of the strategic LPS aspirations. Additionally, the method of asking was often dispensed with in order to finish up the renovation of particular bathrooms.

- Concerning the *PPC* measure it was removed completely from the LPS in the construction project, as it did not bring any visible consequences to the participants. Instead, it achieved a status of being irrelevant.

- Concerning the mechanism of *commitment* project management prioritised the trades over the plans, separating the mechanism of commitment from its potential of being a concurrent control.

All of the above separations of concurrent controls from the renovation project took, interestingly, place according to enacted strategies of flow. The strategy in the LPS therefore remained strong, in spite of, or maybe even because of these separations.

The above episodes support the findings in the two previous sections on the feedback controls and the feedforward controls that similarly to a great extent get separated from the renovation project, while the strategy remains strong. In the following section this point is elaborated upon and the first part of the analysis is concluded.

6.6. Conclusion, analysis part I

In this first part of the analysis, it was illustrated how selections were made between strategy and controls. The LPS was separated from its controls while it simultaneously remained strong as a strategy in episodes of planning and evaluation. In literature the strategy and the controls are in line with each other, meaning that the practical use of the controls will fulfill the strategy. The findings in this thesis have, however, illustrated, that this proposition did not hold strong in this particular renovation project. As the LPS got integrated with construction practice, incongruencies arose between construction practice and the controls. These incongruencies were, however, unproblematic to the continual existence of the LPS and the idea of Lean in the renovation project. This was due to the fact that the ideal of working according to the Lean perspective of flow remained salient and strong. The two-sided structure, it is argued, therefore afforded its continual existence as a planning and evaluation mechanism, though in a merely strategic form.

The main focus in the first part of the analysis was to dig into the specifics of the LPS strategy and the LPS controls in episodes of planning and evaluation. In this relation it was the aim to examine their enactments. Referring to the introductory chapter on the LPS the abstractly proposed strategy concerns maximizing production flow and three types of controls in the LPS are:

- *The contracts* and *the master schedule* perform the general feedback mechanisms
- *The Look-Ahead plan* and its explicit focus on controlling the *seven prerequisites* constitutes the feedforward mechanism
- *The week plan* and the *PPC measure* constitute the concurrent control mechanism. The notion of commitment strengthens the performance of this concurrent control mechanism

The findings from the analysis part I have, however, illustrated that the controls were to a great extent separated from construction practice, while the strategy remained strong in episodes of planning and evaluation:

6.6.1. The feedback controls

The three episodes discussed in chapter 6 – section 3 illustrated that the unambiguous relationship between the strategy and the feedback controls proposed by Ballard was troubled in the particular renovation project. There were more issues at stake than proposed in the LPS. This was, interestingly, not a problem to the existence of the LPS as a strategy, since the participants enacted the LPS pretty pragmatically, selecting (parts of) the strategy and separating it from the feedback controls:

In the first episode the enaction of the strategy by the chief manager rendered the contracts inappropriate: It was not possible to maximize flow when the contracts were settled. The contracts that were meant to be mere frames for the general construction process only controlling final output evidently influenced the planning of input. The contracts therefore became more than mere feedback controls, and they came to act against the chief manager's aspiration of maximizing flow. The contracts therefore had to be unsettled, in order to fit the flow ideal. This was obviously not a

problem to the LPS since the flow ideal was intact. The strategy of flow therefore in this episode attained a function of re-arranging the contracts.

In the second and third episode the relationship between a maximization of production flow and customer value got disordered. The solution was again unproblematic to the LPS existence, as customer value was pragmatically separated from the LPS. It was in the interest to everybody present at the meeting to maximize flow, and at the same time identifying with the LPS.

6.6.2. The feedforward controls

The case of the Look-Ahead Plan in chapter 6 - section 4 illustrated that the feedforward control was not enacted as Lean in the renovation project, and eventually it was dismissed. This is similar to the episodes concerning the feedback controls: A dismissal took place as the control did not attain support in construction practice. The strategy of maximizing flow, though, remained strong:

In order to keep the trades motivated to participate in the weekly LPS meetings, a 1-hour time limit was prescribed, and that made the Look-Ahead Plan a competitor instead of a prerequisite to the Week Plan. In addition, the Look-Ahead Plan did not achieve the competence of managing complexity, since the project was not viewed as complex, although a lot of variability and uncertainty emerged in the project. Issues of variations and uncertainty potentially to be handled by a feedforward control did not therefore automatically attach themselves to the Look-Ahead Plan. An effort to make it easier to handle, made the Look-Ahead Plan even more irrelevant, since the Gantt chart came to over perform it. In addition, a great part of the decision competences to order preconditions in the quest of securing sound activities was allocated to actors that did not participate in the meetings. These issues rendered the Look-Ahead Plan an inefficient control. The Look-Ahead Plan became a waste of precious time, a non-lean element to the participants. The case was, however, also an example of an unproblematic separation of the control from LPS since neither the trades nor project management were seemingly interested in maintaining the Look-Ahead plan, but they remained interested in flow. In that sense, the idea of being Lean remained strong as a strategy.

6.6.3. The concurrent controls

The findings concerning the concurrent controls support the two previous sections on the feedback controls and the feedforward controls in that the concurrent controls to a great extent got separated from the renovation project, while the strategy remained strong:

Concerning the *Week Plan* the evaluation part was to a great extent disconnected from the weekly LPS meeting and evaluation changed partly into facilitating agreements on the future. The limit on time set by management in order to preserve motivation to participate in meetings restricted evaluation. Though part of the concurrent control tool was therefore dismissed, this happened in the name of the strategic LPS aspirations. Additionally, the method of asking was often dispensed with in order to finish up the renovation of particular bathrooms. Concerning the *PPC* measure it was removed completely from the LPS in the construction project, as it did not bring any visible consequences to the participants. Instead, it achieved a status of being irrelevant. Concerning the mechanism of *commitment* project management prioritised the trades over the plans, separating the mechanism of commitment from its potential of being a concurrent control.

All of the above separations of concurrent controls from the renovation project took place according to enacted strategies of flow. The strategy in the LPS therefore remained strong, in spite of, or maybe even because of these separations. This proposition will be elaborated upon later.

The magnitude of selections and separations that took place, do however state a question of whether the LPS actually remained in the renovation project as a planning and evaluation device or it was dismissed. After all, the three controls were rather drastically reconfigured in the project. This question is rather difficult to answer unambiguously. Referring to de Laet & Mol (2000) a fluid object is characterized by its non-essentialism. There must, though, still be some kind of rigidity/stability left in the object in order for it to stay an object. One might then ask the question of

when it ceases to be an object? As the second part of the analysis gets concluded, this discussion is continued, after its fluidity has been fully accounted for.

Another crucial question that brings itself to the fore is the *how* of the enactment of the strategy. It is obvious that the strategy of *maximizing production flow* is rather fuzzy and could be enacted in many ways. So how to interpret this? Does this mean that the strategy has not been present all? It definitely has, though in a very plastic form affording interpretive viability. If the account had merely discussed the reconfigurations of the controls would not tell the whole story of the diffusion capability of the LPS. The strategy definitely was performed. In most of the episodes there were explicitly issues of *Lean* and *flow* visibly present. The words were used intentionally to argue for inappropriateness of certain LPS controls and vice versa.

In the upcoming part II of the analysis, the account in part I of what makes the LPS durable in the renovation project is added to. Part II addresses the identities that the LPS takes on additionally to the one of being concerned planning and evaluation. Part II serves to complete the account in this thesis of the reconfigurations take place in and around the LPS as it achieves durability. Part II therefore adds to the diffusion abilities in the LPS already addressed in part I.

Chapter 7- Analysis, part II: Additions of identities to the LPS

Referring to the preceding chapter, part I of the analysis accounted for the selections and separations of the strategy from the controls in the LPS concerning planning and evaluation that took place in the renovation project studied. It was argued that these episodes of selection and separation made possible because of the two-sided structure in the LPS contributed to the LPS in becoming a durable object in the renovation project. Though the LPS stayed concerned with planning and evaluation, thus as a strategy rather than as a bundle of controls, a number of identities were at the same time added to the MCS. In this part II of the analysis the identities that were added to the LPS in the renovation project are accounted for. Chapter 7 is divided into 6 sections. **Section 1** accounts thoroughly for the structure of the analysis and **sections 2-5** account for the multiple identities that the LPS takes on increasing its durability in the renovation project. **Section 6** concludes on the second part of the analysis.

7.1. Structure of analysis part II

In this thesis, it is proposed that the additional identities, discussed in the following four sections, performed durability of the LPS in the renovation project. At the same time they also locally and temporarily re-defined what was essential to the functioning of the technology. In part I it was argued that the LPS remained present and strong not because it performed as proposed in literature, but because it was separated from some of its controls while the strategy remained strong. In the following sections it is argued that the additional identities that were thrown into the LPS in the renovation project strengthened its durability across different spaces and times. In the following sections the four additional identities that were thrown into the LPS are discussed. These additional identities were:

- A forum for claims of rigidity

- Performer of skilled management

- Facilitator of a harmonic relationship between project managers and consultants

- A branding device for the main contractor

In the following part each of these identities are discussed separately, ending up with a summarising account of the status and the consequences for the LPS in the renovation project. In section 2 it is argued that the function of the weekly LPS meetings as performing planning and evaluation was added an identity, named *a forum for claims of rigidity*. It is argued that this identity strengthened the relevance of the LPS meetings to the participants in the project. The identity is concerned the battles that took place among the trades, and between project management and the trades concerning *who* were to control the planning process and how.

7.2. A forum for claims of rigidity

The planning process concerned which activities to execute in the subsequent week, is according to the LPS proposals to be based on soundness. This means that the activities that are sound according to the seven LPS prerequisites are to be planned and executed. In the construction project, the planning process though assumed a different identity, and the planning process became more of a forum of claiming rigidity than planning for sound activities. When proposals of which activities to execute in the following week were brought to the fore, they were seldom brought forward on the basis of the LPS propositions of soundness. Quite on the contrary they were brought to the fore on the basis of personal preferences. There were always multiple activities per trade on hand ready to be executed, and this situation had made the foremen prioritise activities that were most attractive to their own contracts. This often led to conflicts between the trades making the control of the production process difficult for the project managers:

Bricklayer: It is very important that as soon as the plumber has finished his activity you wire the rooms immediately thereafter.

Electrician: Well, I may not always do that.

Bricklayer: It is very important.

Electrician: But I cannot always promise that. Not if I am in the middle of installing a switchboard, for example.

Bricklayer: But why are we sitting here then?

Electrician: I don't know, but I can't jump from there if I am in the middle of a switchboard.

Daily project manager: Come on, it is a complete waste of time to have these meetings, if.…

Electrian: Yes, yes, but it is not of any help when he is right behind me continually asking when he can take over. Then I would have to stand there wasting time waiting for him, when I instead could have installed a switchboard.

Daily project manager: No, you are not supposed to stand idle.

Electrician: No, that is what I mean. That is why I jump between activities all the time. I am not starting something up, in order to leave later because something is differently prioritised by others.

(file 34, p. 9)

The example demonstrated that the foremen prioritised according to calculations of time and resources and not by calculations of soundness. This method of prioritising became a battle of claiming rigidity. The trade that could bring the most powerful argument to the table concerning which activities to execute and when would achieve the most favourable position. A trade could optimize its own resources by arguing that the other trades' activities had to be arranged flexibly in order to ease the execution of the trades own activities. Consequently claiming rigidity brought advantages. The trades who demonstrated the most powerful arguments that specifically *their* assignments had to order the hows and whens of the execution of the other trades' assignments, could control the planning process without giving up priorities. The above excerpt demonstrated this point, and the point is further illustrated below:

Daily project manager: Then we have the apartment numbers 91, 93, 95, right?

Bricklayer: Those are ready to mount at 9/11.

Daily project manager: When is that?

Bricklayer: But that is today, isn't it?

Daily project manager: Damn, yes it is. When do you take over then, plumber?

Plumber: We have taken up to number 89.

Bricklayer: It is more important that we can progress, so that we do not sit here and promise too much of anything else. If we can postpone mounting activities, you know J. (daily project manager red.), that would be better.

Electrician: No!

Bricklayer: Will you please read this note!

Electrician: Eight bathrooms a week – that is our agreement!

Daily project manager: Yes, we cannot do it like that, H. (bricklayer red.)…

Bricklayer: But we really have to work fast, everybody.

Daily project manager: Yes, we definitely do.

Bricklayer: What I mean is, if I can say something, can I?

Daily project manager: Yes, of course.

Bricklayer: Yes, we are sitting here planning stuff, and then I have noticed something, and correct me if I am wrong. When we mount, we are doing this and that, but it should not obstruct me in the repair I am doing afterwards. That is what we are to optimise somehow, right?

Daily project manager: Right.

Bricklayer: Well, that was all I was trying to say.

Daily project manager: Yes, but isn't it how we agreed from the beginning how to do it. That two rooms were to be ready for the electrician and the plumber?

Bricklayer: Alright.

Daily project manager: But what is the situation at the moment?

Electrician: Well, I have two today.

Bricklayer: Can I add to this…

Daily project manager: We have to close it down now, before we start something new.

Bricklayer: Ok, I understand, otherwise it gets too confusing.

(file 41, p. 3)

In the above example, the battle for rigidity between the two trades ended to the advantage of the electrician. Episodes of claiming rigidity repeatedly returned throughout the weekly meetings that were held during the renovation project. Rigidity, the antithesis of flexibility proposed in the LPS, therefore came to dominate the planning process.

This novel feature of the weekly meeting (claiming rigidity) was an addition to its functionality of planning and control. The trades knew that they had to be present at the meetings in order to be able to claim rigidity, making presence at the meetings mandatory:

Interviewer: But do you actually think these weekly meetings are important?

Electrician: Yes, definitely.

Interviewer: Why?

Electrician: Well, it would be easy to continue one's work without attending the meetings, this we have done in so many other projects. The problem about staying away from these meetings is that you will get passed over.

Interviewer: What do you mean?

Electrician: I mean that things get planned over your head. This damages your own flow.

(Electrician interview)

This identity strengthened the weekly LPS meetings as a recurring event in the renovation project. Claims of rigidity made the LPS meetings almost mandatory to the participants. The identity of the LPS meetings to be a forum for claims of rigidity is argued to be an additional identity, since it is not discussed in literature as related to the LPS. It did, though form part of what the LPS meetings

became in the construction project, and it strengthened the relevance of the LPS meetings to the participants in general. The addition of this identity affords a discussion of the fluid essence of the LPS. Only the mere existence of the weekly LPS meetings, a fractional part of the control system, was conditional for this identity to be played out. In the next sections, the argument that additional identities strengthened the existence of the LPS at the construction project will be supported by the illustration of three additional identities. Whereas the mere existence of LPS meetings became the essence of LPS in episodes a claiming rigidity, other elements in the LPS constituted additional identities in the LPS. Among these was the Look-Ahead Plan that came to represent skilled management. This is discussed in the following section.

7.3. Performer of skilled management

It has already been discussed in the first part of the analysis that the Look-Ahead Plan got removed from the construction project, since it did not manage to interest project management and the trades. It did though remain present as a physical device in for the first three months of the construction project, and in this period it served a purpose. This purpose was, however, different to that of being about planning and evaluation. The consultancy company played a significant role to the Look-Ahead Plan's existence in the renovation project for the three months it was there.

At the LPS meetings, the project managers were very often confronted by Lean Construction consultants who took part in the weekly meetings, especially in the initial part of the construction project. Copies of the Look-Ahead Plan and Week Plan were frequently sent to the consultants in order for them to stay informed about the progress of the renovation project. It was therefore necessary for the project managers to update the Look-Ahead Plans in order to continually demonstrate their skills in using the LPS to the consultants. If the project managers did not use the Look-Ahead Plan according to the consultants' propositions, they were reminded of it:

Consultant: …But it is also important that you have this Look-Ahead Plan covering the upcoming 6-8 weeks. Today you cheerfully jump over the Look-Ahead Plan. You have to put an X against the bricklayer's activity. Here you find an obstacle to flow, called insufficient crew.

Daily project manager: Yes, but… do we all agree on this? Anybody disagree? Ok, we continue with apartment number 198.

Consultant: Yes, there you definitely have a crew problem, right. And then in the explanation, you write down who is responsible for the situation as it is.

Painter: But he (daily project manager red.) does not like this.

Consultant: Maybe not, but he will have to. But today is the last time I will be present at the meeting for a while…. I will return later but…

Painter: To see if he keeps his promises.

Consultant: Yes, I would really like you to use his plan for a start too, J. (daily project manager red.)

Daily project manager: Yes

Consultant: I know it will be good for you. Because then you can see, for example, that the plumber has some trouble with delivery of materials. Then you can take some activities, and move them from one week to another. The plan makes it possible for you to manage issues of flow before they really arise.

(file 19, p. 13)

The mere physical presence of the consultants in the early stages of the renovation project ensured the continued existence of the Look-Ahead plan, and the consultants additionally inquired into the PPC measure:

Consultant: So J., can you manage it?

Daily project manager: Yes, I think we are doing very well with the Weekly plan…. In the beginning we went through each staircase separately, to evaluate. This took an eternity. Now, I have decided to start by planning for the coming week immediately. In this process I will at the same time check if they have executed the activities according to the plan we made last week. What I haven't got going yet is the PPC.

Consultant: It is important that the plans are functional for the teams involved. It is not so important whether you do it one way or the other. But it is important that you activate the PPC procedure.

Daily project manager: Ok, I will try to.

(file 32, p. 18)

The conversations between consultants and project managers surfaced situations in which the project managers did not have any interest in maintaining the Look-Ahead Plan with regard to managing the actual production but they stayed faithful, at least for a while, to the consultant's recommendations about maintaining the Look-Ahead Plan and the PPC even though it was not integrated into the planning and evaluation process. The lack of interest in maintaining the Look-Ahead Plan and the PPC was confirmed in a follow-up interview:

Interviewer: Why haven't you really activated the Look-Ahead Plan and the PPC yet?

Daily project manager: Well, I have had a couple of other things to take care of in the last couple of weeks.

Interviewer: But do you believe it is necessary to use them?

Daily project manager: It might be, but I am not so sure they can be used right now. I can't see what difference they make to the renovation process.

(daily project manager interview)

It is clear that the Look-Ahead Plan and the PPC was not integrated with the planning and control of the renovation process. This point has already been discussed in the first part of the analysis. The Look-Ahead Plan though was continuously sent out to the trades (and the consultant) each week for several months. This can be viewed as a demonstration of project management's lean management skills towards the consultants. In other words, to demonstrate these skills, the Look-Ahead Plan had to exist. This is supported by the concluding comment on the Look-Ahead Plan by the project manager:

Project manager: I am still responsible for running the LPS, so I keep updating the Look-Ahead-Plan.

(daily project manager interview)

The Look-Ahead Plan therefore remained present for a considerable period of time in the renovation project. Returning to the discussion of essences related to identity, it can be argued that specifically the Look-Ahead plan became essential in order for the project managers to demonstrate management skills and claim responsibility. This idea of what was critical to the existence of the LPS therefore differs from what was discussed in the previous section, where the mere existence of the LPS meetings was argued to be essential in order for the LPS to represent a forum for claiming rigidity. Furthermore these two identities differ from the identity discussed in the analysis, part I, where it was argued that the mere strategy and the ability of the LPS to be separated from its controls was essential for the LPS to maintain an identity of being about planning and control.

In the following section, it is illustrated that the Look-Ahead Plan's identity of performing skilled management was reconfigured as the relationship between the consultants and the project managers matured. This finding underlines the temporality and multiplicity of essences in the LPS making it a fluid object.

7.4. A facilitator of a harmonic relationship between project managers and consultants

Referring to the issue in the previous section the consultants' advice and recommendations about how to use the LPS was softened as the renovation project grew older. The consultant realized that evaluating the past week's performance and ascribing it to the PPC measure was perceived as too heavy and time-consuming by the project manager:

Daily project manager: There are some things about the LPS that I think have been very good, and some things I believe should be done in a different manner. It might be that I have misunderstood it

though. I just think that when we have ten ongoing staircases, it is really time-consuming and demanding. It was very confusing to first do the evaluation and then start all over and then do the planning.

Consultant: No, what is important is that you get the plans activated so that you can oversee the renovation process. Because that is somehow what is most important that you have the full overview of what they are doing. Whether you do that in one way or the other is really not important at all.

(file 32, p. 18)

The excerpt illustrates a development where the consultant changed the purpose of LPS evaluation from actively addressing failures and preventing them from recurring to granting a detailed overview of project progress. This change took place because the consultant prioritized the importance of complying with the wishes of the project managers in the right situations:

Interviewer: I noticed that something was changed in relation to how to go about evaluating and using the PPC.

Consultant: It is a balance between pushing forward to have as many LPS features implemented into the renovation project, and then at the same time being realistic and understanding the situation you are in. There are obviously areas you will have to relax a bit in order to keep their motivation intact and avoid certain conflicts. We can't have situations where we fall out over how it is to be used. That would not contribute to anything productive.

(consultant interview)

The final relaxation of the evaluation procedure and the use of the PPC can therefore be interpreted pivotal for maintaining a harmonic relationship between the project managers and the consultants. The LPS therefore gained an identity of maintaining relations, as the evaluation procedure and the PPC was released of duties. Relating this identity to the discussion on essences, what is peculiar in this regard, is that this identity in the LPS depended not on the *presence* of one of its elements but

on the *absence* of the PPC. The essence of the LPS in relation to this identity be performed was therefore an absence of the PPC. This underlines the temporality in LPS essences.

In the following section the fourth additional identity observed in the field study will be accounted for. This relates to its identity of being a branding mechanism.

7.5. A branding device for the main contractor

The main contractor had a long history of being involved in industry-leading processes and projects concerning construction improvement. Members of top management had decided to involve themselves in the Danish Lean Construction community, and concomitantly with the execution of the renovation project a member of top management was appointed chairman of the Lean Construction community in Denmark.

The LPS was viewed by top management as a way of improving the profitability of construction projects, and it was obviously also a way of branding the company as an innovative and Lean company. In the following excerpt is taken from an internal workshop in the company, where the LPS was presented by top management and discussed with area managers in the company:

Chief production officer: We have worked with this management technology in a couple of projects now with great success. We are planning to disseminate the technology to even more construction projects in our company, and therefore require you to learn more about it.

Area manager: But what is it about and what difference does it make to a construction project?

Chief production officer: It allows better control of the construction projects. We achieve a more even construction flow, and we have received positive feedback from the subcontractors who have been involved. In addition, it gives us an advantage when we profile ourselves to customers and subcontractors.

(Management meeting at Scandic, p.2)

This aspect did in itself infuse a kind of stability to the LPS in general during the renovation project. The advantages of the LPS, explicitly presented by top management, made the LPS a technology that could not be removed from the renovation project. It became mandatory for the project managers who referred to both area managers and the chief production officer to maintain the existence of the LPS in the renovation project. However, there was no internal auditing taking place about how the LPS was performed. The specifics of the performance of the MCS were therefore wholly handed over to the project managers.

In this respect the LPS therefore gained an identity of being a branding device, which supported its durability in the renovation project. This particular finding is therefore in line with institutional perspectives on isomorphism, proposing that management technologies are used to represent competiveness in broader discourses of efficiency and stay rather decoupled to particular production processes. In order to uphold this identity, all that was needed of the MCS was its mere existence in an indefinite form throughout the construction project. As mentioned, top management was interested in applying the LPS to a number of future projects. At the end of the renovation project, which was completed two months ahead of the initially projected deadline, top management assigned the project managers to evaluate the LPS with the subcontractors. The excerpt below illustrates part of the evaluation sequence:

Daily project manager: I would like to hear your opinion of these weekly meetings. This so-called Lean Construction. It is not something I will hold you accountable for. It is also reasonably new to me. This is not something that is to take the whole day. But what is your experience of it?

Plumber: I think it is great.

Bricklayer: I don't think it is different from other meetings I have attended and have been involved in. Whether it is called Lean Construction or not, I don't see the difference between this and the meetings held before this Lean Construction came into the picture. I don't see that.

Painter: The difference is that our boss is not the clerk of works who does the planning. We who execute the actual activities do the planning.

Daily project manager: Yes, that is the big difference.

Electrician: That is where things usually go wrong.

Painter: Now, I can only talk for myself. When I am out it is always me who attends the meetings because my boss don't say anything when he is present. But in my experience it is often the clerks of work who perform the planning and evaluation procedure. It is therefore second-hand information that we get. And something is often forgotten in that process. In addition, the agreements you make with the other trades at the construction site…if the boss comes around telling you to do this and that…then you are in trouble concerning the other agreements you made.

Electrician: The LPS is good in this kind of construction. It would not have been of any help if it was a house or something. Then it would have been too comprehensive.

Daily project manager: There would have been too many activities to go through.

Painter: We would lose our overview. If it is to be used in a larger-scope construction project, we would have to use apartment numbers instead of activities. There you can't take every single activity.

Electrician: It fits fine with this type of project.

(file 45)

The rest of the evaluation part did not add further to these reflections. It is evident that even though they expressed a positive attitude towards its use, the trades also had reservations about the application of the MCS in more complex construction projects. In addition, there were divergent perceptions of the innovativeness of the MCS. According to the bricklayer, the LPS did not represent any change from other construction projects that he had participated in. According to the painter, the LPS was an advantageous departure from traditional construction management because agreements were made between the ones who were actually executing the activities and information was therefore first-hand. Whether this information was channeled back to top management is not known, but the company implemented the LPS in several other construction projects after the completion and delivery of the construction project. Additionally a project manager from this project was appointed Lean Construction specialist, counseling other project managers in the

company on Lean Construction principles. These implications emphasized top management's dedication to the maintenance of the LPS.

7.6. Conclusion, analysis part II

The account of the performance of the LPS in the second part of the analysis offers an additional glimpse into the life of the LPS to that in part I of the analysis. Incoming objectives reconfigured abstract propositions and created novel functions and identities for the management control system. The account in part II serves to argue that LPS durability was not only made possible by the separation of controls and the selection of strategy in relation to planning and evaluation but also because identities that were other to planning and control were added to the technology.

It is argued that the additional identities discussed above performed the durability of the LPS locally across time and space throughout the renovation project: The opportunity of the trades to claim rigidity, and the associated risk of being overridden by not attending the meetings, made the meetings mandatory for the trades. The need for project management to demonstrate lean-management skills facilitated a prolonged existence of the Look-Ahead Plan and, to a lesser extent, of the PPC measure. As the construction project progressed, the consultants, however, softened their stance on how the LPS was to be performed. This happened in order to maintain healthy relations with project management, avoiding potential conflicts. This development dismissed the urgency of evaluating according to the LPS procedure and using the PPC. Lastly, due to top management's involvement in the Lean Construction community and the explicit company goal of being an innovative construction company, the presence of the LPS throughout the entire renovation project became a mandatory feature of the construction project. Decisions on the particular composition of the LPS were, however, decentralised. The aforementioned additional identities increased the durability of the LPS in the renovation project, though each of the identities claimed different elements in the LPS as essential to uphold their particular identity.

In the upcoming chapter the subsets from the analysis part 1 and part 2 are summarized and combined into an overall conclusion that is to answer the three research questions proposed in the introduction.

Part III – Conclusion

Chapter 8: Conclusion

This chapter concludes the analysis by answering the three research questions formulated in the introductory chapter. The conclusion is parted into three sections each concentrating on its own research question. **Section 1** serves to answer the first research question that is concerned alternatives the notion of simplicity (Busco et al., 2007) to account for MCS performativity and durability. **Section 2** is occupied with the second research question that focuses on whether the notion of the boundary object (Briers & Chua, 2001) captures the LPS investigated in this thesis. **Section 3** answers the third research question that relates the LPS to the Zimbabwe bush pump (de Laet & Mol, 2001) and discusses differences between the two accounts of fluid objects.

8.1. An alternative to simplicity as a quality of MCS durability

To recapitulate the first research question concerns Busco et al (2007), who in their paper proposed simplicity as a quality in the MCS offering discretion to practice it and make it work. Extending on this notion the first research question in this thesis was accordingly:

1) *Could there be explanations alternative to simplicity as a characteristic that facilitates MCS durability*

The findings from the field study revealed that the LPS became something different from its abstract identity - that of a strategy and a bundle of controls maximizing production flow. In the particular renovation project selections and separations were made to the two-sided structure and new identities were assumed by the MCS. Thus, the controls in literature proposedly performing the management of flow in the production process were to a great extent reconfigured or separated from the LPS, since they came to function contrary to their abstract proposals. As the LPS got integrated with construction practice, incongruencies arose between construction practice and enactments of the operational controls. These incongruencies were, however, unproblematic to the continual existence of the LPS and the idea of Lean in the renovation project. This was due to the fact that the

ideal of working according to the Lean perspective of flow remained salient and strong, it fitted the interests of the participants. The LPS was, in other words, selected in and enacted as a strategy. Additionally, the LPS took on additional identities. The selection of strategy and the separation of controls plus the addition of identities, it is argued, made the LPS a durable management technology in the renovation project:

The main focus in the first part of the analysis was to dig into the specifics of the LPS strategy and the LPS controls in episodes of planning and evaluation. In this relation it was the aim to examine their enactments. Concerning the *feedback controls*, the three episodes discussed illustrate that the unambiguous relationship between the strategy and the feedback controls proposed by Ballard was troubled in the particular renovation project. There were more issues at stake than proposed in the LPS. This was, interestingly, not a problem to the existence of the LPS as a strategy, since the participants enacted the LPS pretty pragmatically, selecting (parts of) the strategy and separating it from the feedback controls:

In the first episode the enaction of the strategy by the chief manager rendered the contracts inappropriate: It was not possible to maximize flow when the contracts were settled. The contracts that were meant to be mere frames for the general construction process only controlling final output evidently influenced the planning of input. The contracts therefore became more than mere feedback controls, and they came to act against the chief manager's aspiration of maximizing flow. The contracts therefore had to be unsettled, in order to fit the flow ideal. This was obviously not a problem to the LPS since the flow ideal was intact. The strategy of flow therefore in this episode attained a function of re-arranging the contracts.

In the second and third episode the relationship between a maximization of production flow and customer value got disordered. The solution was again unproblematic to the LPS existence, as customer value was pragmatically separated from the LPS. It was in the interest to everybody present at the meeting to maximize flow, and at the same time identifying with the LPS.

Concerning the *feedforward control* it was not enacted as Lean in the renovation project, and eventually it was dismissed. This is a similar to the episodes concerning the feedback controls: A

dismissal took place as the control did not attain support in construction practice. The strategic perspective of maximizing flow, though, remained strong:

In order to keep the trades motivated to participate in the weekly LPS meetings, a 1-hour time limit was prescribed, making the Look-Ahead Plan a competitor instead of a prerequisite to the Week Plan. In addition, the Look-Ahead Plan did not achieve the competence of managing complexity, since the project was not viewed as complex, although a lot of variability and uncertainty emerged in the project. Issues of variations and uncertainty potentially to be handled by a feedforward control did not therefore automatically attach themselves to the Look-Ahead Plan. An effort to make it easier to handle, made the Look-Ahead Plan even more irrelevant, since the Gantt chart came to over perform it. In addition, a great part of the decision competences to order preconditions in the quest of securing sound activities was allocated to actors that did not participate in the meetings. These issues rendered the Look-Ahead Plan an inefficient control. The Look-Ahead Plan became a waste of precious time, a non-lean element to the participants. The case was, however, also an example of an unproblematic separation of the control from LPS since neither the trades nor project management were seemingly interested in maintaining the Look-Ahead plan, but they remained interested in flow. In that sense, the idea of being Lean remained strong as a strategy.

The findings concerning the *concurrent controls* support the two previous sections on the feedback controls and the feedforward controls in that the concurrent controls to a great extent got separated from the renovation project, while the strategy remained strong:

Concerning the *Week Plan* the evaluation part was to a great extent disconnected from the weekly LPS meeting and evaluation changed partly into facilitating agreements on the future. The limit on time set by management in order to preserve motivation to participate in meetings restricted evaluation. Though part of the concurrent control tool was therefore dismissed, this happened in the name of the strategic LPS aspirations. Additionally, the method of asking was often dispensed with in order to finish up the renovation of particular bathrooms. Concerning the *PPC* measure it was removed completely from the LPS in the construction project, as it did not bring any visible consequences to the participants. Instead, it achieved a status of being irrelevant. Concerning the mechanism of *commitment* project management prioritised the trades over the plans, separating the mechanism of commitment from its potential of being a concurrent control.

The second part of the analysis added to the notion of durability in the discussion of additional identities taken on by the LPS. Incoming objectives created novel functions and identities for the management control system. The account in part II argued that LPS durability was not only made possible by the separation of controls from the strategy and the simultaneous selection of the strategy concerning planning and evaluation but also because identities that were not directly related to planning and control were added to the technology.

It was argued that additional identities discussed above increased the durability of the LPS locally across time and space throughout the renovation project. The opportunity of the trades to claim rigidity, and the associated risk of being overridden by not attending the meetings, made the meetings mandatory for the trades. The need for project management to demonstrate lean-management skills facilitated a prolonged existence of the Look-Ahead Plan and, to a lesser extent, of the PPC measure. As the construction project progressed, the consultants, however, softened their stance on how the LPS was to be performed. This happened in order to maintain healthy relations with project management, avoiding potential conflicts. This development dismissed the urgency of evaluating according to the LPS procedure and using the PPC.

Lastly, due to top management's involvement in the Lean Construction community and the explicit company goal of being an innovative construction company, the presence of the LPS throughout the entire renovation project became a mandatory feature of the construction project. Decisions on the particular composition of the LPS were, however, decentralised.

Whereas the original propositions thrown into the LPS propose a bundle of propositions about maintaining a productive and profitable project, these did not manage to discipline incoming elements and considerations, giving substance but also re-presenting the LPS. This lead to an MCS that was purportedly to capture the complexity of a construction project, and it succeeded in doing it, but in a different form from that proposed by Ballard. It succeeded, not because it made the seven prerequisites mandatory to managing construction variation, but because of selections, separations

and additions. To use the words of de Laet & Mol (2000, 227), it did not stand out as a solid statue, but did fluidly dissolve into whatever it helped to achieve.

So was it a success? There is no simple 'yes' or 'no' answer to this question. The LPS did manage to establish planning and control in that the week plan was systematically in use for the planning and the foremen were ever present but it did not manage to discipline the construction project according to the propositions about the controls. Its additional identities, however, performed other issues that were important to practice, and in that sense it gained more functionalities than abstractly proposed. These drifting essences in the LPS blur any single rational perspective on the performance of the LPS in the renovation project. Is it to be evaluated by its planning and control function, its ability to rally the trades, its ability to maintain good relations, or maybe even its ability to offer the main contractor a commercial competitive edge? This question will be further discussed in chapter 9.

Summing up, this thesis has accounted for an MCS whose strategy got selected and controls got separated, and whose identity got multiplied as it intermingled with construction practice. This account adds to Busco *et al.* (2007) concerning the issue of diffusion qualities in MCS: According to Busco et al. (2007) the simplicity in the BSC studied offered discretion to the involved parties in enacting the technology. This assured its diffusion across different organisational entities. In this thesis it has been argued, through the investigation of the LPS, that there are additional explanations to organisational diffusion of MCSs:

The selections and separations of strategy from controls made possible as a consequence of the two-sided structure and the addition of identities other to planning and evaluation assured diffusion and durability of the LPS. Concerning the selection and separation of strategy and controls, it is argued in this thesis that this was not to do with simplicity in the technology. Simplicity, as defined in Busco et al. (2007), entails a management technology that retains its abstractly proposed elements as it gets 'filled' with organisational context. In this thesis, the abstractly proposed elements (referred to in this thesis as the strategy and the controls) in the technology were selected from and

some retained, others separated and dismissed. This was due to the uprising of ambiguities and contradictions between construction practice and the technology's abstract propositions. These selections and separations did, unintuitively, partly establish the discretion in the technology that secured its durability. The strategy stayed strong since the parties bought in to the proposition of flow. Though, the propositions in the technology of how flow was achieved (through the controls) fell apart, they did so discretely.

As the strategy got selected and separated from the controls and a number of the controls got dismissed, it can be argued that the technology got simplified since it was almost solely the strategy that was retained. However, this simplification happened in a process, it was not part of the management technology a priori. Additionally, this thesis argues that the ability of the technology to take on additional identities that were not related to planning and evaluation strengthened the durability of the management technology in the construction project. The ability of the LPS to get inflicted with other organisational agendas such as branding, demonstration of management skills and maintaining relationships furthermore increased its relevancy to practice.

In general, this thesis argues that there are always more and different issues at stake in managing with management technologies than the ones textually proposed in management technologies, but this does not mean that they are not handled by the technologies. The technology manages to incorporate into its own network other pressing management issues. The ability of the management technology to subsume a number of alternative agendas does however also come at a potential price: The chameleon-like nature of the management technology might blur any management overview of the status, identity and consequences of the use of the management technology. In chapter 9 the consequences to management are further elaborated upon.

8.2. The LPS, a fluid object, not a boundary object

Having answered the first research question the grounds are established for answering the second and third research questions. The answer to the second research question serves to further clarify

how the account of MCS durability in this thesis adds to existing literature on diffusion qualities in MCS. The second research question is concerned a comparison of the LPS to the notion of *boundary objects* offered by Briers & Chua (2001)

1) *Does the concept of a boundary object account for the LPS investigated in this thesis?*

Briers and Chua (2001), used the concept of the *boundary object* (Star & Griesemer, 1989) to account for how an ABC managed to spread and interest parties across different organisational spaces. They analysed the ABC as a *visionary boundary object* that brought together actors, more than an actor in its own right.

Briers and Chua (2001) proposed that the ABC had at once a core which was hard enough to draw diverse parties together and a periphery which was plastic enough to adapt to local circumstances and facilitate flow across actor-world boundaries. Its concrete core in the particular case study consisted of interconnected statements such as 'activities consume resources', 'products trigger activities' and 'product costs should reflect all resource consumption.'

Briers and Chua (2001) were concerned with the functionalities of an MCS at differing organisational hierarchical levels (or across different social worlds). They merely focused on the coordination of interests across hierarchies and social worlds. The critical management issue for Briers and Chua (2001) was for the MCS to facilitate a network of motivated social groups working in the same direction while maintaining autonomously defined goals. Briers & Chua (2001) introduced to an MCS that was plastic, allowing for different actor interpretations of its functionality. The MCS therefore became epistemologically multifarious. The object did not, however, ontologically multiply, since there was yet a stable core.

This thesis has similarly been occupied with an MCS that was able to adapt to local circumstances and interests. Here the argument is, though, that this adaption was more radical than what is offered in the notion of a *boundary object*. The idea of a core that is rigid and a more plastic periphery does not apply to the LPS studied in this thesis. What was essential or the *core* was in our investigation

of the LPS neither stable nor singular. It merely depended on the particular identity it assumed across space and time:

The findings in the analysis informed of an MCS that in issues of planning and evaluation was enacted as strategy. In these episodes, what was essential to the existence of the MCS was merely the notions of flow and Lean. Concerning its additional identities that were accounted for other elements seemed essential:

Concerning the demonstration of management skills the Look-Ahead plan was essential (at least in a specific point in space and time). Later on in the construction project, the Look-Ahead plan was though given up by the consultants in order to uphold a harmonic relationship between the consultants and the project managers. Presence at the weekly LPS meetings was argued to be essential for the trades to claim rigidity, and the mere existence of LPS as a management technology as a reference was essential to its identity as a branding device. These differing identities and differing essences, it is argued, constituted an MCS that escaped the definition of a boundary object.

Having accounted for the difference between the LPS studied in this thesis and the notion of a boundary object, the thesis turns to the third and final research question.

8.3. The differences between the LPS and the Zimbabwe bush pump

As mentioned in the introduction the approach in the thesis is inspired by de Laet & Mol (2000) and their account of the Zimbabwe bush pump. Having concluded the analysis this poses a question of whether using the approach by de Laet & Mol (2000) to go about analyzing a seemingly very different object has revealed any new insights to the notion of a fluid object. Relating the findings from the analysis the third and final question was:

2) *How does the account of the LPS differ from the account of the Zimbabwe bush pump?*

Similar to the Zimbabwe bush pump, the LPS accounted for in this thesis was proposed as a fluid. There were, however, differences between the two:

In the account of the Zimbabwean bush pump the vantage point of observing durability was multifaceted. The analytical levels spanned from engineers, to individual villagers setting it up and using it, to the village as a whole and moreover to the Zimbabwean nation as a whole. This was exactly de Laet & Mol's argument of durability: the multiple networks in which it was enmeshed relieved it of any 'global' essence. Even though it could break down in one network it remained in existence in other networks or spaces: what made it break down in one space did not make it break down in another space. De Laet & Mol were, however, occupied with an object that came in multiple numbers. They interchangeably discussed a *particular* pump and a *type* of pump that came in thousands. When they discussed the *particular* pump, there was definitely vulnerability involved. Even though the particular pump comprised several networks and was reparable to a certain extent, it could cease to exist. Durability was in this situation only secured because de Laet and Mol switched vantage point and focus on a different particular pump or the pump on a 'type' level.

In this thesis the analytical vantage point was different. The focus was on a particular object that existed in several networks, but the analysis was not broadened to a study of a 'type'. The life of the LPS was, for example, not examined in scientific communities, in yearly statements in consultancy companies, in publishing companies or in other construction projects. If that perspective was applied, then the account of LPS durability would have been ever much longer. One could go as far as stating that this thesis did not really investigate a fluid object, since it was only occupied with the particular. This is though a fragile argument: Though the thesis was only concerned with the particular, the particular came in many faces; the networks in which the LPS performed were multiple. It is therefore proposed that the ability of the LPS to play many roles exclusively in its particular, does also qualify for an account of a fluid object.

In addition, de Laet & Mol (2000) did not focus on any potential *interdependency* of identities in their account of durability of fluid objects. As they used the method of shifting vantage points, from

particular to type, the issue of interdependency between identities became less critical to the creation of an account of a fluid object. If the object broke in the particular, they shifted vantage point to type. In that way they avoided discussing how interdependencies in identities in the particular could influence durability in the particular. The explanation of the absent discussion of interdependencies could reside in the fundamental definition of the fluid object. If there are interdependencies between identities, does one then actually analyse a fluid object that jumps across networks, or does one analyse an object that occupies only one? In other words, if there are interdependencies in identities, is one then not occupied with a fluid anymore? In this thesis it is proposed that the LPS was a fluid object, but since the thesis is occupied only with an object in particular, it is not possible to use the method of shifting vantage point to type. One can, however, imagine a kind of space where there is room for multiple object identities, some intricately related, some loosely coupled and then again some not really related. In that way it is possible to discuss interdependencies of identities in relation to object durability and still maintain the idea of fluidity.

In the account of the LPS in the case study the multiple identities that the LPS assumed throughout the renovation project were addressed. It was argued that it was precisely because of its two-sided structure facilitating a separation of strategy from controls and the assuming of additional identities (even in its particular) that it remained durable. So far a discussion of interdependencies between identities has not been brought to the fore. In the following part this discussion is therefore embraced, though it remains speculative, since the empirical analysis was concluded long before these ideas came up.

Methodologically, the analysis in this thesis was structured around the two-way distinction of analysing diffusion ability. The selection and separations between strategy and controls within the identity of planning and evaluation were discussed isolated from the discussion of additional identities and the additional identities were likewise discussed separately in the second part of the analysis. But the question of interdependencies between the separations and identity additions remains unanswered. If a separation of a control lead to incoming identities, or when incoming identities influenced the controls or enactment of strategy, then interdependencies would have significance for the object's durability. Furthermore, if additional identities influenced the potential

for even more identities to flourish or break down, it would have significance for the durability of the object. Below is a re-listing of the identities discussed in this thesis:

- A planning and control device
- A forum for claiming rigidity
- Performer of skilled management
- Facilitator of a harmonic relationship between project managers and consultants
- A branding device for the main contractor

It would be no surprise if the identity of the LPS as a branding device for the main contractor allowed the LPS a position of being a planning and evaluation device. This is a trivial point in accounting literature. It is, however, by no means certain that this was the case. One does not necessarily have to find the reason in one argument. It could very well be a mixture of arguments meaning that, for example, both the potential of the device to improve production flow and its branding effects played a role in its implementation in the renovation project. Alternatively, the idea of using the LPS as a branding device could have raised out of its planning and control use in the field study accounted for in this thesis or in earlier construction/renovation projects. The relation between these two identities could therefore be influential, conditional, an effect or independent. Regrettably, the empirical study does not offer information on this matter, but the potential for interdependency between identities is high.

The identity of claiming rigidity for the foremen could easily be an effect of the function of planning and control that the object maintained. Without its disciplining mechanism in planning, it would not be interesting or relevant for the foremen to attend the weekly meetings and claim rigidity. The mechanism of claiming rigidity could therefore be conceptualised as an effectual identity. The object's identity of demonstrating skilled management and its facilitation of a harmonic relationship between project managers and consultants could be viewed as independent identities that are consequences of the mere presence of the consultants in the renovation project.

De Laet & Mol (2000) were not interested in interdependencies in the particular. The above discussion has opened up for the possibility of examining interdependencies in object identities in the particular and potentially linking them to concepts of influential, conditional, effectual or independent. It can be speculated that independency affords durability and robustness against individual identity breakdowns, whereas close interdependency affords intense object use in the particular, though making the object fragile in cases of identity breakdowns, since the close connection can affect a chain reaction of multiple identity breakdowns. It can therefore be speculated that issues of interdependencies between identities influence durability.

The investigation of interdependencies between identities in the particular poses the question of the feasibility of methodologically splitting up the analysis into two separate parts, as has been done in this thesis. If it was chosen not to split up the analysis, the potential of focusing on interdependencies could have been realised more easily. On the other hand, the analysis would have become rather fuzzy. In this thesis it was chosen to clarify the two-way distinction in analysing LPS durability leaving the interdependency discussion to this section. This is a matter of choice on methodology.

Having accounted for the differences between the LPS and the Zimbabwean bush pump, the three research questions have been answered. There is still, though, a few threads that need be bound. Accounting for the LPS as a fluid object does not necessarily provide any credible information to management practitioners to go about re-examining their use of the LPS. In the following and final chapter the thesis it concluded by discussing how to use the findings from the thesis in a management oriented perspective.

Chapter 9 – Final comments

Having answered the three research questions the thesis is at its final. A few notes remain though. In the following chapter, the implications of the thesis' findings to managers working with the LPS are discussed in **section 1**. The section covers a general discussion on how to evaluate the performance of the LPS as well as a particular discussion of how to consider the particular elements in and around the LPS. Additionally, **section 2** serves as a comment to Ballard concerning the difference between the LPS in the abstract and the LPS in practice. The two perspectival sections serve to conclude the thesis.

9.1. To managers working with the LPS.

9.1.1. In general

Though the analysis has argued that the LPS remained strong not in spite of but *because* of its fluidity, this is a rather theoretical point that deserves an in-depth discussion of management implications. The two types of fluidity in the LPS proposed in this thesis address the immense amount of discretion that, maybe surprisingly, is related to the LPS. This quality of the object definitely increases the chances of it being able to adapt from abstract modes to practice modes. However, though durability is emphasized, the model is apolitical. This means that even though the rhetoric on the object in this thesis is replete with words like "discretion," "strength" and "durability," this is not positive in and of itself. As mentioned earlier in the thesis, there is nothing intrinsically positive or negative about fluidity in this respect; the only certainty is that of a continuous existence of the object. However, since management is the domain of interest in this thesis, the consequences to management are pivotal to discuss.

Any MCS is proposed a specific identity. Its interrelated perspectives and controls compose the structure of the technology. There is a relatively clear idea of its use and how to go about evaluating it. Unsurprisingly, it is argued in this thesis that managing with management technologies is about

much more than this, which is in line with the literature reviews in the introductory part of this thesis.

Extending on the findings in this thesis, it is argued that if managers are more explicitly oriented towards detecting episodes of selection, separation and addition, much can be learned about the potential of the technology, and just as important, much can be learned about organizing and management. But how should management evaluate upon the performance of the technology and how are they actually to define success and failure? The conclusions hopefully extend the frame of evaluation offered by Ballard (2000). Ordering the daily management of a construction project through a purist LPS perspective is something between chaotic and impossible. The are many risks and ambiguities arising locally that need to be managed, and project management would in many instances appear to act irrationally if the project was to uncritically follow the abstract LPS proposals. The case study demonstrates that there were ambiguities between strategy and controls, making the aspiration of unambiguous management through the LPS a utopian ideal.

As a consequence of this, one could suitably conclude either that the LPS was not an efficient technology or that the organisational context was not adequately designed to utilize the efficiency potential in the management technology. In this thesis it is proposed, however, that evaluation can be conducted differently, in a way that embraces both the context and the technology. This alternative idea to evaluation is by no means a *laissez-faire* perspective in which 'anything goes'. Quite on the contrary, it is a perspective that demands insight into the localities of functionality, thereby demanding more analytical activity from the actors involved, thus with the aspiration of improving organisational management.

Recalling the chapter clarifying the approach, Law (2005, 81) proposes the notion of *balance* in order to evaluate on the fluid object. In the case for alcoholic liver disease in Waterside, Law argues that the problem may be not that the object changes its shape and its name, but rather that the balance and the movement between the different objects and their contexts is unsatisfactory. If the displacement from one method assemblage to the next had been much easier, then the patient would

have been much better off. If the consultants and the doctors caught up in the narrow medical assemblage had devoted more interest to the broader medical-pychiatric-social reality of alcoholism, then the patient would potentially receive a more balanced treatment. As Law states:' the displacement from one method assemblage to the next, 'ought' to be much easier, much more fluid, than it actually is.

The Zimbabwe bush pump, on the other hand, is a fluid object that could be said being 'well balanced'. De Laet & Mol actually happen to *love* (de Laet & Mol, 2000, p.225) the technology. As we have already mentioned, those affections can only be attributed to its enactments, not its fluid qualities. Had they accounted for instances of violence between different villages in fights over scarce pumps, had they accounted for use of child labor in the production of the bush pump, had they accounted for deaths as consequences of lacking poison measuring devices, would they then 'love' the technology for its fluid qualities?

In the above two cases the politics concerning right and wrong is rather straightforward. As one moves to Lean management it does, however become fuzzier to discuss ethics as the ultimate referents to 'good and bad'. This is so because 'the patient' is not a single and unambiguous entity, in the construction project. There are many 'patients'. If one choose to call the end-user 'the patient' then some patients did not get the treatment they hoped for. Is the trades then maybe they LPS was well balanced since the trades were satisfied with the process and the compensation. One could also choose to call the renovation project the 'patient', then it was also a success. If a perspective is chosed where the patient is 'revolutionizing construction management' then the patient arguably died. It did not manage to re-arrange resources in terms of disciplining work solely according to plan, using the seven prerequisites as deciding factors to inform the Look-Ahead Plan and the week plan. The authority of how to evaluate lies with management, and it is therefore proposed an explicit objective for management to consider and be reflective about the how of evaluation.

9.1.2. In particular

Using the findings in this thesis, concerning particular elements in the LPS, it should be of concern to management that plans, customers, commitments and defects, for example, do not necessarily

uphold stable references and they should be thoroughly considered in terms of their potential and limitations. What kind of defects should we allow to exist in order to decrease lead time? How should the customer be defined and served in order to stay productive? What is at risk when commitments include unchecked assignments to be executed'? What is at risk in terms of materials control when the Look-Ahead Plan is dismissed?

A number of the propositions in the LPS, such as the PPC measure and the commitment proposal, might have decreased variation in the production process more in the long run had it been performed more consistently, though conflicts of optimisation would have been obvious in the short run. This issue illustrates a classic dilemma between short-term and long-term optimisation that becomes even fuzzier in a context in which some parties are involved only for a short period of time, and in which the production sequences are changing in the ongoing project as well as across projects. How repetitive does a construction project have to be; how do we define repetitiveness? If production processes change too much, does the PPC become irrelevant, meaning we will have to set a maximum complexity limit? Should there be a minimum limit on duration time and a minimum limit in the number of participants or activities involved to determine whether the LPS should be installed or not?

All the above issues are related to situations of separation of controls from the LPS in relation to planning and evaluation.

A management technology like the LPS – designed for planning and control – might be able to assume other identities, handling organisational issues that go beyond the abstractly proposed identity. Relevant questions for management could be: why is it important to demonstrate skilled management? Could one promote employees based on their use of the LPS? Is the battle of rigidity healthy to the construction project? If yes, how could it be furthered? Should the consultants be granted more decision-making power? Could a branding strategy systematically use more information from the Lean Construction projects? These issues are only a fraction of the management issues that could be discussed in relation to additional identities.

The insights from this thesis concerning selections, separations and additions are to increase knowledge of organising and managing with management control systems. Understanding a management technology as handling management issues other than the ones abstractly proposed on the one hand offers managers a tool of diverse applicability, and on the other hand offers a different entrance view into organisation. Though the LPS can be viewed as a flexible object that is capable of adhering to seemingly unrelated organisational issues, it should also be an explicit management concern to understand what the technology takes on and gets rid of as it takes on this chameleon like form making it durable. The above questions hopefully illustrate the point that understanding the Last Planner System as a fluid object highlights matters of concern to management, not solutions to management.

9.2. A few words to Ballard

Concerning Ballards writings on LPS and the Lean construction literature, this thesis does not seek to dismantle the Last Planner System as an efficient management technology for construction; it seeks to 'add' a perspective to the LPS in the Lean construction literature.

Ballard offers a perspective on success and failure of construction projects. The means to success are found in the use of the Last Planner System according to its textually proposed composition. Reconfigurations of the management technology are implicitly not an option in Ballard's perspective. This thesis does not state the opposite – that successful construction projects depend on the Last Planner System to be reconfigured. Still, it proposes that understanding the phenomenon reconfigurations of management technologies increases knowledge of both the LPS, organising and construction projects. When reconfigurations take place in technologies it is not always because of inappropriate management, rather it could potentially be a case of the opposite.

The assumption that the propositions offered by Ballard concerning management of a construction project are the only ones relevant, irrespective of time and space, is rather contestable. As the field

study demonstrates, the identity of the LPS is about planning and evaluation, but only sometimes, and not necessarily in the way proposed by Ballard *et al.* The MCS keeps getting enmeshed with other agendas, or the existing agendas keep getting bent. The performance keeps getting restructured.

What should be singled out from this thesis in relation to Ballard is not, for example, that defect lists and idle time are more relevant and important than controlling the seven preconditions offered in the original LPS propositions. Nor should it be that customer value and commitment can only work in a reduced form in practice, or that there are many ambiguities present in the technology. The focus should be directed at understanding which elements and propositions are actually performing and reconfiguring the LPS. E.g. why is idle time preferred to controlling the seven preconditions? Why can't they both be controlled equally? These questions can only be answered if one investigates the elements that create the episodes of reconfiguration. One could also go in a different direction and ask ourselves if it is really that problematic to abandon the Look-Ahead Plan, for instance. Many issues could be proposed on the basis of the findings.

What can be said is that the LPS retains its existence as long as it performs efficiently; however, what is efficient does not remain stable. The reconfigurations present a management technology in which many other issues than the ones proposed by Ballard *et al.* (2000) are at stake. Though Ballard *et al.* propose that complexity can be controlled by using LPS and Lean Construction, it is now evident that the identity of the LPS itself is much more complex than they presume. In other words, their reasonably simply solution to what they have proposed as a complex problem, itself exhibits a considerable level of complexity.

Ballard *et al.* presume that:

- Proposals are without any internal trade-offs

- Purposes do not change in time and space. The references to efficiency are stable.

- LPS always maximizes production flow if the controls in the LPS are used.

This thesis argues that the above presumptions are ambiguous in practice. When these presumptions do not hold stable, it means that one might miss out on a lot of knowledge of the existence of the LPS if the thesis is not taken into consideration. The original propositions in the LPS tell of a reality in which management issues are stable and relevant irrespective of time and space. In addition there are ideas of stable optima and that the original LPS propositions catch and discipline all relevant management issues. There is an argument that LPS maximizes production flow. However, it has been demonstrated that risks of unstable production flows lead to action that reconfigures the LPS controls. A number of existing elements in the technology create a risk of technology and construction break down if they are not translated, which is a paradox in the technology.

The thesis dismantles the assumption that functions remain stable. If one accept this argument that references to efficiency change depending on the situation at hand, and reconfigurations are premises to a continued existence, then the LPS might have performed rather well. However, if one remains faithful to the original propositions about the identity of the technology, then the LPS should be viewed as a failure in its encounter with construction practice.

Bibliography

Abernethy, M., Chua, W.F., Luckett, P.F., Selto, F.H. (1999): 'Research in managerial accounting: learning from others' experiences', *Accounting and Finance*, Vol. 39 pp.1-27.

Abrahamson, E. (1991): 'Managerial Fads and Fashion: The Diffusion and Rejection of Innovations', *Academy of Management review,* Vol. 16, 3, pp. 586-612.

Abrahamson, E. (1996): 'Management Fashion', *Academy of Management Review*, 21, 1, pp. 254-285

Ahrens, T., Chapman, C.S. (2006): 'Doing qualitative field research in management accounting: positioning data to contribute to theory', *Accounting, Organizations and Society*, Vol. 31 pp.819-41.

Ahrens, T. and J. Dent. (1998): 'Accounting and Organizations: Realizing the Richness of Field Research', *Journal of Management Accounting Research* 10: 1-39.

Alvesson, M. (2003): "Beyond neopositivists, romantics, and localists: a reflexive approach to interviews in organizational research", *Academy of Management Review, 28*(1), pp. 13-33.

Alvesson M. and Deetz S.(2000): 'Doing critical management research', London, Sage.

Anderson, S.W. & Young S. (1999): "The impact of contextual and process factors on the evaluation of activity-based costing systems", *Accounting, Organizations and Society*, Vol. 24 pp.525 - 559.

Andon, P., Baxter, J.& Chua, W.F.: 'Change of Relational Drifting? A Field Study of Accounting experimentation', (2007), *Management Accounting Research* 18, 2: 273–308.

Ansari, S., & Bell, J. (1997): 'Target costing: the next frontier in strategic cost management, the CAM-I target cost core Group', Chicago: Irwin Professional Publishing

Argyris, C. (1990): 'Overcoming Organizational Defenses', Upper Saddle River, N. J.: Prentice-Hall.

Argyris, C. & R.S. Kaplan (1994): "Implementing New Knowledge: the Case of Activity-Based Costing", *Accounting Horizons,* 8(3), pp. 83–105.

Arrow, K. J. (1964): 'Control in large organizations',. *Management Science,* 10, pp. 397–408.

Arrow, K. J. (1974): 'The Limits of Organization', Norton, New York

Atkinson, P. (1990), *The Ethnographic Imagination: Textual Constructions of Reality*, Routledge, London.

Atkinson, A.A., Banker, R.D., Kaplan, R.S. & Young, S.M. (1997): Management Accounting, Prentice-Hall International, Inc., London.

Baines, A. & Langfield-Smith, K. (2003), "Antecedents to management accounting change: A structural equation approach", *Accounting, Organizations and Society*, Vol. 28 pp.675 - 698.

Ballard, G. (1994): 'The Last Planner', Northern California Construction Institute Spring Conference, Monterey, CA, April,

Ballard, G. (1997): 'Lookahead Planning: The Missing Link in Production Control', Proceedings of the 5th Annual Conference of the International Group for Lean Construction, Griffith University, Gold Coast, Australia, July.

Ballard, G. (2000): 'The Last Planner System of Production Control', School of Civil Engineering, Faculty of Engineering, The University of Birmingham

Ballard, G. & Howell, G. (1998): 'Shielding production: Essential step in production control', Journal of Construction and Engineering Management, ASCE, Vol. 124, Issue 1, p11-17.

Ballard, G. & Howell, G. A. (2003): 'Lean project management', *Building Research & Information*, Vol. 31 Issue 2, p119, 15p.

Barley, S. R. & Tolbert, P. S. (1997): 'Institutionalization and Structuration: Studying the links between Action and Institution', *Organization Studies*, 18, 1, pp. 93-117

Bate, S. (1997): 'Whatever Happened to Organizational Anthropology? A Review of the Field of Organizational Ethnography And Anthropological Studies', *Human Relation*, Vol. 50, 9, pp. 1147-1175.

Baxter, J. & Chua W. F. (2008): 'The field researcher as author-writer', *Qualitatice Research in Accounting & Management*, 5, 2, pp. 101-121

Becker, M.C. (2004), "Organizational routines: a review of the literature", *Industrial and Corporate Change*, Vol. 13 No. 4, pp. 643-77.

Becker, M.C. (2005), "A framework for applying organizational routines in empirical research: linking antecedents, characteristics and performance outcomes of recurrent interaction patterns", *Industrial and Corporate Change*, Vol. 14 No. 5, pp. 817-46.

Benders, J. & Van Veen, K (2001): What's in a fashion? Interpretative Viability and Management Fashions', *Organization*, Vol. 8, No. 1, pp. 33-53.

Bertelsen, S. & Koskela, L. (2002): 'Managing the three aspects of production in construction', IGLC-1

Bicheno, J. (2004): 'The New Lean Toolbox: Towards Fast, Flexible Flow', 3rd ed., PICSIE Books, Buckingham.

Bjornenak, T. (1997): 'Diffusion and Accounting: The Case of ABC in Norway', *Management Accounting Research*, Vol. 8, no. 1.

Briers, M. & Chua, W.F. (2001): "The role of actor-networks and boundary objects in management accounting change: a field study of the implementation of activity-based costing", *Accounting, Organizations and Society*, 26, pp. 237–269.

Bromwich, M. (1990): "The case for strategic management accounting: the role of Accounting Information for strategy in competitive markets", *Accounting, Organisations and Society*, 15, 1, pp. 27-46.

Burns, J & Scapens, R. W. (2000): “Conceptualising Management Accounting Change: An Institutional framework”, *Management Accounting Research*, 1, March pp. 3-25.

Busco, C; Quattrone, P. Riccaboni, A. (2007): ’Management Accounting: Issues in interpreting its nature and change’, *Management Accounting Research, 18, 2, pp. 125-149*

Chenhall, R. H. (2003): ‘Management control system design within its organizational context: Findings from contingency-based research and directions for the future’, *Accounting, Organizations and Society,* 28, (2-3), pp. 127-168.

Chenhall, R. H. & Euske, K.J. (2007): ’The role of management control systems in planned organizational change: An analysis of two organizations´, *Accounting, Organizations and Society, 32*, 601-637.

Chenhall, R. H. & Langfield-Smith, K. (1998): ‘The relationship between strategic priorities, management techniques and management accounting: an empirical investigation using a systems approach’, *Accounting, Organizations and Society,* 23, 3, pp. 243–264.

Chua, W. F. (1995): “Experts, networks and inscriptions in the fabrication of accounting images: a story of the representation of three public hospitals”, *Accounting, Organization and Society*, 20, pp.111-146.

Clark, J. (1985): ‘Costing for quality at Celense’, *Management Accounting,* USA, (March), pp. 33–35.

Clegg, S. (2006): ‘The bounds of rationality: power/history/imagination’, *Critical Perspectives on Accounting*, Vol. 17 pp.847-63.

Cooney, R. (2002): "Is ‘lean’ a universal production system?: Batch production in the automotive industry", *International Journal of Operations & Production Management*, Vol. 22, No.10, pp. 1130-47.

Czarniawska-Joerges, B. (1999): ‘Writing management: organization theory as a literary genre’, Oxford; New York: Oxford University Press.
Daft, R.L. (1983): ‘Organization Theory and Design’, West, St. Paul, MN.

Denzin, N. K. & Lincoln, Y. S. (1994): 'Handbook of Qualitative Research', Thousand Oaks, CA: Sage

DETR (1998), Rethinking Construction, Department of the Environment, Transportation and the Regions, London.

Dugdale, A. (1999): 'Materiality: juggling sameness and difference', In: Law, J., Hassard, J. (Eds.), Actor Network Theory and After. Blackwell Publishers, Oxford, pp. 113–135.

Duncan, R. B. (1979): 'Qualitative Research methods in strategic management'. In *Strategic Management*, Boston: Little, Brown, and Company, pp. 424-447

Feld, W.M. (2001): 'Lean Manufacturing: Tools, Techniques, and How to Use Them', St Lucie Press, Boca Raton, FL.

Firth, M. (1996), "The diffusion of managerial accounting procedures in the People's Republic of China and the influence of foreign partnered joint ventures", *Accounting, Organisations and Society*, Vol. 21 No.7/8, pp. 629-654.

Flynn, B.B., Sakakibara, S., Schroeder, R.G. (1995): 'Relationship between JIT and TQM: practices and performance', *Academy of Management Journal,* 38, 5, pp. 1325–1360.

Gallivan, M.J., (2001). Organizational adoption and assimilation of complex technological innovations: development and application of a new framework', *Database Advances Info. Systems.* 3, pp. 51–85.

Garson, D. (2002): 'Guide to writing empirical papers, theses and dissertations', Marcel Dekker

Geertz, C. (1988), *Works and Lives: The Anthropologist as Author*, Stanford University Press, Palo Alto, CA.

Golden-Biddle, K. & Locke K. (1993): 'Appealing Work: An Investigation of How Ethnographic Texts Convince', *Organization Science*, Vol. 4, no. 4, pp. 595-616.

Goldratt, E. (1990): 'The Theory of Constraints', North River Press, New York, NY.

Gosselin, M. (1997): 'The effect of strategy and organizational structure on the adoption and implementation of activity-based costing', *Accounting, Organizations and Society*, Vol. 22, No. 2, pp. 105-122

Govindarajan, V., & Gupta, A.K. (1985): 'Linking control systems to business unit strategy: Impact on performance', *Accounting, Organizations, and Society,* 10, 1, pp. 51-66.

Granlund, M. (2001): ' Towards explaining stability in and around management accounting systems', *Management Accounting Research,* 12, pp. 141-166

Green, S. & May, S. (2005). "Lean Construction: Arenas of Enactment, Models of Diffusion and the Meaning of 'Leanness'". *Building Research & Information*, 33, 6, pp. 498-511.

Green, S. & Welsh, M. (1988): 'Cybernetics and dependence: reframing the control concept', *Academy of Management Review*, 13, 2, pp. 287–301.

Hall, R.W. (1987): 'Attaining Manufacturing Excellence: Just in Time, Total Quality, Total People Involvement', The Dow Jones-Irwin/APICS Series in Production Management.

Hannan, M.T., Po´los, L. and Carroll, G.R. (2004), "The evolution of inertia", *Industrial and Corporate Change*, Vol. 13 No. 1, pp. 213-242.

Hayek, F. (1945): 'The Use of Knowledge in Society', *American Economic Review, XXXV,* No. 4; September, pp. 519-30.

Hines, P., Holweg, M. and Rich, N. (2004). "Learning to Evolve. A review of Contemporary Lean Thinking". *International Journal of Operations and Production Management*, 24, 10.

Hines, P. and Rich, N. (1997), "The seven value stream mapping tools", *International Journal of Operations & Production Management*, Vol. 17 No. 1, pp. 46-64.

Hopper, T.; Jazayeri, M; Westrup, C. (2008): 'World class manufacturing and accountability: How companies and the state aspire to competitiveness', *Journal of Accounting & Organizational Change*, Vol. 4, 2, pp. 97-135

Howell, G. & Macomber, H.(2005): 'Why do a project on a Lean basis?', Special report #1,

Howell, G. A. & Ballard, G. (1995): 'Factors affecting project success in the piping function.', Proceedings of the 3rd annual conference of the IGLC, Albuquerque, NM. Available in Alarcon, 1997, pp. 161-186.

Imai, M.(1975): 'Never take yes for an answer: An inside look at japanese business'.

Ittner, C. D. & Larcker, D.F. (1997): 'Quality strategy, strategic control systems, and organizational performance', *Accounting, Organizations and Society*, 22, 293-314.

Ittner, C. D., & Larcker, D. F. (1998): 'Innovations in performance measurement: trends and research implications', *Journal of Management Accounting Research*, 10, pp. 205–238.

Jacob, E. (1989): 'Qualitative research: A defense of traditions', *Review of Educational Research*, 59, 2, pp. 229-235.

Jensen, M. C. & Meckling, W. H. (1992): "Specific and General Knowledge, and Organization Structure". *Contract Economics*. L. W. a. H. Wijkander. Oxford, Basil Blackwell**,** pp. 251-274.

Jones, T. C. (1992): "Understanding management accountants: the rationality of social action", *Critical Perspectives on Accounting*, 2.

Juran, J.M.: 'Juran on Planning for Quality', (1988), The Free Press, New York. 341 p.

Jürgens, U. (1995): "Lean production in Japan: myth and reality", in Littek, W., Charles, T. (Eds),*The New Division of Labour: Emerging Forms of Work Organisation in International Perspective*, Walter de Gruyter, New York, NY, pp. 349-66.

Jørgensen, B. & Emmitt, S. (2008): 'Lost in transition: the transfer of lean manufacturing to construction', *Engineering, Construction and Architectural Manaagement,* Vol. 15, no. 4, pp. 383-398

Kaplan, R. S. & Cooper, R. (1998): 'Cost and effect', Harvard Business School Press, Boston, Massachusetts.

Kaplan, R. S. & Norton, D. P.: 'The Balanced Scorecard: Translating Strategy into action', (1996), Boston: Harvard Business School Press.

Katayama, H., Bennett, D. (1996): "Lean production in a changing competitive world: a Japanese perspective", *International Journal of Operations & Production Management*, Vol. 16 No.2, pp.8-23.

Kieser, A. (1997): 'Rhetoric and Myth in Management Fashion', *Organization*, 4, 1, pp. 49-76

Koskela, L.: 'Application of the New Production Philosophy to Construction**',** (1992), Technical Report #72, CIFE, Stanford University.

Koskela, L.: 'We need a theory of construction', (2000), White Paper, *Berkeley-Standford CE&M* workshop.

Kreiner, K. & Mouritsen, J. (2005), "The analytical interview – relevance beyond reflexivity", in Tengblad, S., Solli, R., Czarniawska, B. (Eds),*The Art of Science*, Liber and Copenhagen Business School Press, Malmø, pp. 153-76

Kristiansen K.; Emmitt, S.; Bonke, S. (2005): 'Changes in the Danish construction sector: the need for a new focus', *Engineering, Construction and Architectural Management*, Vol. 12, 5, pp. 502-511

Laet, de, M. & Mol A. (2000): 'The Zimbabwe Bush Pump. Mechanics of a Fluid Technology', *Social Studies of Science,* (30), 2, pp. 225–263.

Latour, B. (1987): '*Science in action*', Cambridge: Harvard University Press.

Latour, B. (1991): 'Technology is society made durable', In J. Law (Ed.), *A sociology of monsters. essays on power, technology and domination,* pp. 103–131, London: Routledge.

Latour, B. (1993): 'We Have Never Been Modern', Brighton, Harvester Wheatsheaf

Latour, B & S. Woolgar (1979): 'Laboratory Life: The Construction of Scientific Facts'

Law, J. (2002): “Objects and spaces”, *Theory, Culture & Society*, Vol. 19, no. 5-6, pp. 91-105.

Law, J. (2005): ‘After Method – mess in social science research’, Routledge.

Law, J. (2007): ‘Making a Mess with Method’, *The Sage Handbook of Social Science Methodology*. W. Outhwaite and S. P. Turner. Sage, London and Beverly Hills, pp. 595-606.

Law, J. & Mol, A. (2001): ‘Situating technoscience: an inquiry into spatialities’, *Environment and Planning D: Society and Space,* 19, pp. 609 – 621

Law, J. & Singleton, V. (2005): ‘Object lessons’, *Organization,* 12, pp. 331 – 355

Lee, N. and Hassard, J. (1999): `Organization unbound: actor network theory, research strategy and institutional flexibility", *Organization*, Vol. 6 No. 3, pp. 391-404.

Leonard-Barton, D. & Deschamps, I. (1988): ‘Managerial Influence in the Implementation of New Technology’, *Management Science,* 34, pp. 1252–1265.

Lewis, M. (2000): "Lean production and sustainable competitive advantage", *International Journal of Operations & Production Management*, Vol. 20 pp.2-14.

Liker, J.K. (2004): ‘The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer’, McGraw-Hill, New York, NY, .

Lillrank, P. (1995): "The transfer of management innovations from Japan", *Organization Studies*, Vol. 16 No.6, pp. 971-989.

Madill, A., Jordon, A., Shirley, C. (2000), "Objectivity and reliability in qualitative analysis: realist, contextualist and radical constructionist epistemologies", *British Journal of Psychology*, Vol. 91 pp.1-20.

Malmi, T. (1997): ‘Towards explaining activity-based costing failure: accounting and control in a decentralised organisation’, *Management Accounting Research,* 8, pp. 459–480.

Malmi, T. (1999): 'Activity-based costing diffusion across organizations: an exploratory empirical analysis of Finnish firms', *Accounting, Organisations and Society,* 24, pp. 649-672

Marcus, G.E., Cushman, D. (1982): 'Ethnographies as texts', *Ann. Rev. Anthropol.*, Vol. 11 pp.25-69.

Maxwell, J.A. (1992): 'Understanding and validity in qualitative research', *Harvard Educational Review*, Vol. 62 No.3, pp.279-300

McLachlin, R. (1997): 'Management initiatives and just-in-time manufacturing', *Journal of Operations Management,* 15, 4, pp. 271–292.

McLaren, J. (1999): 'A strategic perspective on economic value added', *Management Accounting,* (April), pp. 36–37.

Mehri, D. (2005): ' Notes from Toyota-land: an American engineer in Japan', Ithaca, N.Y. : ILR Press.

Merchant, K. & D. Otley. (2007): 'A review of the literature on control and accountability', *Handbook of Management Accounting Research,* C.S. Chapman, A. G. Hopwood & M.D. Shields (eds.), Amsterdam: Elsevier.

Miller P. (1997): 'The multiplying machine', *Accounting, Organizations and Society*, 22, (3/4), pp. 355–64.

Miller, P. & O'Leary, T. (1994) "Accounting, 'Economic Citizenship', and the Spatial Reordering of Manufacture", *Accounting, Organizations and Society,* Vol. 19, No. 1, pp. 15-43

Mintzberg, H. (1979): 'The Structuring of Organizations', Prentice Hall, Englewood Cliffs, NJ.

Mitchell, J. C. (1983): 'Case and situation analysis'. *The Sociological Review*, 31, pp. 187-211.

Modell, S. (2005): 'Triangulation between case study and survey methods in management accounting research: An assessment of validity implications', *Management Accounting Research,* Vol. 16, no. 2, pp. 231-254

Mol, A. (1999): ‘Ontological politics. A word and some questions’, In: Law, J., Hassard, J. (Eds.), Actor Network Theory and After. Blackwell Publishers, Oxford, pp. 74–89.

Mol, A. & Law, J. (1994) :'Regions, Networks, and Fluids: Anaemia and Social Topology', *Social Studies of Science*, vol. 24(4), pp. 641-672.

Monden, Y. (1983): ‘Toyota Production System’, Georgia: Institute of Industrial Engineers

Mouritsen, J. & Bekke, A. (1999): ‘A Space for Time: Accounting and Time Based Management in a High Technology Company’, *Management Accounting Research*, vol. 10, pp. 159-180

Mowday, R.T.; Porter, L. W.; Steers, R. M. (1982): ‘Employee-organization linkages: The psychology of commitment, absenteeism and turnover’, Academic Press (New York)

Ohno, T. (1988): ‘Toyota Production System: Beyond Large-Scale Production’, Productivity Press

Otley, D. (1999): ‘Performance Management: A Framework for Management Control Systems Research’, *Management Accounting Research,* Vol 10, No 4.

Otley, D. & Berry, A. (1980): "Control, organization and accounting ", *Accounting, Organizations and Society*, Vol. 5 No.2, pp.231-44

Ouchi, W. G. (1977): ‘The relationship between organizational structure and organizational control’, *Administrative Science Quarterly,* Vol. 22, pp. 95-113.

Pall, G. A. (1987): ‘Quality Process Management.’, Prentice-Hall, Englewood Cliffs, NJ.

Paez, O.; Salem, S.; Solomon, J.; Genaidy, A. (2005): ‘Moving from lean manufacturing to lean construction: Toward a common sociotechnical framework’, *Human Factors and Ergonomics in Manufacturing & Service Industries*, Vol. 15, 2, pp. 233-245

Pettersen, J. (2009): ‘Defining lean production: some conceptual and practical issues’, *The TQM Journal,* Vol. 21, 2, pp. 127-142

Perera, S.; Harrison, G. and Poole, M. (1997): 'Customer-focused manufacturing strategy and the use of operations-based non-financial performance measures: a research note', *Accounting, Organizations and Society*, 22, pp. 557–572

Perera, S.; McKinnon, J. L.; Harrison (2003): 'Diffusion of transfer pricing innovation in the context of commercialization – a longitudinal case study of a government trading enterprise', *Management Accounting Research,* 14, pp. 140-164.

Pinch, T., Mulkay, M., Ashmore, M. (1989), "Clinical budgeting: experimentation in the social sciences: a drama in five acts", *Accounting, Organizations and Society*, Vol. 14 No.3, pp. 271-301.

Powell, W. W. & DiMaggio, P. J. (1991): 'The new institutionalism in organizational analysis', University of Chicago Press.

Preston, A., Cooper, D., Coombs, R. (1992), "Fabricating budgets: a study of the production of management budgeting in the national health service", *Accounting, Organizations and Society*, Vol. 17 No.6, pp.561-93.

Quattrone, P. & Hopper, T.: 'What does organizational change mean? Speculations on a taken for granted category', (2001), *Management Accounting Research* ,**12** , pp. 403–435.

Robson, K., (1991): 'On the arenas of accounting change', *Accounting, Organizations and Society*, Vol. 16, pp. 521-547.

Rogers, E. M. (1995): 'Diffusion of innovations', New York: free Press

Rother, M. and Shook, J. (1998): 'Learning To See: Value Stream Mapping to Add Value and Eliminate Muda', The Lean Enterprise Institute, Brookline, MA.

Røvik, K. A. (1998): 'Moderne Organisasjoner', Oslo/Bergen, Fagbokforlaget

Samson, D. & Daft, R. L. (2008): 'Management', Cengage Learning.

Sarkar, D. (2007): 'Lean for Service Organizations and Offices - A Holistic Approach for Operational Excellence'.

Scapens, R.W. (1990), "Researching management accounting practice: the role of case study methods", *British Accounting Review*, Vol. 22, pp.259-81.

Scapens, R. W. & Roberts, J. (1993): 'Accounting and control: a case study of resistance to accounting change', *Management Accounting Research,* 4, pp. 1–32.

Schonberger, R. (1982): 'Japanese Manufacturing Techniques: Nine Hidden Lessons in Simplicity'

Shah, R. & Ward, P. T. (2003): 'Lean manufacturing: context, practice bundles, and performance', (2003), *Journal of Operations Management*, 21 (2), pp.129-149.

Shah, R. & Ward, P. T. (2007): 'Defining and developing measures of lean production', *Journal of Operations Management*, 25, pp. 785-805.

Shank, J. K., & Govindarajan, V. (1993): 'Strategic cost management: The new tool for competitive advantage', New York, NY, The Free Press

Shields, M. D.: "An Empirical Analysis of Firms' implementation experiences with Activity-Based Costing.", (1995). *Journal of Management Accounting Research*, pp. 148-166.

Shields, M. D., & Young, S. M. (1991): 'Managing product life cycle costs: an organizational model', *Journal of Cost Management*, 5, pp. 39–52.

Shingo, S. (1981): 'Study of Toyota Production System.', Japan Management Association, Tokyo.

Shingo, S. (1985): 'A Revolution in Manufacturing : The Smed System', Productivity Press

Shigeo Shingo (1990): 'Modern Approaches to Manufacturing Improvement : The Shingo System', Productivity Press.

Silverman, D. (2000): 'Doing Qualitative Research: A Practical Handbook', Sage.

Souza, L. B. d. (2009): 'Trends and approaches in lean healthcare', *Leadership in Health Services*, Vol. 22, no. 2, pp. 121-139.

Stalk, G., Jr., and Hout, T.M (1990): ‘Competing against time: How time-based competition is reshaping global markets’, NY: Free Press.

Star, S. L. and J. R. Griesemer (1989): "Institutional Ecology, 'Translations,' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907 - 1939", Social Studies of Science 19: 387-420.

Steen, M. van der (2009): ‘Inertia and management accounting change’, *Accounting, Audability & Accountability Journal,* Vol. 22, No. 5, pp. 736-761

Stiles, W.B. (1993): ‘Quality control in qualitative research’, *Clinical Psychology Review*, Vol. 13 pp.593-618.

Strank, R. (1983): ‘Management Principles and Practice. A Cybernetic Approach’, Gordon and Breach Science Publishers, New York.

Suarez Barraza, M. F. (2009); Smith, T., Dahlgaard-Park, S. M.: ‘ Lean-kaizen public service: an empirical approach in Spanish local governments’, *The TQM Journal,* Vol. 21, no. 2, pp. 143-167.

Sugimori, Y., Kusunoki, K., Cho, F., Uchikawa, S., (1977): ‘Toyota Production System and Kanban system: materialization of just-intime and respect-for-human system’, *International Journal of Production Research*, 15, 6, pp. 553–564.

Sullivan, J.J. (1992): "Japanese management philosophies: from the vacuous to the brilliant", *California Management Review*, Vol. 34 No.2, pp.66-87.

Swan, J. (2004): ‘Reply to Clark: Fashion of Management Fashion’, *Organization*, Vol. 11, 2, pp. 307-313

Taylor, F. (1911): ‘The Principles of Scientific Management’

Van de Ven, A.H., Angle. H.A., & Poole, M.S. (1989): ‘Research on the Management of Innovation: The Minnesota Studies’, New York: Ballinger/Harper and Row.

White, H. (1978), *Tropics of Discourse: Essays in Cultural Criticism*, The John Hopkins University Press, Baltimore, MD, .

Williams, K., Haslam, C., Johal, S., Williams, J., Adcroft, A., Willis, R. (1995): "Management practice or structural factors: the case of America versus Japan in the car industry", *Economic and Industrial Democracy*, Vol. 16 No.1, pp.9-37.

Winch, G.M.: 'Towards a theory of construction as production by projects', (2006), *Building Research and Information*Vol. 34 No.2, pp.164-74.

Wolcott, Harry F. (1999): "Ethnography: A Way of Seeing." Walnut Creek, CA: AltaMira Press.

Womack, J.P.; Jones, D.T.; Roos, D.(1990): 'The Machine That Changed The World'.

Womack, J.P.; Jones, D.T. (1996): 'Lean Thinking: Banish Waste and Create Wealth in Your Corporation'.

Wruck, K. H. & Jensen, M. C.: "Science, Specific Knowledge, and Total Quality Management", *Journal of Accounting & Economics,* 18, no. 3, pp. 247-287.

Yin, R. (1994): "Case study research: Design and methods", (2nd ed.), Beverly Hills, CA: Sage Publishing.

Yin, R. (2003): "Case study research: Design and methods", (3rd ed.), Beverly Hills, CA: Sage Publishing.

TITLER I PH.D.SERIEN:

2004

1. Martin Grieger
Internet-based Electronic Marketplaces and Supply Chain Management

2. Thomas Basbøll
LIKENESS
A Philosophical Investigation

3. Morten Knudsen
Beslutningens vaklen
En systemteoretisk analyse of moderniseringen af et amtskommunalt sundhedsvæsen 1980-2000

4. Lars Bo Jeppesen
Organizing Consumer Innovation
A product development strategy that is based on online communities and allows some firms to benefit from a distributed process of innovation by consumers

5. Barbara Dragsted
SEGMENTATION IN TRANSLATION AND TRANSLATION MEMORY SYSTEMS
An empirical investigation of cognitive segmentation and effects of integrating a TM system into the translation process

6. Jeanet Hardis
Sociale partnerskaber
Et socialkonstruktivistisk casestudie af partnerskabsaktørers virkelighedsopfattelse mellem identitet og legitimitet

7. Henriette Hallberg Thygesen
System Dynamics in Action

8. Carsten Mejer Plath
Strategisk Økonomistyring

9. Annemette Kjærgaard
Knowledge Management as Internal Corporate Venturing
– a Field Study of the Rise and Fall of a Bottom-Up Process

10. Knut Arne Hovdal
De profesjonelle i endring
Norsk ph.d., ej til salg gennem Samfundslitteratur

11. Søren Jeppesen
Environmental Practices and Greening Strategies in Small Manufacturing Enterprises in South Africa
– A Critical Realist Approach

12. Lars Frode Frederiksen
Industriel forskningsledelse
– på sporet af mønstre og samarbejde i danske forskningsintensive virksomheder

13. Martin Jes Iversen
The Governance of GN Great Nordic
– in an age of strategic and structural transitions 1939-1988

14. Lars Pynt Andersen
The Rhetorical Strategies of Danish TV Advertising
A study of the first fifteen years with special emphasis on genre and irony

15. Jakob Rasmussen
Business Perspectives on E-learning

16. Sof Thrane
The Social and Economic Dynamics of Networks
– a Weberian Analysis of Three Formalised Horizontal Networks

17. Lene Nielsen
Engaging Personas and Narrative Scenarios – a study on how a user-centered approach influenced the perception of the design process in the e-business group at AstraZeneca

18. S.J Valstad
Organisationsidentitet
Norsk ph.d., ej til salg gennem Samfundslitteratur

19. Thomas Lyse Hansen
Six Essays on Pricing and Weather risk in Energy Markets

20. Sabine Madsen
Emerging Methods – An Interpretive Study of ISD Methods in Practice

21. Evis Sinani
The Impact of Foreign Direct Investment on Efficiency, Productivity Growth and Trade: An Empirical Investigation

22. Bent Meier Sørensen
Making Events Work Or, How to Multiply Your Crisis

23. Pernille Schnoor
Brand Ethos
Om troværdige brand- og virksomhedsidentiteter i et retorisk og diskursteoretisk perspektiv

24. Sidsel Fabech
Von welchem Österreich ist hier die Rede?
Diskursive forhandlinger og magtkampe mellem rivaliserende nationale identitetskonstruktioner i østrigske pressediskurser

25. Klavs Odgaard Christensen
Sprogpolitik og identitetsdannelse i flersprogede forbundsstater
Et komparativt studie af Schweiz og Canada

26. Dana B. Minbaeva
Human Resource Practices and Knowledge Transfer in Multinational Corporations

27. Holger Højlund
Markedets politiske fornuft
Et studie af velfærdens organisering i perioden 1990-2003

28. Christine Mølgaard Frandsen
A.s erfaring
Om mellemværendets praktik i en transformation af mennesket og subjektiviteten

29. Sine Nørholm Just
The Constitution of Meaning – A Meaningful Constitution?
Legitimacy, identity, and public opinion in the debate on the future of Europe

2005

1. Claus J. Varnes
Managing product innovation through rules – The role of formal and structured methods in product development

2. Helle Hedegaard Hein
Mellem konflikt og konsensus – Dialogudvikling på hospitalsklinikker

3. Axel Rosenø
Customer Value Driven Product Innovation – A Study of Market Learning in New Product Development

4. Søren Buhl Pedersen
Making space
An outline of place branding

5. Camilla Funck Ellehave
Differences that Matter
An analysis of practices of gender and organizing in contemporary workplaces

6. Rigmor Madeleine Lond
Styring af kommunale forvaltninger

7. Mette Aagaard Andreassen
Supply Chain versus Supply Chain Benchmarking as a Means to Managing Supply Chains

8. Caroline Aggestam-Pontoppidan
From an idea to a standard
The UN and the global governance of accountants' competence

9. Norsk ph.d.

10. Vivienne Heng Ker-ni
An Experimental Field Study on the

Effectiveness of Grocer Media Advertising
Measuring Ad Recall and Recognition, Purchase Intentions and Short-Term Sales

11. Allan Mortensen
Essays on the Pricing of Corporate Bonds and Credit Derivatives

12. Remo Stefano Chiari
Figure che fanno conoscere
Itinerario sull'idea del valore cognitivo e espressivo della metafora e di altri tropi da Aristotele e da Vico fino al cognitivismo contemporaneo

13. Anders Mcllquham-Schmidt
Strategic Planning and Corporate Performance
An integrative research review and a meta-analysis of the strategic planning and corporate performance literature from 1956 to 2003

14. Jens Geersbro
The TDF – PMI Case
Making Sense of the Dynamics of Business Relationships and Networks

15 Mette Andersen
Corporate Social Responsibility in Global Supply Chains
Understanding the uniqueness of firm behaviour

16. Eva Boxenbaum
Institutional Genesis: Micro – Dynamic Foundations of Institutional Change

17. Peter Lund-Thomsen
Capacity Development, Environmental Justice NGOs, and Governance: The Case of South Africa

18. Signe Jarlov
Konstruktioner af offentlig ledelse

19. Lars Stæhr Jensen
Vocabulary Knowledge and Listening Comprehension in English as a Foreign Language
An empirical study employing data elicited from Danish EFL learners

20. Christian Nielsen
Essays on Business Reporting
Production and consumption of strategic information in the market for information

21. Marianne Thejls Fischer
Egos and Ethics of Management Consultants

22. Annie Bekke Kjær
Performance management i Proces-innovation
– belyst i et social-konstruktivistisk perspektiv

23. Suzanne Dee Pedersen
GENTAGELSENS METAMORFOSE
Om organisering af den kreative gøren i den kunstneriske arbejdspraksis

24. Benedikte Dorte Rosenbrink
Revenue Management
Økonomiske, konkurrencemæssige & organisatoriske konsekvenser

25. Thomas Riise Johansen
Written Accounts and Verbal Accounts
The Danish Case of Accounting and Accountability to Employees

26. Ann Fogelgren-Pedersen
The Mobile Internet: Pioneering Users' Adoption Decisions

27. Birgitte Rasmussen
Ledelse i fællesskab – de tillidsvalgtes fornyende rolle

28. Gitte Thit Nielsen
Remerger
– skabende ledelseskræfter i fusion og opkøb

29. Carmine Gioia
A MICROECONOMETRIC ANALYSIS OF MERGERS AND ACQUISITIONS

30. Ole Hinz
Den effektive forandringsleder: pilot, pædagog eller politiker?
Et studie i arbejdslederes meningstilskrivninger i forbindelse med vellykket gennemførelse af ledelsesinitierede forandringsprojekter

31. Kjell-Åge Gotvassli
Et praksisbasert perspektiv på dynamiske
læringsnettverk i toppidretten
Norsk ph.d., ej til salg gennem Samfundslitteratur

32. Henriette Langstrup Nielsen
Linking Healthcare
An inquiry into the changing performances of web-based technology for asthma monitoring

33. Karin Tweddell Levinsen
Virtuel Uddannelsespraksis
Master i IKT og Læring – et casestudie i hvordan proaktiv proceshåndtering kan forbedre praksis i virtuelle læringsmiljøer

34. Anika Liversage
Finding a Path
Labour Market Life Stories of Immigrant Professionals

35. Kasper Elmquist Jørgensen
Studier i samspillet mellem stat og erhvervsliv i Danmark under 1. verdenskrig

36. Finn Janning
A DIFFERENT STORY
Seduction, Conquest and Discovery

37. Patricia Ann Plackett
Strategic Management of the Radical Innovation Process
Leveraging Social Capital for Market Uncertainty Management

2006

1. Christian Vintergaard
Early Phases of Corporate Venturing

2. Niels Rom-Poulsen
Essays in Computational Finance

3. Tina Brandt Husman
Organisational Capabilities, Competitive Advantage & Project-Based Organisations
The Case of Advertising and Creative Good Production

4. Mette Rosenkrands Johansen
Practice at the top
– how top managers mobilise and use non-financial performance measures

5. Eva Parum
Corporate governance som strategisk kommunikations- og ledelsesværktøj

6. Susan Aagaard Petersen
Culture's Influence on Performance Management: The Case of a Danish Company in China

7. Thomas Nicolai Pedersen
The Discursive Constitution of Organizational Governance – Between unity and differentiation
The Case of the governance of environmental risks by World Bank environmental staff

8. Cynthia Selin
Volatile Visions: Transactons in Anticipatory Knowledge

9. Jesper Banghøj
Financial Accounting Information and Compensation in Danish Companies

10. Mikkel Lucas Overby
Strategic Alliances in Emerging High-Tech Markets: What's the Difference and does it Matter?

11. Tine Aage
External Information Acquisition of Industrial Districts and the Impact of Different Knowledge Creation Dimensions

A case study of the Fashion and Design Branch of the Industrial District of Montebelluna, NE Italy

12. Mikkel Flyverbom
Making the Global Information Society Governable
On the Governmentality of Multi-Stakeholder Networks

13. Anette Grønning
Personen bag
Tilstedeværelse i e-mail som interaktionsform mellem kunde og medarbejder i dansk forsikringskontekst

14. Jørn Helder
One Company – One Language?
The NN-case

15. Lars Bjerregaard Mikkelsen
Differing perceptions of customer value
Development and application of a tool for mapping perceptions of customer value at both ends of customer-supplier dyads in industrial markets

16. Lise Granerud
Exploring Learning
Technological learning within small manufacturers in South Africa

17. Esben Rahbek Pedersen
Between Hopes and Realities: Reflections on the Promises and Practices of Corporate Social Responsibility (CSR)

18. Ramona Samson
The Cultural Integration Model and European Transformation.
The Case of Romania

2007

1. Jakob Vestergaard
Discipline in The Global Economy
Panopticism and the Post-Washington Consensus

2. Heidi Lund Hansen
Spaces for learning and working
A qualitative study of change of work, management, vehicles of power and social practices in open offices

3. Sudhanshu Rai
Exploring the internal dynamics of software development teams during user analysis
A tension enabled Institutionalization Model; "Where process becomes the objective"

4. Norsk ph.d.
Ej til salg gennem Samfundslitteratur

5. Serden Ozcan
EXPLORING HETEROGENEITY IN ORGANIZATIONAL ACTIONS AND OUTCOMES
A Behavioural Perspective

6. Kim Sundtoft Hald
Inter-organizational Performance Measurement and Management in Action
– An Ethnography on the Construction of Management, Identity and Relationships

7. Tobias Lindeberg
Evaluative Technologies
Quality and the Multiplicity of Performance

8. Merete Wedell-Wedellsborg
Den globale soldat
Identitetsdannelse og identitetsledelse i multinationale militære organisationer

9. Lars Frederiksen
Open Innovation Business Models
Innovation in firm-hosted online user communities and inter-firm project ventures in the music industry
– A collection of essays

10. Jonas Gabrielsen
Retorisk toposlære – fra statisk 'sted' til persuasiv aktivitet

11. Christian Moldt-Jørgensen
Fra meningsløs til meningsfuld evaluering.
Anvendelsen af studentertilfredshedsmålinger på de korte og mellemlange videregående uddannelser set fra et psykodynamisk systemperspektiv

12. Ping Gao
Extending the application of actor-network theory
Cases of innovation in the telecommunications industry

13. Peter Mejlby
Frihed og fængsel, en del af den samme drøm?
Et phronetisk baseret casestudie af frigørelsens og kontrollens sameksistens i værdibaseret ledelse!

14. Kristina Birch
Statistical Modelling in Marketing

15. Signe Poulsen
Sense and sensibility:
The language of emotional appeals in insurance marketing

16. Anders Bjerre Trolle
Essays on derivatives pricing and dynamic asset allocation

17. Peter Feldhütter
Empirical Studies of Bond and Credit Markets

18. Jens Henrik Eggert Christensen
Default and Recovery Risk Modeling and Estimation

19. Maria Theresa Larsen
Academic Enterprise: A New Mission for Universities or a Contradiction in Terms?
Four papers on the long-term implications of increasing industry involvement and commercialization in academia

20. Morten Wellendorf
Postimplementering af teknologi i den offentlige forvaltning
Analyser af en organisations kontinuerlige arbejde med informationsteknologi

21. Ekaterina Mhaanna
Concept Relations for Terminological Process Analysis

22. Stefan Ring Thorbjørnsen
Forsvaret i forandring
Et studie i officerers kapabiliteter under påvirkning af omverdenens forandringspres mod øget styring og læring

23. Christa Breum Amhøj
Det selvskabte medlemskab om managementstaten, dens styringsteknologier og indbyggere

24. Karoline Bromose
Between Technological Turbulence and Operational Stability
– An empirical case study of corporate venturing in TDC

25. Susanne Justesen
Navigating the Paradoxes of Diversity in Innovation Practice
– A Longitudinal study of six very different innovation processes – in practice

26. Luise Noring Henler
Conceptualising successful supply chain partnerships
– Viewing supply chain partnerships from an organisational culture perspective

27. Mark Mau
Kampen om telefonen
Det danske telefonvæsen under den tyske besættelse 1940-45

28. Jakob Halskov
The semiautomatic expansion of existing terminological ontologies using knowledge patterns discovered

on the WWW – an implementation and evaluation

29. Gergana Koleva
European Policy Instruments Beyond Networks and Structure: The Innovative Medicines Initiative

30. Christian Geisler Asmussen
Global Strategy and International Diversity: A Double-Edged Sword?

31. Christina Holm-Petersen
Stolthed og fordom
Kultur- og identitetsarbejde ved skabelsen af en ny sengeafdeling gennem fusion

32. Hans Peter Olsen
Hybrid Governance of Standardized States
Causes and Contours of the Global Regulation of Government Auditing

33. Lars Bøge Sørensen
Risk Management in the Supply Chain

34. Peter Aagaard
Det unikkes dynamikker
De institutionelle mulighedsbetingelser bag den individuelle udforskning i professionelt og frivilligt arbejde

35. Yun Mi Antorini
Brand Community Innovation
An Intrinsic Case Study of the Adult Fans of LEGO Community

36. Joachim Lynggaard Boll
Labor Related Corporate Social Performance in Denmark
Organizational and Institutional Perspectives

2008

1. Frederik Christian Vinten
Essays on Private Equity

2. Jesper Clement
Visual Influence of Packaging Design on In-Store Buying Decisions

3. Marius Brostrøm Kousgaard
Tid til kvalitetsmåling?
– Studier af indrulleringsprocesser i forbindelse med introduktionen af kliniske kvalitetsdatabaser i speciallægepraksissektoren

4. Irene Skovgaard Smith
Management Consulting in Action
Value creation and ambiguity in client-consultant relations

5. Anders Rom
Management accounting and integrated information systems
How to exploit the potential for management accounting of information technology

6. Marina Candi
Aesthetic Design as an Element of Service Innovation in New Technology-based Firms

7. Morten Schnack
Teknologi og tværfaglighed
– en analyse af diskussionen omkring indførelse af EPJ på en hospitalsafdeling

8. Helene Balslev Clausen
Juntos pero no revueltos – un estudio sobre emigrantes norteamericanos en un pueblo mexicano

9. Lise Justesen
Kunsten at skrive revisionsrapporter. En beretning om forvaltningsrevisionens beretninger

10. Michael E. Hansen
The politics of corporate responsibility: CSR and the governance of child labor and core labor rights in the 1990s

11. Anne Roepstorff
Holdning for handling – en etnologisk undersøgelse af Virksomheders Sociale Ansvar/CSR

12. Claus Bajlum
Essays on Credit Risk and Credit Derivatives

13. Anders Bojesen
The Performative Power of Competence – an Inquiry into Subjectivity and Social Technologies at Work

14. Satu Reijonen
Green and Fragile
A Study on Markets and the Natural Environment

15. Ilduara Busta
Corporate Governance in Banking
A European Study

16. Kristian Anders Hvass
A Boolean Analysis Predicting Industry Change: Innovation, Imitation & Business Models
The Winning Hybrid: A case study of isomorphism in the airline industry

17. Trine Paludan
De uvidende og de udviklingsparate
Identitet som mulighed og restriktion blandt fabriksarbejdere på det aftayloriserede fabriksgulv

18. Kristian Jakobsen
Foreign market entry in transition economies: Entry timing and mode choice

19. Jakob Elming
Syntactic reordering in statistical machine translation

20. Lars Brømsøe Termansen
Regional Computable General Equilibrium Models for Denmark
Three papers laying the foundation for regional CGE models with agglomeration characteristics

21. Mia Reinholt
The Motivational Foundations of Knowledge Sharing

22. Frederikke Krogh-Meibom
The Co-Evolution of Institutions and Technology
– A Neo-Institutional Understanding of Change Processes within the Business Press – the Case Study of Financial Times

23. Peter D. Ørberg Jensen
OFFSHORING OF ADVANCED AND HIGH-VALUE TECHNICAL SERVICES: ANTECEDENTS, PROCESS DYNAMICS AND FIRMLEVEL IMPACTS

24. Pham Thi Song Hanh
Functional Upgrading, Relational Capability and Export Performance of Vietnamese Wood Furniture Producers

25. Mads Vangkilde
Why wait?
An Exploration of first-mover advantages among Danish e-grocers through a resource perspective

26. Hubert Buch-Hansen
Rethinking the History of European Level Merger Control
A Critical Political Economy Perspective

2009

1. Vivian Lindhardsen
From Independent Ratings to Communal Ratings: A Study of CWA Raters' Decision-Making Behaviours

2. Guðrið Weihe
Public-Private Partnerships: Meaning and Practice

3. Chris Nøkkentved
Enabling Supply Networks with Collaborative Information Infrastructures
An Empirical Investigation of Business Model Innovation in Supplier Relationship Management

4. Sara Louise Muhr
Wound, Interrupted – On the Vulnerability of Diversity Management

5. Christine Sestoft
Forbrugeradfærd i et Stats- og Livsformsteoretisk perspektiv

6. Michael Pedersen
Tune in, Breakdown, and Reboot: On the production of the stress-fit self-managing employee

7. Salla Lutz
Position and Reposition in Networks – Exemplified by the Transformation of the Danish Pine Furniture Manufacturers

8. Jens Forssbæck
Essays on market discipline in commercial and central banking

9. Tine Murphy
Sense from Silence – A Basis for Organised Action
How do Sensemaking Processes with Minimal Sharing Relate to the Reproduction of Organised Action?

10. Sara Malou Strandvad
Inspirations for a new sociology of art: A sociomaterial study of development processes in the Danish film industry

11. Nicolaas Mouton
On the evolution of social scientific metaphors:
A cognitive-historical enquiry into the divergent trajectories of the idea that collective entities – states and societies, cities and corporations – are biological organisms.

12. Lars Andreas Knutsen
Mobile Data Services:
Shaping of user engagements

13. Nikolaos Theodoros Korfiatis
Information Exchange and Behavior
A Multi-method Inquiry on Online Communities

14. Jens Albæk
Forestillinger om kvalitet og tværfaglighed på sygehuse
– skabelse af forestillinger i læge- og plejegrupperne angående relevans af nye idéer om kvalitetsudvikling gennem tolkningsprocesser

15. Maja Lotz
The Business of Co-Creation – and the Co-Creation of Business

16. Gitte P. Jakobsen
Narrative Construction of Leader Identity in a Leader Development Program Context

17. Dorte Hermansen
"Living the brand" som en brandorienteret dialogisk praxis:
Om udvikling af medarbejdernes brandorienterede dømmekraft

18. Aseem Kinra
Supply Chain (logistics) Environmental Complexity

19. Michael Nørager
How to manage SMEs through the transformation from non innovative to innovative?

20. Kristin Wallevik
Corporate Governance in Family Firms
The Norwegian Maritime Sector

21. Bo Hansen Hansen
Beyond the Process
Enriching Software Process Improvement with Knowledge Management

22. Annemette Skot-Hansen
Franske adjektivisk afledte adverbier, der tager præpositionssyntagmer indledt med præpositionen à som argumenter
En valensgrammatisk undersøgelse

23. Line Gry Knudsen
Collaborative R&D Capabilities
In Search of Micro-Foundations

24. Christian Scheuer
Employers meet employees
Essays on sorting and globalization

25. Rasmus Johnsen
The Great Health of Melancholy
A Study of the Pathologies of Performativity

26. Ha Thi Van Pham
Internationalization, Competitiveness Enhancement and Export Performance of Emerging Market Firms:
Evidence from Vietnam

27. Henriette Balieu
Kontrolbegrebets betydning for kausativalternationen i spansk
En kognitiv-typologisk analyse

2010

1. Yen Tran
Organizing Innovationin Turbulent Fashion Market
Four papers on how fashion firms create and appropriate innovation value

2. Anders Raastrup Kristensen
Metaphysical Labour
Flexibility, Performance and Commitment in Work-Life Management

3. Margrét Sigrún Sigurdardottir
Dependently independent
Co-existence of institutional logics in the recorded music industry

4. Ásta Dis Óladóttir
Internationalization from a small domestic base:
An empirical analysis of Economics and Management

5. Christine Secher
E-deltagelse i praksis – politikernes og forvaltningens medkonstruktion og konsekvenserne heraf

6. Marianne Stang Våland
What we talk about when we talk about space:
End User Participation between Processes of Organizational and Architectural Design

7. Rex Degnegaard
Strategic Change Management
Change Management Challenges in the Danish Police Reform

8. Ulrik Schultz Brix
Værdi i rekruttering – den sikre beslutning
En pragmatisk analyse af perception og synliggørelse af værdi i rekrutterings- og udvælgelsesarbejdet

9. Jan Ole Similä
Kontraktsledelse
Relasjonen mellom virksomhetsledelse og kontraktshåndtering, belyst via fire norske virksomheter

10. Susanne Boch Waldorff
Emerging Organizations: In between local translation, institutional logics and discourse

11. Brian Kane
Performance Talk
Next Generation Management of Organizational Performance

12. Lars Ohnemus
Brand Thrust: Strategic Branding and Shareholder Value
An Empirical Reconciliation of two Critical Concepts

13. Jesper Schlamovitz
Håndtering af usikkerhed i film- og byggeprojekter

14. Tommy Moesby-Jensen
Det faktiske livs forbindtlighed
Førsokratisk informeret, ny-aristotelisk ἦθος*-tænkning hos Martin Heidegger*

15. Christian Fich
Two Nations Divided by Common Values
French National Habitus and the Rejection of American Power

16. Peter Beyer
Processer, sammenhængskraft og fleksibilitet
Et empirisk casestudie af omstillingsforløb i fire virksomheder

17. Adam Buchhorn
Markets of Good Intentions
Constructing and Organizing Biogas Markets Amid Fragility and Controversy

18. Cecilie K. Moesby-Jensen
Social læring og fælles praksis
Et mixed method studie, der belyser læringskonsekvenser af et lederkursus for et praksisfællesskab af offentlige mellemledere

19. Heidi Boye
Fødevarer og sundhed i senmodernismen
– En indsigt i hyggefænomenet og de relaterede fødevarepraksisser

20. Kristine Munkgård Pedersen
Flygtige forbindelser og midlertidige mobiliseringer
Om kulturel produktion på Roskilde Festival

21. Oliver Jacob Weber
Causes of Intercompany Harmony in Business Markets – An Empirical Investigation from a Dyad Perspective

22. Susanne Ekman
Authority and Autonomy
Paradoxes of Modern Knowledge Work

23. Anette Frey Larsen
Kvalitetsledelse på danske hospitaler
– Ledelsernes indflydelse på introduktion og vedligeholdelse af kvalitetsstrategier i det danske sundhedsvæsen

24. Toyoko Sato
Performativity and Discourse: Japanese Advertisements on the Aesthetic Education of Desire

25. Kenneth Brinch Jensen
Identifying the Last Planner System
Lean management in the construction industry

TITLER I ATV PH.D.-SERIEN

1992
1. Niels Kornum
Servicesamkørsel – organisation, økonomi og planlægningsmetoder

1995
2. Verner Worm
Nordiske virksomheder i Kina
Kulturspecifikke interaktionsrelationer ved nordiske virksomhedsetableringer i Kina

1999
3. Mogens Bjerre
Key Account Management of Complex Strategic Relationships
An Empirical Study of the Fast Moving Consumer Goods Industry

2000
4. Lotte Darsø
Innovation in the Making
Interaction Research with heterogeneous Groups of Knowledge Workers creating new Knowledge and new Leads

2001
5. Peter Hobolt Jensen
Managing Strategic Design Identities
The case of the Lego Developer Network

2002
6. Peter Lohmann
The Deleuzian Other of Organizational Change – Moving Perspectives of the Human

7. Anne Marie Jess Hansen
To lead from a distance: The dynamic interplay between strategy and strategizing – A case study of the strategic management process

2003
8. Lotte Henriksen
Videndeling
– om organisatoriske og ledelsesmæs-

sige udfordringer ved videndeling i praksis

9. Niels Christian Nickelsen
Arrangements of Knowing: Coordinating Procedures Tools and Bodies in Industrial Production – a case study of the collective making of new products

2005

10. Carsten Ørts Hansen
Konstruktion af ledelsesteknologier og effektivitet

TITLER I DBA PH.D.-SERIEN

2007

1. Peter Kastrup-Misir
Endeavoring to Understand Market Orientation – and the concomitant co-mutation of the researched, the researcher, the research itself and the truth

2009

1. Torkild Leo Thellefsen
Fundamental Signs and Significance-effects
A Semeiotic outline of Fundamental Signs, Significance-effects, Knowledge Profiling and their use in Knowledge Organization and Branding

2. Daniel Ronzani
When Bits Learn to Walk Don't Make Them Trip
Technological Innovation and the Role of Regulation by Law in Information Systems Research: the Case of Radio Frequency Identification (RFID)

2010

1. Alexander Carnera
Magten over livet og livet som magt
Studier i den biopolitiske ambivalens