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A Case Study: An Analysis of a Finnish Construction Site Meeting Through the Lens of Chaos and Control Theories

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Abstract

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The purpose of the dissertation is to examine and analyse a Finnish construction site meeting through the lens of chaos and control theories and to determine why the construction site meeting did not work out well and how to solve the issues aroused in the meeting. As construction site meetings play a key role in the communication and integration between all crucial participants of construction site meetings, this study will contribute in understanding the meetings better and the nature of chaos and control in construction site meetings and how to make the construction site meetings more efficient.

A qualitative analysis of a confidential Finnish construction site meeting was conducted and a critical review of chaos and control theories was carried out. Some chaotic aspects can be seen in the case study as the degree of control is fairly low making the meeting inefficient and long lacking of direction. In this case there is a need for control in construction site meetings because a higher degree of control instead of chaos in this construction site meeting will make the meetings more efficient whereas low level of control only lead to long discussions instead of innovation and creativity.

However, as chaos and control theories have been applied only to this one particular case study the findings cannot be generalized into meetings. The end result of construction site meetings might also be dependent of the group dynamics, culture and background of the participants and therefore they need to be examined more.

Keywords	chaos, complexity, control, construction site meeting

Contents

1 Introduction

The purpose of this dissertation is to examine a particular case of a Finnish construction site meeting through the lens of chaos and control theories. This research is a part of a larger project that the University of Helsinki is conducting. The case study is a two and a half hour long video of a Finnish construction site meeting held on 7th November 2011 with fifteen participants; project manager who also works as the chairman for the meeting, architect, general superintendent, structure designer, construction site supervisor, electricity contractor, thermal contractor, hpac (heating, plumbing, air-conditioning) foreman, hpace (heating, plumbing, air-conditioning and electricity) designer, ac (air-conditioning) contractor, the researcher from the University of Helsinki and three other participants with no background information of their position and therefore we will call them John, Adam and Dan. As the meeting was being held at the construction site, the noise of machines was overwhelming some parts of the conversations making it extremely difficult to listen to the conversation. The research was strictly confidential. The construction site meeting lasted 142 minutes altogether after ten minutes of general discussion.

The aim of the dissertation is to analyse a particular Finnish construction meeting through chaos and control theories and to determine whether the construction site meeting was well managed or not. The central question to answer through the lens of chaos and control theories is why the construction site meeting did not work out well and how to resolve the issues? It is analysed if the chaos and complexity theories apply also to one this particular case and analyse if chaos in the construction site meeting leads to more open discussion and innovation or whether it will lead to a long, inefficient meeting without any decisions being made. As chaos and complexity theories have been used to analyse everyday conversations by Isabell in 2009, can some aspects of the theories be found in the construction site meeting? One of the key issues is to analyse how tight control the project manager has in the construction site meeting and how it affects the meeting and if control is needed in the construction site meeting at all. As some authors such as De Wit and Meyer (2010) argue, there is need for both control and chaos in organisations since without adequate degree of control the organisation might suffer

from weak co-operation and dissatisfaction among the employees might arise. However, with too tight control over the everyday procedures in an organisation the employees might feel suffocated (De Wit and Meyer, 2010). Same principles apply to meetings as well; it is important for a manager to control the time, topics and amount of people attending in the meeting since without proper control the meeting might suffer from several interruptions and participants talking on top of one another (Ranjit, 2005). One key point to examine is if the construction site meeting is efficient and are there people in the meeting who do not necessarily need to be there since meetings with large amount of people can quickly turn into inefficient conversation session with a little focus on the actual agenda (Hawkings, 1997). Analysing construction site meetings in Finland through the chaos and control theories can contribute significantly to improving communication and management in construction site meetings affecting the whole industry in a positive way and therefore this dissertation topic can be turn-taking.

The complexity theory is a study of dynamic, complex, non-linear systems pioneered by Lorenz as early as in 1963 (Levy, 2000). Complex systems are non-linear and capable of self-organisation which often occurs at the edge of chaos (Hilburt-Davis, 2000). Both chaos and complexity theories strive for detecting and integrate non-linear systems that are unpredictable, yet have underlying structure and order. There is a wide variety of literature available for chaos and complexity theories that have been applied first to physics and natural sciences but has later on become a hot theory to be used in social sciences as well. Many authors such as Merry (1990) have argued that many other systems such as social and ecological systems can be characterized by non-linear, complex relationships and interactions that tend to evolve over time and therefore chaos and complexity theories can be applied to them. Further research reveals that chaos and complexity theories have been applied also to conversations since many conversations are in fact, when examined closer, highly complex, non-linear, multi-topical entities (Isabell, 2009). Because construction site meetings are managed through conversations, it can be assumed that chaos and control theories can be applied to meetings as well. The subject of organisational meetings is fairly understudied because of the difficulty in accessing the meetings and documents that are usually confidential. However, meetings play key role in the co-ordination and management of organisational activities (Rice and Shook, 1990; Schwartzman, 1994; Smeltzer, 1993) and therefore they should be

examined more closely. In Finland, especially in recent years, some of the fundamental components affecting to the construction industry's poor performance have been identified to be ineffective communication practises, organisational fragmentation and lack of integration between design and production processes (Dainty et al, 2006). Construction site meetings play a key role in the communication and integration between all crucial participants since construction site meetings are participated by project manager, general superintendent and superintendent among other necessary advocates such as constructor, architect and construction site supervisor. Also, subcontractors, purchasing engineers and specialized foremen can be invited to the construction site meetings when necessary (RT 16-10837, Työmaakokouksen pöytäkirjan laatiminen, 2005). Therefore analysing construction site meetings can be extremely beneficial for the whole construction industry in Finland.

2 Literature Review

First it is necessary to look into some theory of construction in Finland in order to understand what construction sites are like in Finland, who participates the construction, how construction site meetings are being handled and what the issues are over all in Finland in project management. Background information will be given in order to achieve a general degree of understanding how construction is generally done in Finland. The information will focus purely on the key points relevant to the case study even though the material available is massive. In order to look into the case study through the lens of control, some key points of managerial control needs to be examined. Again, there is a large amount of literature available about control in management and the managerial control systems, the focus will be on the definition, the importance of control and on the consequences of control. The theories of control in management and meetings are chosen because even though the meeting has chaotic aspects, it also includes control in the form of agenda and chairman and therefore it is beneficial to use theory about control in this case study. To analyse the case through the lens of chaos and control theories, it is necessary to understand the nature of chaos and the theories available. The chosen theories to be beneficial are the chaos and complexity theories because the construction site meeting has chaotic aspects and the conversation in the meeting is

non-linear including complex relationships and interactions that evolve during the meeting. As the theories were firstly invented to be used in the field of physics and natural sciences it is essential to understand the key principles of the theories and to examine how they have been used before in social sciences and in particular, how they can be applied to conversations and therefore also in the particular case of construction site meeting. The theories of control and chaos might resolve why the construction site meeting does not work out well and to explain how to resolve the issues concerning the construction site meeting. Complexity and chaos theories are also used because they give us a new, interesting framework and a new point of view on how to analyse construction site meetings.

2.1 Construction site meetings in Finland

No general, comprehensive theory or principle for project management is being followed in Finland. Instead project management model consists of a combination of several different tools, methods and systems (Kankainen, 2009). According to a survey conducted in 2010, project management theories were the most unknown area for the project managers in Finland who answered the survey. 49% of the participants did not know about the subject or did not think to follow any theory or philosophy. The survey included 49 statements in the field of project management and was sent to 17 TuoVa project's participant construction sites and to 86 comparison construction sites. The participants would rate the statements from 1-4 according to how well the statement fit to the person's experience and aspect. The response percentage was 45% altogether (TuoVa-project, 2010). Project management's purpose in general is to plan how the objectives and requirement can be achieved as efficiently and economically as possible (PMBOK, 1996). Even though the main focus of management is on planning, the issue is usually not in planning but the implementation of plans and keeping them up to date because of the complex and apparently chaotic nature of production. In the majority of projects, time is being lost because of poor implementation of plans and needs to be compensated by unplanned compression of timetable (Seppänen, 2009). In recent years, some of the fundamental components affecting to the construction industry's poor performance have been identified to be ineffective communication practises, organisational fragmentation and lack of integration between design and production

processes (Dainty et al, 2006). In Finland, a construction site organisation is assembled by the constructor at the beginning of every construction project. According to the Finnish Land Using and Building Act which was renewed in 2000, there must be a superintendent who is responsible for the performance and quality of work (general superintendent) and when needed, specialised foremen. The construction site is being managed by the general superintendent who is in charge of, among other things, several foremen and often also construction site engineers or purchasing engineers (Koski, 1992). Even when there are foremen of special trades in the construction site, the general superintendent has the legal liability of the construction site management (Suomen ympäristö 565, 2002) and the general superintendent is also responsible for the end product, organising the required inspections, managing the work within accordance of the regulations and for occupational and site safety (Koski, 1992). Because foremen's actions have a direct effect on the productivity and the final quality of work (Serpell and Ferrada, 2006), they need to be managed productively. The two areas with the highest potential for influencing the performance and productivity are management skills and issues in man power and therefore management is the essential target for development (Rojas and Aramvareekul, 2003). In Finland, construction site meeting is defined as an occasion taking place in the construction site in which contractor parties and experts have the opportunity of meeting one another. For a construction site meeting, a prime contractor's announcement of the situation in the construction site and the agenda of the meeting are being prepared literary. The construction site meeting is usually being prepared by the construction site's general superintendent. The construction site meetings are held once a month *(Ratu KI-6016, Rakennutöiden laatu. 2009. p. 32).* Project manager, general superintendent and superintendent participate in the construction meeting among other necessary advocates such as constructor, architect and construction site supervisor. Subcontractors, purchasing engineers and specialized foremen can be invited to the construction site meetings when necessary, although it is essential to limit the amount of participants according to the topics covered in the construction site meeting (RT 16-10837, Työmaakokouksen pöytäkirjan laatiminen, 2005). According to a survey conducted in 2010, the participation of the subcontractors to meetings varies significantly even inside of the same organisation. Planned timetables do not always become true because the majority of the construction sites will not be

ready with the planned resource and a working phase that is considered to be “normal” (TuoVa-project, 2010).

2.2 How control is being used in management and meetings

Control is considered as one of the most important functions of managers. Though, for managers balancing creative innovation and the achievement of goals in a profitable, efficient way is problematic (Simons, 1995). The concept of management control can be traced back to the early sixties or even further and since then there has been an increase in the literature studying the concept (Bredmar, 2011). In management, control refers often to the activities of achieving certain standards or performance, evaluating and comparing the actual performance against the set standards and when necessary, employs corrective actions to achieve the organisation’s objectives. The organisation is effective when it achieves its goals and purpose. Management control systems are essential especially in cases where employees and managers do not have a clear idea what’s expected of them. In the management literature, the activities performed by managers have been divided into many different categories such as strategy planning and implementation, objective setting, performance measurement and control (Mintzberg, 1973; Merchant, 1985). Even though it is impossible to separate concretely the functions of a manager, both theorists and practitioners agree that the final function in the process of management is control (Chenhall, 2003). Although having many different meanings and variations, management control systems can be referred to be a combination of management, control and systems (Machin, 1983). The design and use of management control systems are influenced by, for example, the size and structure of the organisation, corporate strategy and managerial styles. Managerial styles play an essential role in the design and implementation of control systems since the chosen managerial style influences in the behaviour of the employees in the organisation (Chenhall, 2003). Control can be thought of as a part of strategic implications. It is argued that the proper execution of strategy is impossible without control (Anthony, 1988). It is also suggested that a certain level of control is necessary to ensure that the employees will do as the organisation expects them to do and to keep the organisation functional. Without control employees will lack of direction and motivation which will affect the outcome. In organisations chaos can be detected as missed deadlines, having

too few employees and other similar situations that are often considered negative (Hubler, Foster and Phelps, 2007). In order to have an absolute control the manager would need to have perfect control over all the employees which is not likely to happen because of human nature. However, the literature suggests that a decent degree of control is achievable and reasonable (Merchant, 1985). Without adequate degree of control, symptoms such as weak co-operation and dissatisfaction among the employees might arise. However, with too tight control over the everyday procedures in an organisation the employees might feel suffocated. The innovation and creativity in the organisation will suffer and might lead to the organisation to stay put not being able to get forward and obtain a sustainable competitive advantage. On the other hand, with too little control and too much of chaos in the organisation the organisation might not be successful in obtaining a competitive advantage since the employees can do what they want in the organisation and some important procedures might not be taken care of as well as they could be taken care off. Therefore there is demand for both control and chaos in organisations. The challenge for managers has always been balancing chaos and control (De Wit and Meyer, 2010).

To determine whether or not the construction site meeting was efficient or not, some theory about meetings in general is crucial to be looked into. Organisational meetings often have several characteristics; they are organised and planned in advance and involve invitations and possible goals of meeting in the form of agenda. The participants act according to their institutional roles and deal with institutional issues. Turn taking usually differs from everyday conversations and expert-lay interaction in that it is most often administered by a chairman (Asmuß and Svennevig, 2009). Meetings in an organisation have remained largely understudied subject although they have key role in the co-ordination and management of organisational activities (Rice and Shook, 1990; Schwartzman, 1994; Smeltzer, 1993). This is partly due to the difficulty of gaining access to the meetings and the documents produced in an organisation (Volkema and Niederman, 1996). An effective meeting increases work productivity, saves time, arouses motivation among the employees and becomes a tool for problem solving (Exforsys Inc). The use of an agenda to structure a business meeting is commonly thought to increase the efficiency of a meeting (Doyle and Straus, 1976; Kieffer, 1988; Mosvick and Nelson, 1987; Scholtes, 1988; The 3M Meeting Management Team, 1987). For influencing

meeting outcome and process, control of an agenda is a powerful tool (Kieffer, 1988). Agendas define also the purpose and structure for the meeting (Schwartzman, 1989) allowing participants to prepare for presentations, discussions and debate beforehand (Doyle and Straus, 1976; Scholtes, 1988). Along with agenda, it is advised to also use visual displays such as flip charts, transparencies and display technologies such as chalk boards (Burleson, 1990; The 3M Meeting Management Team, 1987). For meetings it is a necessity for the manager to firstly invite the right people and secondly to keep the focus on the agenda to ensure the efficiency of the meeting. Meetings with large amount of people can quickly turn into inefficient conversation session with a little focus on the actual agenda; therefore it is important for a manager to control the time, topics and amount of people attending in the meeting. The likelihood of having an efficient meeting lies in making a mutual consensus on key issues rather than delaying the decisions for future meetings (Hawkings, 1997). In some meetings being in control can mean co-ordination managing the meeting time whereas sometimes being in control can mean generating discussion and leading it towards a conclusion. Without proper control the meeting might suffer from several interruptions and participants talking on top of one another (Ranjit, 2005).

2.3 What are chaos and complexity theories and how can they be used?

Chaos and complexity theories walk often hand in hand. Chaos theory has demonstrated how a simple set of deterministic relationships can cause patterned but still unpredictable outcomes. For example tossing a coin is theoretically a simple, deterministic system, however the result of tossing a coin is more or less random because we can never toss the coin exactly the same way. Each toss is subject to different circumstances and air currents which cannot be predicted beforehand (Ford, 1983; Stewart, 1989). Even though chaotic systems never return to the same precise state the outcomes are confined and create patterns that designate the mathematical constants (Feigenbaum, 1983). The paradoxical fact about chaotic systems that makes the chaotic systems so interesting lies in their structure and order even when they are in a state of chaos – the hidden order. One of the key ideas in chaos theory is the butterfly effect; a small disturbance in the flow of air for example can cause something huge to happen on the other side of the Earth in future. In other words: small disturbances can multiply over

time because of linear relationships and feedback effects. It is said that a butterfly flapping its wings can cause a tornado on the other side of the world (Levy, 2000). Another interesting fact of chaotic systems is that their long-term behaviour cannot be predicted. Chaotic systems exhibit strange attractors that are described as elliptical or torus shaped orbits that appear to follow a certain pattern in phase space even though they never repeat themselves precisely. Weather is an amazing example of chaotic system since the same patterns and limits can be observed in different parts of the Earth even though the conditions are never precisely the same. As system parameters change, chaotic attractors can remain fairly stable but it is possible for the system to move to a very different attractor when a parameter passes a certain threshold level. The system might not return to its previous state because of the path dependency meaning that the parameter that causes the change is being pushed back to its former level (Levy, 2000). Strange attractors can therefore be thought of as strange forces that seem to pull the system in multiple directions (Isabell, 2009). Chaotic systems can change suddenly and rapidly. A drastic change might not have a huge influence on the outcome but instead a small change or act might have a huge impact (Levy, 2000).

The complexity theory is a study of dynamic, complex, non-linear systems pioneered by Lorenz in 1963 (Levy, 2000). The basic idea of the complexity theory is that there is an unseen or hidden order to behaviour of complex systems. Complex systems are non-linear and capable of self-organisation which often occurs at the edge of chaos (Hilburt-Davis, 2000). Both chaos and complexity theory strive for detecting and integrate non-linear systems that are unpredictable, yet have underlying structure and order. Even though the chaos and complexity theories sound alike, there are few differences between them. While chaos theory looks into a small number of deterministic in mathematical functions driving a system by using for example fluctuations in population, complexity theory is more interested in looking for the patterns and order in complex systems rather than trying to search for a simple mathematical “engine” in the system. In both theories the word “chaos” is understood differently. In chaos theory, the chaotic state is the point of interest and contains hidden order in the form of strange attractors. In complexity theory, the point of interest on the other hand is systems that are in ordered regime, but are approaching the edge of chaos (Levy, 2000). It is argued that chaos and complexity theories can also be applied to social sciences and that for example a national economy,

an ecosystem or an organization is a form of a complex system. Even though the complexity theory was originally developed in the context of physics and biology (Butler, 1990) many authors including Merry (1995) have noted that many other systems such as social and ecological systems can be characterized by non-linear, complex relationships and interactions that tend to evolve over time. These notions have expanded the usage of complexity theory to other fields of study such as management. The proponents of complexity theory see signs of it everywhere, but the extent to which traditional linear models and approximations are inadequate is not clear. One of the key issues is also to determine if and how well the complexity theory can fill the gaps at all (Levy, 2000). The proponents of the complexity theory claim that the traditional approaches to social sciences have been overtaken by the all increasing complexity in economic and social life since the rapid development of technology, communication and transportation (Merry, 1995). However, as critics point out, it is not the modern technology that makes the social and economic life complex, instead social and economic life have always been complex, and the societies in every era have considered themselves to have suffered unusual amount of stress and change (Shackley, Wynne, and Waterton ,1996). The two main streams of scholars trying to apply the complexity concepts into management and organizational studies are using two different methodologies. The first stream with tight relationship to scientific paradigm relies upon sophisticated computer simulations and mathematical investigation in their endeavour of modelling complex systems. The researchers aim to capture, with a help of well-specified models, the patterns of behaviour and its responses to parameter changes without the ability of predicting the absolute state of the system at a certain time in future. The critics have stated the research to be rigor and argue that in order to truly understand complex systems, nonpositivist methods such as longitudinal studies are required as they will lead to inductive approaches to find patterns and meaning (Stacey, 1995). The complexity theory also suggests that future cannot be predicted. Even though formulating long-term plans for organisations is one of the key strategic tasks in organisations, the people involved with planning have always known that no matter how sophisticated the forecast model is, it is only a simplified model which does not always apply in real world. The uncertainty of the forecasts only grow the more time passes. Critics of applying chaos and complexity theory into social sciences argue that since the theories were originally designed for physical and natural sciences, applying the theories into social sciences

without taking into account the differences between the sciences might not be possible. The nature of unpredictability in physics differs from the unpredictability in social sciences. In physics, unpredictability is a result of reiteration in non-linear systems and our inability to recreate precisely the same starting conditions whereas in social world we do not think of ourselves to be the variables at work in a system. Not surprisingly, one of the major issues of applying chaos and complexity theory to social sciences has to do with human nature. Whereas physical systems are shaped by unchanging laws of nature, human nature is essentially unpredictable. Even though when being a part of social system, humans are individuals and might cause intervention to the system. (Levy, 2000).

The proponents of chaos and complexity theory suggest that when poised on the “edge of chaos”, self-organisation might arise with emerged order that makes the organisation bloom (Allen 1988; Brown and Eisenhardt 1997). When forced to the edge of chaos, adaptation and creativity are maximized (Stacey, 1993). The proponents of chaos and complexity theory also pin point the importance of encouraging all employees to contribute in a dialogue, "the free and creative exploration of complex and subtle issues, a deep 'listening' to one another and suspending of one's own views." (Senge, 1990). However, when is an organisation in the edge of chaos? What does it really mean to be in a chaotic, yet organised regime (Hill and Levenhagen 1995)? It is not easy to apply chaos and complexity theory into organisations and social sciences, but one approach to applying the theories could be to employ them in a more qualitative or metaphorical way by empowering employees to work as individuals and having more independence but within frames of common mission, culture and intense communication. These methods are claimed to increase creativity, flexibility and learning (Levy, 2000).

As Isabell (2009) suggests “Conversation is a basic form of discursive interaction”. Some conversations may seem to be nothing more but a simple linear exchange of words but when examined closer, many conversations are in fact highly complex, non-linear, multi-topical entities. Topics may change rapidly into different ones; a topic may drift into other, seemingly unrelated topics before sprawling into new topic until the topic drifts suddenly back to the initial topic – but with a broader context and with a higher potential for dichotomy . As the conversation is highly complex, it is affected by many factors such

as the personality of the speaker, group dynamics and the hierarchy of the participants. A closer study would detect even higher levels of complexity in discussions taking including many factors such as the background of participants, the presence of face-work, the conversational style, the presence of narratives, issues of intertextuality and even the gender effects on discourse. Therefore we are not dealing with only with non-linear dynamics but multi-dimensional non-linear dynamics. The literature on chaos theory being used in the field of linguistics is fairly limited on small groups communications (Isabell, 2009). Chaos theory has been used in for example analysing the arguments of students in class room setting or institutional talk and to study meetings within the European Union where Sannino (2003) argued that "conversations can be a chaotic phenomenon". Several concepts of chaos and complexity theory can be applied into conversations. As Isabell (2009) states, the butterfly effect can be detected in conversations since small changes in any of the multiple, complex variables elaborated upon above can have far-reaching effects. "At any moment, a conversation has acting upon it countless forces that lead the conversation through multiple topical shifts and down increasing, seemingly different paths". The feedback from chaos theory can be seen in conversations when for example a question or even spoken words lead to multiple other questions or the discussion shifting to other topics. The questions or spoken words can be thought as "the noise" of conversation amplified through the effects of positive feedback (Isabell, 2009). However, cannot the feedback be negative as well instead of positive since negative feedback can also arouse questions and amplify conversation? Isabell (2009) argues that whereas negative feedback regulates the system steering it towards a higher level of order, positive feedback, on the contrary, serves to move toward less order or at least to a higher level of complexity because re-entering a small amount of "noise" can build up though repetition and create a high degree of disorder. On the other hand the hypothesis has a truth in it since many conversations have withered away because of conflict, ill-will and misunderstandings. Self-organisation from chaos theory can be applied to conversations since people tend to adapt into different roles if the conversation is not being led. When thinking of conversations as chaotic systems many things can be thought as "strange attractors" pulling the conversation to different direction, in a chaotic way, yet back again, towards a complex order. In 2008 Rush launched a hypothesis that every person engaged in a conversation brings an area of their own expertise and interest waiting to introduce it to

the current conversation. Each person engaged in a conversation waits and listens to a possible entry point where to introduce their angle of situation and attempt to pull the conversation toward their own area of interest. When applying strange attractors into the hypothesis, strange attractors can be thought of as knowledge and experience sets that each person participating in the conversation brings to the conversation. However, it can be argued that topics themselves can be seen as conversational strange attractors. The topic can continue indefinitely forward in the background of the conversation, ready to be energize a force of attraction on the conversation at any point, re-introducing itself. For example weather is a topic which tends to appear over and over in conversations. Pre-established agendas can serve as the ordering principle in more formalized discussion such as business meetings (Isabell, 2009). If chaos and complexity theories can be applied to conversations it might be possible to apply them also into the particular case study since the construction site meeting is managed through conversation.

3 Methodology

The research included both primary and secondary research. Primary research included the observation of a two and a half hour long video of a Finnish construction site meeting held on 7th November 2011 in Finland. The video is one part of a larger project that the University of Helsinki, Facility of behavioural science is conducting. As the objective was to analyse one particular case study, the size of the sample is valid. The main points to observe from the video were the people who appear in it; their tone of voice turns of say, appearances and the spoken words as well as their nonverbal communication. The objective was to analyse the co-operation and the way the participants lead the conversations or participate the conversation and how long covering each topic will last and to use the gained data to determine through the lens of chaos and control if the construction site meeting was efficient or not. The video is classified and therefore in order to guarantee the anonymity of the people who appear on the video, the name of the construction site will never be mentioned by name nor will the people appearing in the video ever be referred by their names. Instead they will only be referred as their position in the construction site meeting such as “the architect” or “the chairman”. To gain in-depth knowledge from the video it was necessary to watch it

several times. Making notes from the video was crucial and gathering the data of the topics spoken, participants to the conversation, the time spent on the topic and the overall atmosphere of the conversation and comparing them to the actual agenda and how efficient and well-led construction site meetings are done will reveal if there is a lack of leadership in the meeting and if the construction site meeting is under control or not and how it will affect the meeting. It was also necessary to execute an Excel table of the topics spoken, time spent on the topic and the participants of the discussion (see appendix 1). The video was filmed by an employee of the University of Helsinki and therefore there is no relationship between the subject and the researcher. The University of Helsinki already had notes about the spoken words in the construction site meeting, but the notes had significantly more incoherent points than what they usually have because the background noise coming from the construction site was overwhelming and the participants spoke fairly quietly. The primary data therefore was based on qualitative analysis of the video. Secondary research included mostly examining articles, books and academic journals in order to gain in-depth knowledge about different chaos and control theories and how they can be applied to this case and how they have been applied to other cases. As control is a wide topic with huge academic literature it was important to narrow it down to the definition of control and why control is needed in organisations. Examining theories about effective meetings and especially control in meetings was crucial to determine if the construction site meeting was efficient and in control. Secondary research concentrated also on how construction site meetings are often held in Finland in order to determine if this particular construction site meeting was efficient and well managed or not. These methods were sufficient and necessary in order to get the sufficient primary and secondary data needed for the conclusion.

4 Findings

As the mandator of this research was hoping for analysing especially the turns of say, co-operation and the way topics were discussed in the construction site meeting, the findings will focus on the matters mentioned above through the lens of chaos and control. The actual construction site meeting started after ten minutes of filming. The first ten minutes included general, chaotic conversation with a product introduction by a salesman who did not participate the actual construction site meeting. The quality of the

voice in the video was very poor at some points and it was difficult to hear what people were saying and to determine who was actually speaking. During the construction site meeting, people talked on top of each other quite a lot, the chairman did not introduce the participants and identifying the speakers was not always possible because the chairman did not usually distribute turns by naming the people whose turn it was to share their opinion on the matter. The participants of the meeting were not introduced probably because the meeting was not the first one and the participants already knew each other beforehand. The project manager did have an agenda to follow but the meeting itself had some chaotic aspects in it for example the hpac (heating, plumbing, air-conditioning) foreman leaves the meeting after an hour for a district heating inspection and comes back after being away for approximately twenty minutes. The agenda itself did not have any plan on maximum time of discussion on each topic which might have been one of the reasons why the construction site meeting took almost two and a half hours. The general agenda of construction site meetings consists usually of sixteen different topics starting with the opening of the meeting, appointing the chairman and secretary and announcing the quorum of the meeting. The construction site meeting then continues with approving the minutes of the previous meeting which is followed by authority matters, construction site situation and work force, timetable situation, purchasing situation, work safety and environment related subjects, finance, additional and alteration work, main contractor's matters, building service technology matters, design situation, constructor's situation, observed risks and other matters. The construction site meeting is ended with deciding the next meeting. This particular construction site meeting followed the general agenda quite well but for a better analysis, examining the findings in more detail is necessary by looking into each topic specifically, examining who participates in them, how they are managed and how long the discussion on each topic lasts.

In this case, the construction site meeting was started by the chairman with stating the secretary and a quick question, or rather just a statement: "Does anyone have anything to comment on the previous minutes of meeting? If not, then we will go to authority matters". The quorum of the meeting was most likely skipped since it was obvious for the participants that the people needed in order for the meeting to have quorum were present. For authority matters, the chairman distributes turns for statements individually

to the appropriate participants who clearly state their matters shortly and efficiently ending up using only approximately three minutes on the topic. The chairman then moves on to the construction site situation and work force, appointing the say to the general superintendent who discusses about the situation and work force in the construction site which leads to a couple of questions from the chairman. The chairman keeps track of the turns and appoints turns of saying to the appropriate people who again state the situation shortly taking altogether approximately seven minutes which is not much. The next topic, timetable situation, however arouses more conversation and opinions without the delegation of the chairman. As it turns out, the different areas of production have fallen behind the schedule from two to four weeks. The chairman asks what they could do in order to catch up which leads to the general superintendent getting a bit upset forcing the chairman to clarify that he is not looking for a scapegoat but a solution. Others join the discussion by explaining how the amount of work has changed since the beginning and what kind of problems they are facing. The conversation drifts to work force since the thermal contractor points out how they would need more work force in order to catch up with the schedule. Several people participate in the conversation giving their opinions about how to catch up with the schedule. From there the discussion continues freely, the general superintendent asks about plumbing and gets his answer and only then the chairman takes control again asking the ac (air-conditioning) contractor about their situation. The air-conditioning contractor complains about subcontractors and the conversation drifts to issues in the construction site such as the quality of drains is not being approved by the plumbers. The topic seems to be covered but as the chairman asks if there is anything else about timetable, the discussion suddenly drifts to suspended ceiling and the seizing of wool which causes a long discussion with several participants included the general superintendent, electricity contractor, air-conditioning contractor, Dan, architect, construction site engineer and chairman. Overall the discussion takes over twenty minutes and has definitely drifted away from the actual topic of timetable.

The next topic of purchasing situation or purchasing schedule is managed mostly by the chairman asking specifying questions from certain participants. The construction site engineer explains the situation and answers questions alongside with the architect. Adam is also commenting the situation. In the middle, a positive feedback is given to the

architect for a great list of needed items by Adam. Giving positive feedback from eye-to-eye is quite rare in Finland and therefore it was a pleasant finding. The chairman then continues to ask purchasing questions from the thermal contractor, air-conditioning contractor and electricity contractor. Meanwhile the construction engineer, electricity contractors and architect participate in their own discussion about cutting the wool. Going through the purchasing schedule takes about fourteen minutes. The next topic of work safety and environment related subjects is yet again handled well by the chairman appointing questions to the specific participants who answer them quite effectively taking only approximately four minutes. The topic is being covered fast partially because the chairman decides to look into the issues in work safety with the general superintendent after the actual meeting, not wasting other people's time. Since there are no finance related matters, the meeting continues with the main contractor's matters. At this point, the topics change constantly, almost chaotically from shower rooms to demolition work, the colour of the tiles, plans about roller cage storage, overland flow and other issues such as telephone subscriptions. This time the chairman does not manage the turns; instead the participants can speak freely which drives the discussion to byways loosely connected to the actual topic taking approximately thirty six minutes. During the thirty six minutes, many people participate in conversations talking on one another, moving places in order to look into the plans asking questions. One of the participants, the hpac (heating, plumbing, air-conditioning) foreman, actually leaves in the middle of the conversation for a district heating inspection and comes back after being away for twenty minutes.

The next topic, building service technology matters is mostly being covered by the hpace (heating, plumbing, air-conditioning and electricity) designer and the ac (air-conditioning) contractor going through issues in air-conditioning pipelines planning trying to solve the issues together with the architect. At one point the chairman tries to move on with the agenda by asking if there is anything else that needs to be discussed so that the work won't stop because of the plans. However the effect is not probably what the chairman was expecting since the hpace (heating, plumbing, air-conditioning and electricity) designer argues that the issues need to be solved together, but decide then to solve the issues with a smaller group after the meeting. However, the discussion continues even after the decision of solving the problems later on for some minutes. In

the end of the discussion people mumble a lot talking on top of each other. In whole, going through the topic takes approximately twenty one minutes. The next topic in the agenda, design situation, arouses again many complex discussions with several participants such as the architect, the chairman, the general superintendent, the construction site engineer and the construction site supervisor (see appendix 1). The topics vary from geo-planning to drainage and heating, plumbing, air-conditioning planning situation which are relevant topics to be discussed at this point. Some decisions are being made, for example a geo-designer needs to be invited to the construction site to determine the situation concerning the amount of water flowing to the property. However, some decisions are being pushed to the future. One positive finding was that the chairman actually asks for feedback for the architect. When going through the situation in heating, plumbing, air-conditioning planning, the architect and the structure designer discuss about their own matters. The chairman mostly asks questions. It takes a bit over a half an hour (thirty three minutes) to go through the design situation.

Constructor situation is being rushed through in just two minutes because the chairman has already sent a list to certain people about issues that he wishes to go through with a smaller group. Therefore time will not be used in the meeting to go through the list. As the construction site meeting has already taken several hours, the last topic of risks and other matters is being rushed through in two minutes. The general superintendent is worried about the schedule and some other issues. People mumble and it is very difficult to define who is saying and what. The next meeting is being scheduled and the construction site meeting ends with participants talking on each other and going for a construction site round to see the issues on the spot and to further discuss and solve them. The overall discussion time was one hundred and forty two minutes; however in discussions and during even speech, there were many pauses that lasted easily from ten to twenty seconds. There were many silent spots or people mumbling silently or speaking on top of each other stating what is on their minds, not really offering solutions and therefore the actual conversation time is lower than 142 minutes.

When examining the chairman's speech, he speaks over 164 times during the construction site meeting. 65% of his speech is in a form of short questions, 21% is comments and the rest are mumbling, direct decisions and direct distribution of turns

which are not in the form of questions. Some of the questions are half-decisions asking for people's approval in the form of question such as "But the plan is that we will demolish it to the bottom tile…or?" whereas some of the questions are used to dividing the turns such as "Building technology services matters. Who will start, the thermal contractor?" and some questions are direct questions concerning for example the safety issues in the construction site "Is the demolition to be blamed also to that (safety) measurement?". Even though the chairman participates the conversation a lot, his comments and questions are short, not taking a lot of time. During the construction site meeting, some visual aids were used for example the layout design, however the visual aids were mostly in paper and there were often only one copy of the visual aid. The chairman definitely has the most turns in speech, for example the general superintendent speaks approximately 41 times during the meeting. His speech consists mostly of explaining the situation and comments with only approximately three questions. Some of the participants such as the construction site supervisor speak only three times during the whole meeting. Every participant comment or participate the discussion at least once during the meeting. However since the aim is to analyse especially the project manager's degree of control the focus will be on the chairman's speech rather than on the other participants' speech.

5 Analysis and discussion

The analysis is based on the confidential video and since the subject of examining meetings is lacking of previous data the analysis and results cannot be applied into other cases directly or generalised to apply to all meetings. Even though different authors argue about the validity of using chaos and complexity theory in social sciences, the theories offer an interesting aspect to social sciences. As conversations can be seen as non-linear, dynamic, highly complex entities (Isabell, 2009), same qualities can be found in meetings as well since they are being managed through conversations which often tend to be multi-topical and complex. Even though the chairman has many turns in conversations, the control over the conversations is fairly low since the chairman does not always point out the turns to speak and gives the participants fairly free hands on when to talk and what to talk about. The construction site meeting had some chaotic

aspects in it such as people coming and going during the meeting, people having small overlapping conversations, speaking at the same time, a lot of mumbling and the conversations drifting into different topics without the chairman intervening or guiding towards the actual agenda. The fact that it took ten minutes to actually begin with the meeting shows that the chairman did not have a firm control over the meeting and was using his power to rather be one of the participants or their friend than a chairman. Even though the chairman spoke over 164 times during the meeting, the control over the meeting was more conversational and loose, managed in the form of questions which certainly did not help in making the meeting efficient since questions only aroused more questions and discussion with often no actual decisions being made. During the construction site meeting, the chairman only made 9 direct decisions about how to handle the situation. Some decisions were being made in the form of a question which can have a good effect on participants since they do not feel being forced by the manager but to be asked to do something. A good manager needs to know how to delegate (Fine, 2009) and in this case the chairman did delegate some of the issues to the appropriate people, however too often the issues were not solved at hand but delayed to be decided later on. The tone of the chairman's voice was not enthusiastic but monotonic including mumbling and sentences that faded into the thin air. The construction site meeting took 142 minutes from start to finish and did not have any breaks which might have caused participants getting tired and lose focus during the meeting. The meeting would have lasted a lot less if there had not been so many pauses during conversations where people were silent, thinking. The pauses between topics were also long wasting over 5 minutes of the meeting time when combined altogether. The rhythm of the speech is also very slow and unenthusiastic affecting the meeting to last longer.

According to the chaos and complexity theory, at the edge of chaos, the system self-organises and when applied to conversations it means people taking their places in the conversation. In this case though, the participants of the construction site meeting already had a certain pre-determined place since all of the participants had a specified role beforehand such as "the architect". However during the conversation some roles were shifting and participants did adapt to different roles such as the general superintendent taking a more leading role making decisions which could have been

thought to belong to the chairman. The general superintendent for example took control over one situation making a decision to meet with a smaller group after the construction site meeting to solve an issue. Therefore at the edge of chaos the self-organisation from the chaos and complexity theory could be seen in this case as well. However, it there is no definition in social sciences of when something is at the edge of chaos (Hill and Levenhagen 1995) and therefore it is unsure if the theory applies in the case study or if the shifting of roles was due to human nature or group dynamics. The butterfly effect from the chaos theory can also be seen in the case study as one spoken word makes the topic shift dramatically into another, seemingly unrelated one “Speaking of which... What do you think of...?” which creates a huge buzz with many participants joining the discussion that lasts surprisingly long. In this case it is controversial though if the participants or the topics worked as strange attractors from the chaos and complexity theories. On the other hand, the participants each had a certain area of expertise and waited to introduce their area of expertise to the conversation but then again the topics could also be seen as strange attractors in the case because each topic attracted certain people to participate in the conversation. As the chairman manages the conversation mostly through questions, the feedback from chaos theory can be seen in this particular case when for example giving feedback to the architect for a great purchasing list, it leads to multiple other questions for different participants discussing about timetable and other purchasing matters.

Even though some chaotic aspects can be found from the construction site meeting, the chairman does have some control over the discussion especially in the beginning when the chairman appoints turns of say, keeping the discussion focused, short and efficient. The chairman does try to control some of the discussions by asking specified questions leading the discussion to the correct direction. The aspect of control can also been seen in some points of the meeting when the chairman actually makes decisions on who does and what to solve the problem and also deciding to have a meeting with specific, appropriate people after the meeting. The chairman also does follow the agenda which has been said to be a powerful tool of control (Kieffer, 1988), however as there is no timetable on how long each topic should last, the time spent on each topic varies from a couple of minutes to a whopping half an hour. For example when speaking of the schedule, the topic drifts to suspended ceiling which takes over five minutes to be

discussed before the chairman takes control again moving back to the actual agenda. Although the chairman does try to solve some issues, he does not have a tight control over the decision since he often asks “How to solve this?” letting the participants to try to decide the solution which according to the chaos and complexity theory, could in fact lead to innovation and creative ways of solutions (Levy, 2000). However in this case the lack of control leads to long discussions, sighs, mumbling and eventually, no concrete solution is being made, just like Ranjit (2005) and Hawking (1997) suggest. Instead the conversation goes on and on, drifting to other unrelated topics. Also at one point, when the chairman tries to take control by asking how to solve an issue, some participants get upset misunderstanding the question by thinking that the chairman is looking for someone to blame. This action might be a result of the actual lack of control on behalf of the chairman since the participant was lacking of direction from the chairman or project manager and suddenly felt as if he was being personally attacked when the chairman simply just tried to take control over the discussion.

As Seppänen (2009) argues, time is being lost in the majority of projects because of poor implementation of plans and needs to be compensated by unplanned compression of timetable. This applies in the case study as well. The project was from two to four weeks late from the schedule and one of the issues that worries the general superintendent the most is indeed the timetable and how to make up the time. The key issues talked during the construction site meeting were the implementation of the plan and the mistakes made in the construction site while not following the plan. The topic of issues in the schedule was introduced in the beginning and did continue indefinitely forward in the background of other conversations, re-introducing itself from time to time just as the chaos and complexity theory suggests.

6 Conclusions

As chaos and complexity theory can be applied into social sciences and conversations they can also be seen in the meeting itself. However there are some paradoxes with using the theory in this particular case. One of the key issues of applying the chaos and complexity theory into the case study was the fact that it has been applied beforehand

on everyday conversations demonstrating how uncontrolled conversations include hidden order whereas in this case the topics were controlled and fairly pre-determined. Although the assumed order in the form of agenda though, the meeting did have chaotic aspects and the discussion was quite uncontrolled and chaotic at some points even though there was an agenda which could have been thought as a controlling tool. It was clear that aspects of chaos and complexity theories could be seen in the construction site meeting. As some of the aspects of chaos and complexity theories could be found in the case the theories provide us an interesting standpoint of analysing meetings although it is questionable if the chaos and complexity theories can be applied to other pre-planned meetings and if they are a constant part of all meetings rather than being just a coincidence. The interpretation of the theories in conversations is also questionable since for example “strange attractors” can be seen in two different ways in conversations as either the topics or the participants and there is no one concrete answer to which one is the correct way of interpretation. Therefore chaos and complexity theories do give a new aspect or a way to analyse meetings but the subject needs to be examined further. Also as this is only one case study and organisational meetings remain understudied subject, the findings of this dissertation cannot be generalised to apply to every meeting.

The degree of control on behalf of the chairman was fairly low even though he comments, asks questions and participate the conversations the most from all the participants. Despite the chairman’s active role in discussions, the degree of control ended up being quite low because of the chosen way of trying to gain control by using questions making the chairman to be more of the participants’ friend than a manager. Even though the chaos and complexity theory suggest that chaos can create innovation and creativity (Levy, 2000), in this case low level of control did not lead to higher level of creativity and innovation but to long discussions, lack of direction and lack of decisions. However the lack of creativity and innovation might actually be a product of the industry, regulations and laws. In the construction industry, laws and regulations are very strict and have a huge control over the production and therefore regulate the innovation and creativity inside the industry making it difficult for participants to make up innovative solutions which could be detected in the case study as well. The chairman did give space for creativity and innovation in the construction site meeting; however it is difficult to be innovative and creative if there is a strict set of rules to follow in production that need to

be followed. The amount of direct decisions being made by the chairman in the construction site meeting was alarmingly low and even though the chairman did try to give the opportunity to the participants to solve the problems, it only lead to mumbling and wasting time and therefore the chairman should have had a higher level of control offering solutions while for example letting the participants to determine which solution would be the best one.

It is difficult to balance chaos and control but in this case a higher degree of control would have been needed since decisions were delayed and the atmosphere was frustrated which could be seen in the discussions by participants complaining about issues and misunderstanding some words getting upset because of them. With higher degree of control, the construction site meeting would have taken less time and would have given direction to the participants perhaps making them more motivated and efficient. In this case the lack of control made the construction site meeting fairly ineffective even though some decisions were made and some progress was being made in the meeting. However, too often the decisions were delayed and decided to be solved later on. Even so, with more planning and higher degree of control, the construction site meeting would have been less time consuming and more effective. Visual aids could be more helpful if they were available for everybody and not on one piece of paper appended on a door. In the future, the construction site meeting should be planned better beforehand with a schedule of how long the meeting should last and how much time covering each topic should last. The chairman should be more focused on sticking to the agenda and controlling the direction of discussion dividing turns of say in order to make the meeting more efficient and to give the other participants an image of a manager who actually knows what to do. As the chairman in this case mostly asked questions it gave the image that he was not quite sure what the situation was and how to solve issues whereas the general superintendent felt more of a leader knowing all about the situation.

The meeting was lacking of a manager which made the construction site meeting inefficient with few concrete decisions being made. Inefficiency could also been detected as participants talked on top of each other and interrupted each other pushing solutions further to the future. Even though the construction site meeting had many participants,

the amount of participants is valid because every participant needs to know what is going on with different aspects of production since everybody's issues will affect everybody and the production as a whole. However improvements for future could be to plan the meeting better in advance asking the participants also to make notes beforehand about their issues and how to fix them. The balance between chaos and control is very delicate and as identified before, one of the most difficult aspects in management and in this case the meeting had a higher degree of chaos rather than control which led to the construction site meeting lack of management making the meeting inefficient. The conclusion therefore is that the construction site meeting could have been managed better with a higher degree of control and as this case proves, control indeed is necessary at least in construction site meetings in order to make them efficient. The reasons behind why the construction site meeting did not work out well are a combination of all the issues mentioned above, but mostly the reason was lack of control and management in the construction site meeting. Chaos in the construction site meeting did not lead to innovativeness; however it might be because of regulations and laws in construction which have a tight control over the production. To solve the issues in the case study; people mumbling on top of each other, the lack of decisions and long discussions only loosely related to the actual topic, the degree of chairman's control should be higher, the agenda should be timed and the participants should be more prepared beforehand.

Even though the conclusion of the dissertation is that the meeting was fairly chaotic and inefficient, it raises a question of cultural aspect; how are other construction site meetings managed in general and how does Finnish culture actually affect the management of construction site meetings? As the dissertation only analyses one case study, it is impossible to know if the chairman always manages the construction site meetings the way he did in the case. Also we do not have any background information about the chairman or the participants. We do not know how their background affects the dynamics of this particular construction site meeting. We do not know how long they have been working together or what has happened between them before. Would the past affect the way the chairman managed the construction site meeting as being their friend? One interesting aspect would be to examine how the background and culture affect the degree of control and chaos in construction site meetings and to examine how

leadership styles affect the meetings. Also as applying chaos and control theory to meetings is a fairly new idea it would be interesting to examine it further and clearer. The problem with examining how background and culture affect the degree of chaos and control would be though generalisation. Does the background or culture themselves affect the same way to everybody since humans are individuals?

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Construction site meeting topics and times

Topic	Who participates in the conversation	Time that the discussion takes (minutes)	How discussed
Authority matters	Architect, thermal contractor, hpace designer	2,5	Participant in charge of the matter tells their situation. No other comments or questions.
Construction site situation and work force	General superintendent, thermal contractor, air-conditioning contractor, chairman	7	General superintendent, thermal contractor and air-conditioning contractor explain their situation one at time, chairman asks questions
Schedule	Chairman, general superintendent, thermal contractor, air-conditioning contractor, electricity contractor, Dan	13	The necessary participants explain their situation, the chairman asks a question which arouses discussion including problem solving.
(Subtopic) The digging of drainage and the quality	General superintendent, air-conditioning contractor	1	Air-conditioning contractor makes a statement, general superintendent comments.
(Subtopic) Suspended ceiling	Chairman, electricity contractor	1	Chairman asks, electricity contractor answers.
(Subtopic) Attaching the wool	Dan, air-conditioning contractor,architect, general superintendent, electricity contractor, chairman	4	Discussion, many participates.
Purchasing schedule	Construction site engineer, structure designer, architect, thermal contractor, air-conditioning contractor, Adam, chairman	15	Construction site engineer tells about the situation, participants ask questions and comments.
Work safety	General superintendent, chairman, Construction site supervisor	4	General superintendent states the situation, chairman asks specifying questions, supervisor tells about accidents.
Finance, additional and alteration work	Chairman	less than one	Chairman asks, no comments.
Main constructor's matters: demolition of a floor, work content and future structure	Dan, chairman, general superintendent, construction site engineer, Adam, architect, construction site supervisor	36	Participants asking questions, murmurring, talking on top of each other, commenting. Lots of questions answered by several participants. People moving around.
Building service technology matters	Hpac foreman, hpace designer, thermal contractor, air-conditioning contractor,chairman	21	Participants asking questions and pointing out problems, negotiating and trying to solve the issues. Some mumbling and talking on each other.
Design matters	General superintendent, architect, construction site engineer, structure designer, chairman, construction site supervisor	24	Chairman asks questions, general superintendent answers, architect asks questions and also answers some questions. Structure designer and construction site supervisor comment.
hpac (thermal, plumbing, air-conditioning) design situation	Chairman, hpace designer	2	Chairman asks questions, hpace designer asnwers while the structure designer and the architect are talking together quietly.
(Subtopic) Email discussion with another organisation	Chairman,hpace designer, architect, air-conditioning contractor	5	Chairman brings out the topic, architect and others comment. Chairman concludes the topic.
Electricity design	Hpace designer, Chairman, electricity contractor, thermal contractor	2	Hpace designer states the situation, chairman asks questions, other comment.
Constrcutor's matters	Chairman, hpace designer	2	Chairman makes a statement, hpace designer comments.
Risks, concerns	Chairman, general superintendent	2	Chairman asks question, general superintendent comments.
Time altogether		~142	