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## It's Just Rocket Science, Not Project Management

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### **It's Just Rocket Science, Not Project Management**

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## IT'S JUST ROCKET SCIENCE, NOT PROJECT MANAGEMENT

Mikkel Vangsgaard<sup>1</sup> and Christian Thuesen<sup>2</sup>

### ABSTRACT

This paper presents an inductive, empirically based research on the Danish non-profit voluntary space association Copenhagen Suborbitals. The purpose was to execute a qualitative constructivist grounded theory study to discover and explain the behavior and operation of the case subject. Based on this, grounded theory methodology was found highly adequate, as it allowed an investigation without predetermined hypotheses, specific research questions, and a theoretical framework. The central question was: *What are they actually doing?* Therefore, prior to the study, the researcher formed no specific expectations or demands, and thus, the research could develop in either way. The primary data collection involved observations, open interviews, and conversations. Observations of meetings and conducted work at the organizational location enabled the study of participants who acted in their natural environment, while interviews and conversations enabled a source of more concentrated and direct information. Secondary data was also collected, which primarily consisted of an extensive research of web-blog posts from the study subject. Primarily based on the primary data the grounded theories were developed. Subsequently to the analysis, the study was contextualized with literature to identify the academic relations. The study showed that the subject had successfully integrated the concepts of consensus and initiative, and achieved an organizational form that, at one level promoted member unity and collective steering, and at another level encouraged individual initiative. The association rejected hierarchy, and thus the executive coalition involved all members. Moreover, the study discovered two distinctive operational processes: (1) direction, established a flexible organizational heading, and (2) navigation, allowed liberated groups to develop accordingly, but ensured that evaluation and coordination was done in collectivity. The processes of direction and navigation were congruent with well-known methods of trial-and-error and parallel trails, and based on iterative processes and learning by doing. Unexpectedly the research evolved to support contemporary claims that the practice of project management has forgotten these values, and that intuitive and alternative methods should be accepted as viable project management.

**KEYWORDS:** Grounded theory, project organizing, rethinking project management, consensus vs. initiative.

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## INTRODUCTION

*“The probability of success is difficult to estimate; but if we never search, the chance of success is zero.” Cocconi and Morrison, 1959.*

On July 20th 1969, Neil Armstrong took a famous step; a step that defined a giant leap for mankind, and set a milestone in the human aspiration to explore and understand our existence. Furthermore, he confirmed the American success in their competition with the Russians, in what is commonly known as the space race. The famous step by Armstrong was also the climax of uncountable interconnected projects performed, executed, and managed by the American NASA (the National Aeronautics & Space Association).

Originally, project management trails back to the development of nuclear missiles in the 1950s. Back then, project management was a practice of coping with contingent and complex propositions, and early projects accepted risk and unforeseeable development as a part of the chance for success. In the early 1960s, the newly formed NASA, along with other significant institutions, adopted the discipline of project management in its operation. However, NASA facilitated a more analytical and process oriented approach than the original projects. Since then, the discipline has been extensively discussed, and the practice as we know it today has been subject to continuous development and standardization. In recent years, the emphasis has especially become devoted to optimization of certain constraints: Scope, cost, and time; and some contemporary researchers claim that the discipline inadequately neglects the original methods.

This paper is an extraction from a thesis at the Technical University of Denmark, Department of Management Engineering, and presents of study of Copenhagen Suborbitals (CS). CS is a volunteer based non-profit association aspiring to send a man into space in a homemade rocket – *The world’s only amateur space program*; instantly the case raises questions of *how* and *why*. By developing comprehensive rocket technology in a hobby-association, CS challenges the common notion that rocket science is entitled the brightest minds on the planet.

As the case subject was perceived as special, and potentially interesting in many different directions, the study approach was chosen as inductive and empirical, and the methodology as grounded theory. With grounded theory there were neither hypotheses nor extant theory to be tested in the study. Hence, going into the research anything could happen and I, as a researcher, did not know what to expect from the result. The purpose was to discover: *What was actually going on in CS*, and to develop theoretic and abstract explication of the subject behavior. In grounded theory, “If you offer a fresh or deeper understanding of the studied phenomena, you can make an original contribution” (Charmaz, 2006, p. 153). Furthermore, in order to raise the academic level and to create influence, a literature review was conducted subsequently to the analysis, which enabled a succeeding discussion and contextualization.

As the thesis implements the discipline of grounded theory, it offers an untraditional development of research data and thus an unconventional paper structure. The study is presented in

chronological order congruent to the actual research progression: Data, literature, and context. Accordingly, due to the development, the actual findings, study influence, and context is not discovered until the final chapters. However, to maintain your interest, I can reveal that the study actually identified more issues related to the practice of management than rocket science; for that reason the provocative title. Moreover, the literature review led to some unexpected findings and connections between the studied behavior and contemporary claims of project management.

The paper opens with a description of the research methodology, followed by a story setting the scene for the subsequent analysis where the grounded theories are developed. The developed theories are finally contextualized through the literature review and subsequent discussion and conclusion.

## **METHODOLOGY**

### **Research Philosophy**

Glaser and Strauss introduced grounded theory in the 1960s, and the philosophy behind the methodology has evolved ever since; even the founders diverted into different basic principles. The philosophical foundation for this particular research was *constructivism*. “A constructivist approach places priority on the phenomena of study and sees both data and analysis as created from shared experiences and relationships with participants” (Charmaz, 2006, p. 130). Therefore, data was not understood as factual reality, but as sources’ interpretations of their reality in Copenhagen Suborbitals. Furthermore, it is acknowledged that data also is interpreted by me, thus running the risk of potentially biasing the analysis with the background within engineering management. According to Charmaz (2006), constructivists are aware that pre-assumptions may affect the research, and they attempt to define the affects hereof. Constructivist grounded theorists are placed in a reality where they have to balance empirical findings with their extant knowledge (Suddaby, 2006). In relation to the origin of the methodology, constructivist grounded theory is furthestmost similar to the principles of Strauss and his later companion Corbin. They define theory as abstract and as emerged through series of interpretations that undeniably is affected by the interpreter (Charmaz, 2006).

In order to claim the outcome to be theoretical, *theory* was defined. *Positivist* theory seeks causes, favors deterministic explanations, and emphasizes generality and universality; *interpretive* theory calls for the imaginative understanding of the studied phenomenon (Charmaz, 2006, p. 126). The contribution of this research could not offer generic deterministic theory of project management, as it was only based on one case study. However, it proposed a subjective conceptualized theoretical explication of the premises investigated in Copenhagen Suborbitals. Thus, the theoretical outcome of this research was defined interpretive rather than positivistic.

### **Research Method**

Grounded theory is a methodology that allows thorough examination of a subject, with the least possible biased position. The core philosophy is pragmatism, as grounded theory was originally founded to help researchers understand complex situations, in a practical manner (Suddaby, 2006). It contrasts common research approaches where preset hypotheses are tested throughout the study. Theory grounded in data is more likely to predict and explicate the subject, rather than a theory

generated by traditional deduction (Glaser & Strauss, 1967). “Grounded theory methods foster seeing your data in fresh ways and exploring your ideas about the data through early analytic writing” (Charmaz, 2006, p. 2). Consequently, grounded theory methodology offered an opportunity to contribute with something unique and special to the engineering management community.

**Data Collection**

Everything experienced during the research was considered as data, as all impressions contributed to the construction and interpretation of meaning. The following qualitative methods were used: Observations, interviews, a blog, articles and internal documents. Primary source data collections are shown in Table 1.

**Table 1**

#	Date	Location	Method	Subject	Duration [min]
1	11.11.14	CS workshop	Conversation	Mads Wilson (MW)	40
2	17.11.14	CS workshop	Observation	CS members	100
3	17.11.14	CS workshop	Semi-structured	Mads Wilson (MW)	60
4	21.11.14	Meeting room	Observation	CS members	135
5	21.11.14	Meeting room	Conversation	Claus Mejling (CM)	30
6	24.11.14	CS workshop	Observation	CS members	90
7	24.11.14	CS workshop	Semi-structured	Kristian Sørensen (KS)	130
8	25.11.14	DTU	Observation	CS- /CSS members	150
9	15.12.14	CS workshop	Observation	CS members	90
10	02.02.15	CS workshop	Observation	CS members	70
11	02.02.15	CS workshop	Semi-structured	Kristian Sørensen (KS)	50
Total hours: 15 h 45 min					

Table 1. Primary source (PS#) data collections

Observations were performed at meetings and hanging around members, and thus participants were observed in their own environment, and were affected least possible. Interviews were divided in two forms: *semi-structured* and *conversations*. Semi-structured interviews had few open-ended questions that invited the participant to elaborate in own choice of direction. Conversations were completely non-planned and unstructured.

The most significant secondary source was the CS web-blog, adding up to around 650 unique posts. It was an important source of background information, and the foundation for the story section. A critic view on the blog was attained since it was personal and had PR incentives, questioning its credibility. Therefore, the blog was not used in the analysis.

### **Analysis Approach**

Following is a review of the performed techniques and analytical process.

#### *Coding and Memoing.*

Open coding of data started with the data collection. It was important to keep a receptive mind, and continuously I asked myself: *What does the data really mean?* Data reports were ordered in initial codes where single words, quotes, or sentences were separated. The following codes are from the primary data collection: “Conflicts have vigorously been reduced due to better communication” and, “Sometimes we did not find out before Peter wrote it in his blog.” Later, they were connected to other codes like: “Right now no-one really dares to slam the table” and, “Members constantly seek consensus.” Consequently, these connections evolved into the following focused code (remember that this is uncorrected material):

*“The many conflicts in CS is now a part of the new shaping, and many of the initiatives are done to avoid conflicts. No one really dares (or wants) to slam the table in discussion. The tone is kept low, and most solutions are found in some kind of consensus. In general, the concept consensus is used all the time, and sometimes it causes that discussion are dragged for a long time, and maybe not solved. According to KS, all the initiative on communication has reduced the conflicts critically, especially the part about informing about processes of the respective groups. KS often acts as a mediator and regulator to avoid any confrontation of interest between groups. He says that he has to remind them to be informative. Often they did not know what was going on before they read it in the blog. ‘The internal communication was that bad’ MW.”*

Focused codes were descriptive paraphrases of interconnected codes based on data; and were not subject to rationalization, as this would contradict the production of pure data. When data was mature and had evolved into paraphrases and sections of data, the different parts were ordered and clustered into portions of data within the same category.

#### *Categories*

Categories explicated a larger portion of connected data, and for the first time gave an overview of the findings. In Table 2, categories and focused codes are presented. This table illustrates a phase late in the research, where categories were well established and focused codes mature.

**Table 2**

		Categories				
		Steering	Resources	Communication	Motivation	Stakeholders
Focused codes	Structure		Human resources	Meetings	Incentive to change	External
	Decisions		Economy	Internal communication	Volunteers	Internal
	Direction		Materials	Conflicts	Involvement	PR
	Coordination			Social feeling	Motivation of CSS	The blog
	Inspiration					External communication
	Navigation					
	Group forming					

Table 2. Data categories. Color code was used as a technique to visibly connect codes in the data.

Data collection stopped when nothing new was evidenced. According to Charmaz (2006, p. 113), “grounded theorists should stop when categories are ‘saturated’.” With theoretical sampling, the data was narrowed down to a few categories for further refinement. As seen in Table 2, *steering* had most focused codes connected, hence it was chosen for further analysis.

*Theoretical Coding and Contribution.*

With a much narrower data perspective, the research went into a phase of deeper analysis and development of theories. Theoretical coding connected the focused codes, and with use of memoing it formed an increasingly detailed clarification of the subject. Consequently, the analysis formed into a deeper explication of CS, and eventually constituted an abstract contribution.

**Limitations**

Following are the limitations identified in the study.

- Methodology
  - A bifurcation in the philosophical foundation of grounded theory methodology parts researchers; positivists on one side and constructivists on the other. Nonetheless, the limitation here was to accept either philosophy, possibly narrowing the acceptance of the research.
  - Grounded theory was unknown to me prior to the dissertation; thus, it required an extensive methodology investigation before and during the research.
- Data
  - The data came from a single case study, thus the generic appliance and the discussion was naturally less reliable in universal context. A generically stronger contribution would have been based on more organizations, and thus grounded the theory in more data.



- The research participants were busy people with full time jobs, which occasionally prohibited data collection.
- Data was collected in Danish, yet the paper developed in English. This caused linguistic interpretation of all data, and a risk of points getting lost in translation.
- Time
  - The research period was limited by the thesis due date. Grounded theory did not consider this, and was a time consuming methodology, steered by data.
  - Data was not transcribed, due to the time limit. Transcriptions might have developed more data than reviews did.

## STORY

In 2008, two men met in the hull of a submarine. Their dream was to travel into space in a homemade rocket, and return to earth safely – proving that rocket science was not only entitled NASA and other governmental organizations. They did not know whether it was possible, they did not know how much money they would need or if they would ever succeed. Nonetheless, they agreed to work together on this dream; a project most people would have discarded immediately because it seemed impossible.

Peter Madsen and Kristian von Bengtson were both regarded as men with passion and with personalities that did not take no for an answer. They founded Copenhagen Suborbitals (CS), as a non-profit space association based on volunteer workers. There was immediate attention from the media, as Madsen and Bengtson quickly had a small rocket engine ready for a first test. Unlike NASA and other governmental space programs, CS was based on cheap materials and simple technology. The concept was that space technology did not require governmental budgets, if they were creative enough. Rocket science was not rocket science anymore, and did not necessarily require the brightest minds on the planet; just dedication, hard work, and persistency. An example of simple technology was evidenced by the failure of the test rocket HEAT 1X in 2010, which never got off the platform due to a frozen valve, which should have been heated by a regular, low price, hair dryer.

To most people this space mission might sound optimistic and foolish. However, it also stimulated dreams and science passion, and people, especially engineers, started to join the project. CS accelerated when a blog was initiated at *ingeniøren.dk*, a Danish engineering magazine. The interest exploded, and engineers from entire Denmark would comment, give advice and help acquiring materials. However, raising money was an ongoing topic, and CS was always in economic trouble. Several times, they announced to be in danger of shutting down. Therefore, in 2010, fans established a support organization that through memberships, raised money for the program. Throughout the history of CS, the supporters donated up to EUR 13.500 every month.

CS was always trying to be active, and donations were instantly used for research and development. Especially one of the founders, Madsen, was always testing and experimenting many different things, new engines, new fuel, etc. Fans were frustrated that Madsen constantly changed the technology, instead of being consistent. A bifurcation started within the organization; some wanted to plan and develop well-known technology, and some wanted to experiment with novel technology.

Madsen claimed that theory, calculations, and rigid planning were not right for CS. He promoted practical solutions, and learning from mistakes.

In 2011, CS successfully launched the HEAT 1X rocket, a pioneer in amateur rocket science, being about 500 times bigger than most amateur rockets. The launch was a gigantic success in CS, and an existential acknowledgement to the members. By the end of 2013, there were just under a thousand members in the support group, and almost 50 active members in CS. Even though everything appeared successful, internal issues had started to shine through the blog, and the social atmosphere was tense. The program had grown to a size that challenged the structure and the founders, and with the increasing number of supporters and fans, they had an increasing number of stakeholders to please. There were internal disagreements about the association, the economy, and technology. Hard working members had earned the right to make decisions; however, the founders still had the last word. Madsen, being very tempered, had outbursts against Bengtson or other members when they disagreed. In the beginning of 2014, a dispute resulted in Bengtson leaving CS. Soon after, a board was elected to take care of the conflicts, and ensure survival of the association. CS was on shaky ground, and in the beginning of June the static test of HEAT 2X, the biggest in history, failed. After months of hard work, it was a hard blow to the members and a setback of the association. From here, the internal conflicts escalated, and the chemistry between Madsen and the other members was at a boiling point. This resulted in Madsen leaving.

Copenhagen Suborbitals had the challenge of proving that they could proceed without the founders, with a new board and new organization. The situation with the economy was serious, and the board wanted to make economic sanitation, reducing the number of expensive side projects. Via the blog, fans were told about all the members that had been hidden behind Madsen and Bengtson's ego for many years. Even though the founders were gone, it was the same dream, with almost 50 skilled and passionate people. What the board emphasized was the importance of all members, and that they were all equal parts of CS. The members did not want hierarchy, but unity.

## **ANALYSIS**

The present chapter and analysis is based on the data from primary sources, thus grounded in Copenhagen Suborbitals; it takes off apparently where the story section ends. The analysis has two contributions: Organizational balance and operational processes.

### **Organizational Balance**

As there were no intentions going into the research, it was unknown what the focus would be. As rocket science is generally perceived as difficult, it was a surprising experience that the development of technology itself was relatively unproblematic. The issues, both observed and stated by participants, related to management and steering.

The research discovered that CS recently had changed their internal organization. The organization was now without individualistic profiles, and the ownership and power was given to the remaining members. The newly selected board had the important mission of reducing conflicts and ensuring the association's future. After both founders had left CS, the board introduced an egalitarian

model that rejected hierarchy and had completely decentralized power structures. A significant finding was that neither the board nor the chairman had executive power, but only did what they were expected to do: To bring order and ensure the future. Evidently, this created member unity and an environment of consensus with increased communication, a good social atmosphere, and - unlike in the past, carefully thought through decisions. However, the environment of extreme consensus was not exactly utopia. The extreme consensus meant slow decisions and complicated procedures, which evidently were unproductive. Meanwhile, CS was organized in few, over-populated groups with unspecific focus areas, which disabled members to take initiative and create activity.

CS members were aware of this problem; consensus was a vital part of their organization, however, concurrently it disabled them to produce rockets. During the research, a new initiative in the organizational form was initiated. By clarifying technological areas, more groups emerged, and members were scattered into smaller groupings. Members were liberated to join the groups they found interesting, which caused groups to have competent and engaged members. Conclusively, this initiative caused groups to have more specific work areas, and fewer and competent members. This development had a significant effect on the productivity. The reason hereof was that members had now had individual space and took initiative within their field, and because there were fewer members present, group consensus was simple. Nonetheless, the core of CS was still based on collectivity and broad consensus, and as such the small organization operated in two levels, the collective and the individual.

The data suggested a balance between consensus and initiative. Consensus promoted unity, increased social factors, and reduced conflicts; it also caused substantial decisions, defined as effectivity. However, too much consensus was inefficient and extremely time consuming. The opposing force was initiative, which created activity and efficiency; however, it also implied quick decisions and individualism, and eventually it could lead to conflicts. In Figure 1, the balance-relationship in CS is depicted.

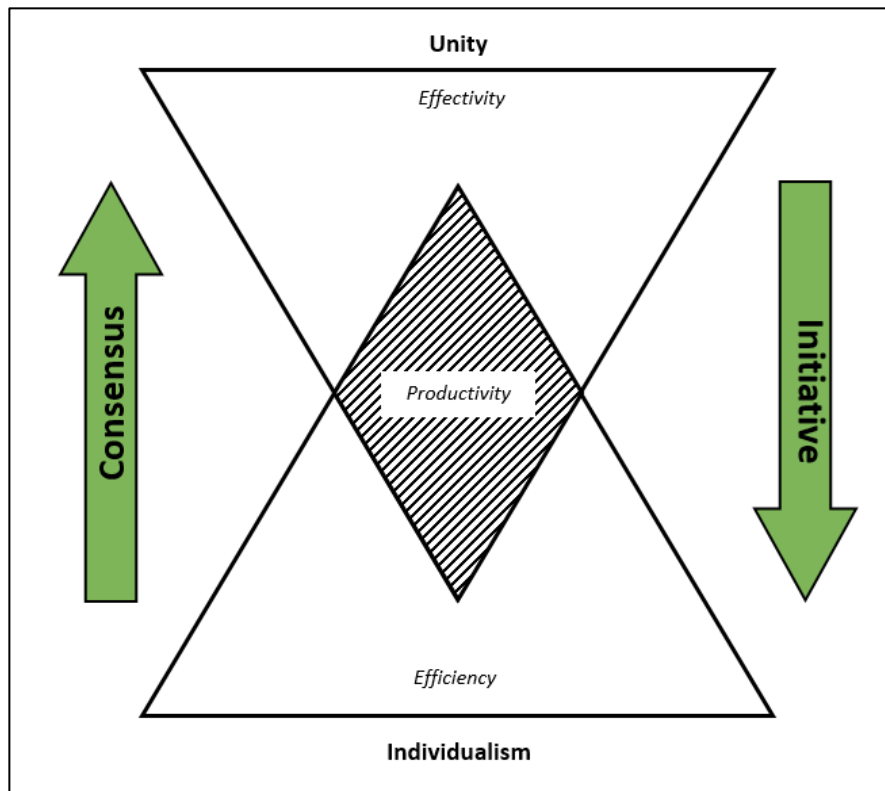


Figure 1. Balance model - illustrates the connection of consensus and initiative

The organization was in a state where the collective was united, there was good communication, and decisions were made in consensus. Thus, from a steering/managerial point of view all members were involved in the executive coalition. However, members were also scattered in groups that individually were responsible for delivering different rocket parts, and these groups enabled initiative and action. Balancing the concepts of consensus and initiative showed to be most productive – decisions were agreed upon by the collective and initiated by the individual.

### Operational Processes

So, how did this organizational form operate? The operation consisted of two significant processes: Direction and navigation. The analysis of these processes reveals how CS alters between consensus seeking and individual initiative.

The term *direction* was mentioned by a source in an interview, and was found to be an appropriate term. It meant the development of a non-fixed course with approximately the right specifications, whilst identifying important activities. This was a new initiative in CS, and a source explained, “It has increasingly occurred to us how important a base plan is.” However, the direction had to remain flexible due to uncertainties with materials, member presence, and technology development. A few terms affected the forming of direction. The board had responsibility of the economy and was thus allowed to steer the budget. This notion was supported by a source stating that, “we have solid steering on budgets, because we do not have a lot of money.” Furthermore, CS had a

responsibility to the volunteer donators, “We know that we have to deliver the goods, and make sure that donations are used right.” Consequently, economy and showing progress to donators were terms of the direction.

With the terms in mind, the collective group shaped a *macro direction* with a long-term overall perspective. The macro direction was undetailed and flexible, and the most important aspect was to create mutual expectations that limited hasty individual decisions. The macro direction was a collective activity and based on consensus seeking by all members; it was the most complicated consensus-dominated process in the research, however an important activity to maintain the unity and equality.

*Micro direction*, however, was a group activity, where the individual groups had to plan within their own area. Creating a micro direction was about assessing the technology and the tasks within the frame and collective expectations of the macro direction. As an individual group activity, it was not dominated by broad consensus, but a responsibility of the local group members. Accordingly, micro direction was shaped by individual initiative and simple local consensus seeking, and was observed to be relatively productive. In Figure 2, a simple model demonstrates the formation of macro- and micro direction.

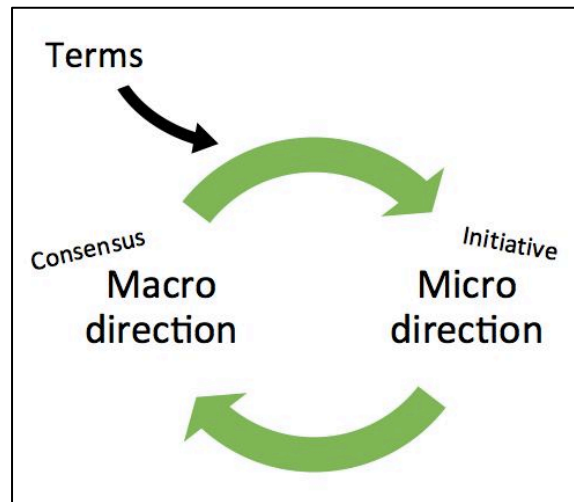


Figure 2. The direction process – Ingoing terms and iteration process of macro- and micro direction.

As shown in the model, the process of making direction was highly dynamic, and observed as an ongoing iterative process between the micro and macro level. Thus, the direction formation was balanced between consensus and initiative, and as seen in Figure 1 – the balance model, it implied productivity.

The iterative process of direction created an increasingly clear plan both at the collective and individual level. When the direction was clear enough, and both the collective and individual plans were in agreement, CS proceeded to navigational processes, concerned with following the direction. During navigation, groups had freedom with responsibility and were self-controlled. According to a

source, “Groups can steer themselves, as long as it doesn’t affect the others (groups).” Hence navigation and production in CS were delegated to the groups, and implied initiative and activity. However, in order for the collective to follow the development, one of the most important elements in navigation was that groups were obligated to be informative about their process and development. This is where the operation went back to consensus seeking, to ensure that everything was in order and followed the right trail of development and expectations. With information from groups, the collective evaluated the current development and position in comparison to the direction. Evaluation in collectivity either resulted in direct feedback to individual groups or caused the organization to re-assess the direction and the underlying norms of their development. The following Figure 3 depicts a model illustrating the navigation.

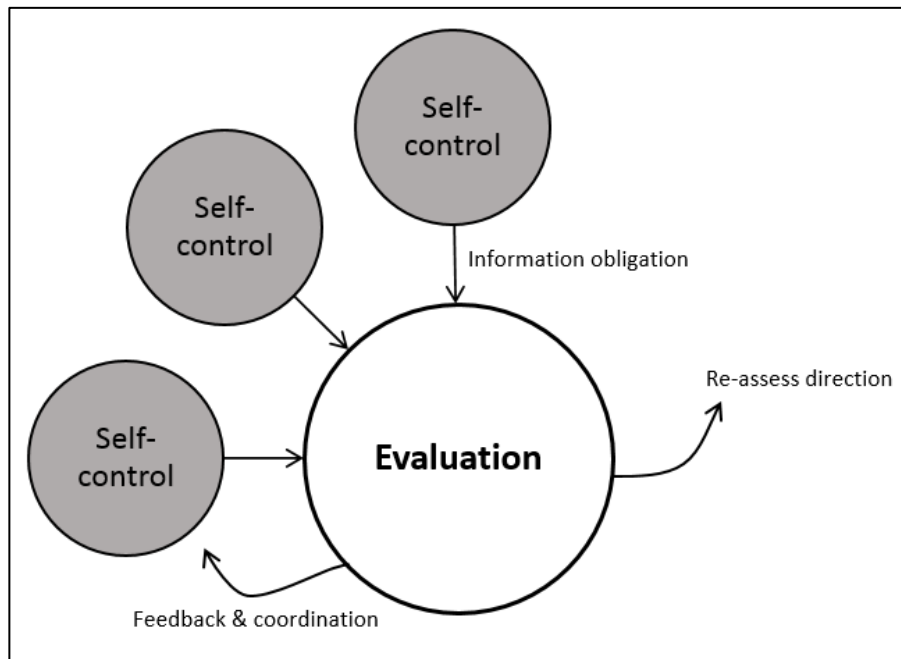


Figure 3. Navigation process – self-controlled groups inform the collective, which evaluates the situation, leading to either feedback and coordination, or a re-assessment of the direction.

As seen in the model, self-controlling groups, based on initiative, informed the collective, which evaluated the situation and compared the different groups development. This resulted in direct feedback or re-assessment of the direction. In this model, CS used the balance of initiative and consensus to navigate towards a united goal by allowing individual activity. As with the direction, the navigation had a high use of iterations between the collective and the individual groups. Practically, each group worked with their technology, seeking to develop a good solution within their field. Concurrently, different developments were presented and tested, and if successful the group would proceed, if not, it would try something alternative.

### *Conclusive Remarks on Analysis*

The research and analysis of the organizational form suggested that CS were organized in two levels and despite of lack of chiefs, achieved to execute steering based on consensus and equality. However, to ensure productivity the association delegated the responsibility for activity and production to the initiative of the group members. This form was based on the balance of consensus and initiative. The organizational arrangement became visible in the operation, where both in the direction formation and in navigation, consensus and initiative were vital parts of the process. The operation was based on iterations and concurrent research and development.

### **LITERATURE REVIEW**

Project management is defined as, “The application of knowledge, skills, tools, and techniques to project activities to meet the project requirements” (PMI, 2008, p. 4), in order to meet the constraints of scope, time, and cost (Hällgren & Söderholm, 2010; Lenfle & Loch 2010). Standards suggest a solution to contingencies in projects, by introducing risk management, which is the application of “probabilities times the impact” (Pich et al., 2002, p. 1009). There seems to be a bifurcation in the field; on one side there is numerous project management standards with positivistic approach to contingency, and on the other side researchers claim that contingencies cannot be foreseen or predicted, especially those of social character (Ghoshal, 2005; Morris, 2013). “There is no scientific basis on which to form any calculable probability whatever. We simply do not know” (Keynes, 1937, p. 211). McFarlan (1981) argues that in uncertain and ambiguous projects, tight planning and control only gives the manager an idea of having control, when in reality they do not. This is supported by Morris (2013) and Söderlund (2002), highlighting that standards present unpredictable variables in positivistic theories.

Standard planning measures are only successfully applicable when an adequate level of information is present (Pich et al., 2002). There do exist methods suited for contingency management and complex development; trial-and-error learning and parallel trails (Lenfle & Loch, 2010; Pich et al., 2002; Sommer & Loch, 2004). Both methods originated in complex and uncertain projects in USA around the 1950s - before the project management institutionalization around the 1970s (Lenfle & Loch, 2010). The trial-and-error learning method implies experimentation and iterative development of knowledge, and is associated with innovation and single- and double loop learning (Lenfle, 2008; Mintzberg, 2014). Double-loop learning enables the institution to, not only redirect their current path, but to revise the underlying strategic norms (Argyris & Schön, 1983). Trial-and-error methods allow projects to become strategy tools, rather than strategy fulfillers, as ongoing development allow managers to change and adapt the underlying norms and not only the project development (Lenfle & Loch, 2010). Developing parallel trials involves the development of several design proposals, in order to increase the likelihood to develop at least one successful design (Lenfle & Loch, 2010). Neither of the methods are found in the standards, as they are conflicting many of the standardized beliefs concerned with scope, cost and time.

Lenfle and Loch (2010) claim that modern practice has lost its roots, and that project management standards favor cost/performance relationship instead of the optimal solution. Furthermore, they accuse the standards of being obsessed with “execution” and “uncertainty elimination and control” (p. 48). Morris (2013) agrees with this by stating that project management has to focus on delivering the adequate output, not solely on constraints of cost, budget and scope. Contemporary standards use a phased approach of controlled sequential stages; thus, projects are managed on calculations rather than possibilities, causing free innovation and new ideas to be limited (Lenfle & Loch, 2010). Kreiner (1992) supports this, and argues that projects in organizations should be releasing creative forces instead of planning, and increase people participation instead of control. The result hereof, is that the art of project management has placed itself in a niche of top-down perspectives, where innovation and strategy formation are under-prioritized (Blomquist, Hällgren, Nilsson & Söderholm, 2010; Cicmil, Williams, Thomas, & Hodgson, 2006; Hällgren & Söderholm, 2010, Lenfle & Loch, 2010; Pich et al., 2002). Ghoshal (2005) argues that excessive use of assumptions and partial empirical analysis has created imperfect positivistic theories that are destroying good practice. Organizations that use iteration and parallel methods are often novel, or in a complex and dynamic environment, and perceived as unprofessional and poorly managed, because their techniques are situated “outside” (Lenfle & Loch, 2010, p. 47) of best practice (Aiken & Hage, 1971; Van de Ven 1986).

However, research in the last decade has shown that trial-and-error and parallel trial is a viable method of managing novelty, especially when “unforeseeable uncertainty” is high (Loch, Solt, & Bailey, 2008, p. 33). When managing technology and innovation with high risk, management should acknowledge the uncertainty and expect situational variables; thus, methods should differ from standardized measures (Lenfle, 2008; Lenfle & Loch, 2010; Loch et al., 2008; McFarlan, 1981; Mintzberg, 2014; Pich et al., 2002; Van de Ven, 1986). Conclusively, project management should emphasize both standard- and specific measures, by then optimizing when possible, but not neglecting to have a specific focus on context and contingency (Besner & Hobbs, 2008; Hällgren & Söderholm, 2010; Söderlund, 2004).

## **DISCUSSION**

This research was performed at Department of Management Engineering at DTU; thus, there was an underlying expectation of finding something with academic interest within this area. Grounded theory is steered by data, which did not indicate much about management. From the first conversation, sources were talking about CS’ lack of project management; they neither had managers nor any interest in processes related to project management - it is an amusing finding that an amateur rocket manufacturer has more problems with managing the workforces than actually creating rockets. During the literature review – after the analysis, I read the article by Lenfle and Loch (2010) concerning project management having forgot its roots, and how standards only offer positivistic response to contingencies. Lenfle and Loch specifically notice two neglected methods that they argue should be part of modern project management; trial-and-error and parallel trials. The message in the article struck



me like a lightning, as I suddenly realized that CS was using exactly these methods - without having established project management, and without being aware of it. The alternative processes found in the analysis – direction and navigation, had strong connections to trial-and-error and parallel trails, and almost everything CS did was done by iterations and learning circles. They had been using original project management methods right in front of me, although claiming to reject it. This suggests the methods and processes to be intuitively applied by CS, and the fact that they worked with complex and unpredictable technology, while applying the same methods that Lenfle and Loch suggest to viable in these situations, becomes a strong argument for the context of this research.

Before going into a discussion about the findings, there is an interesting point here. I, as a researcher, have been educated in project management, but obviously did not identify the connection to CS' methods, during the data collection. Similarly, participants did not make the connection either. This exposes how these methods are not perceived as viable to manage projects, but more as alternatives in the absence of standards. An answer to why these methods are not commonly understood as feasible might lie in the common obsession of scope, cost, and time, taught at university. As a grounded theorist researcher with constructivist philosophy, this is an interesting point. The argument is that trial-and-error and parallel trails are costly methods; doing it right the first time, and doing it once, is profitable – it is as simple as that. Lenfle and Loch argue that our search to know everything has caused us to standardize, and deny that some things cannot be foreseen. Hence, we have forgotten to appreciate methods that allow us to learn by doing, and experiment with different solutions. In the study of CS, members seemed embarrassed when stating that they did not perform proper management, because their comprehension of project management was similar to standards. Conclusively, neither my sources nor I identified CS' apparent connection to project management, which support the contemporary literature claim that best practice neglects these original methods. As stated earlier, it was acknowledged that my background might influence the research, and when I did not recognize project management, it suggests that my perception of the discipline was locked on other methods; most likely concerned with scope, cost, and time. The fact that I did not recognize, and yet the analysis were supportive of contemporary claims, suggest the analysis to be pure. Luckily, this turn of event contextualized the contribution, and enabled an interesting discussion about project management. After all grounded theorists do need good luck sometimes (Suddaby, 2006).

The organizational form in CS is unconventional; CS rejected individual authority and the existence of floor managers, and instead they operated in a switching state of collectivity and delegated individualism. By balancing consensus and initiative in this form, CS had arranged a steering form for practicing rocket science without having rigid organizational structure, specialized positions, or executive managers. This form creates unity and equality, while still allowing each member to contribute and take action in the production. The surprising thing with the organizational part, might be the aspect that consensus both saves the organization from individualism and conflicts, and endangers the production with extremely slow pace. Thus, in this research, consensus is not a utopia of agreement, but a dangerous state if it becomes too extreme. Likewise, initiative has similar affect: No initiative cause no activity, and too much initiative endangers the state of equality and unity of the members.

Thus, this research suggests a balance of initiative and consensus in order achieve optimal production, in an organization like CS.

The operational processes identified in the analysis connect to known methods that often imply innovation and development – like double-loop learning. If the development of technology and rocket parts showed to be unfulfilling or faulty, CS had two responses; they navigated around it, or they looped back to the direction formation and changed the expectations and underlying norms of development. Remember from the analysis how the direction was flexible because adjustments were expected. Thus, in CS failures were not necessarily a bad thing, but an opportunity to learn and adapt. Consequently, building rockets were done in iterative development and constant adjustment of strategy.

CS managed to use both consensus and initiative in the operation; this evidently had great effect. This is depicted in Figure 4.

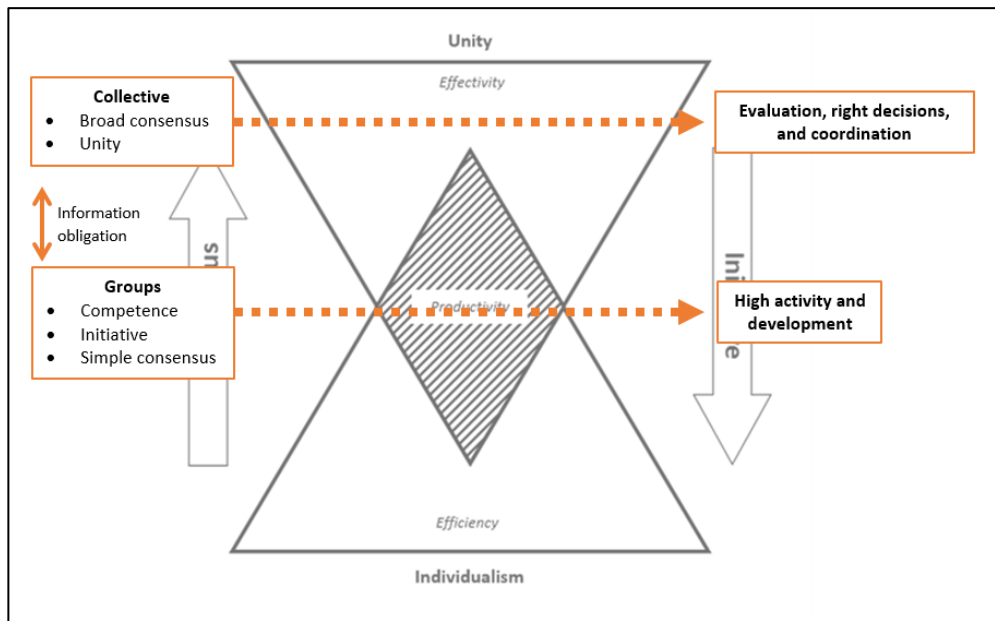


Figure 4. Compare of balance model and trial-and-error process

- On the left upper corner in the model is the collective activity, which is placed in the top of the balance model. Here the focus is broad consensus and organizational unity. During operation the collective made evaluations, coordinated, and ensured right decisions.
- Between the collective and groups is a critic link – the information obligation. This ensures that development of rocket parts are known to all members.
- Groups are depicted below the collective, on the left-middle side of the model. Here reside competent members, initiative, and simpler agreement due to few members engaged. The groups have both initiative and consensus, depicted by the dotted line through the middle of the balance model. Consequently, groups had relatively high activity and development.
- CS as a whole is a blend of these collective and individual activities, and as an organization is situated between these levels in the balance model.

Subsequently to the analysis, I realized that the actual operation never changed in CS, and the development had always been based on trial-and-error. Evidenced through the blog, they started out by making the simplest technology they could come up with; remember how a dysfunctional hair dryer was the reason for an unsuccessful launch of HEAT 1X back in 2010. Peter Madsen (2014) once wrote in a blog, “Accept calculated risk [sic], you will eventually die anyway’,” addressing the essence in CS. Since the beginning, they had been accepting risks and the possibility of failure. The technology in CS had become more complex, and according to sources, this progress was expected in CS. They always knew that simple was not enough, they just had to start with simple. In an innovative organization like CS, the knowledge and complexity will keep growing until it reaches its final destination, whether it ends above the Karman line or a huge explosion in Copenhagen Harbor.

Acknowledged, CS is a special case study and the theoretical outcome is not generically applicable. For instance the balance model would probably scale differently in comparison of other cases, or even look completely differently. However, I do argue that the study supports the literature about lost roots in project management, and the need for adopting integrating practices. CS was using trial-and-error and double-loop learning intuitively, probably because it is good sense in their environment with complex technology and contingent propositions. Perhaps modern project management needs more intuition? Rather, complex projects in contingent environments will either fail or apply specific measures to cope with its proposition. The advantage of standardized methods should not be rejected, especially in organizations with standardized quantitative production. Of course, companies can stay innovative while standardizing some processes, and NASA, just to stay within the subject of rocket science, has a whole department standardizing their processes. Hence, NASA manages to balance outside- and inside-the-box thinking. Whether it is pure coincidence or it has a deeper explanation, it is a fascinating discovery that this study has been connecting a non-profit and voluntary space program, with some of the original project management methods that NASA developed their program on, in the *space race* in the 1950s. Conclusively, institutions will find a way to manage their operation, whether methods are standardized by professional organizations, or intuitively developed, to fit the proposition. Moreover, institutions can only claim to reject project management, because project management has been standardized to meet specific constraints. Everything performed in a project matter is the appliance of management.

This discussion has focused on the application of intuitive methods in managing projects. If the definition of project management is “The application of knowledge, skills, tools, and techniques to project activities to meet the project requirements,” as PMI has stated, then there should not be a blind devotion to standards, but focus on applying adequate methods that meet the constraints of the respective situation. Members of CS seemed embarrassed when acknowledging that they did not apply standardized methods of management. I state, in contrary, that they should be proud of their intuitive methods and acknowledge that their situation as hobby-organization is special. Special situations might require special methods. Conclusively, the intuitive methods found in the analysis of CS, are actually encouraged by contemporary researchers in project management practice. The takeaway from this research is that a small organization that rejected executive leaders and hierarchy, were still able attain

a steering coalition by involving all members in broad consensus. It was also successful in avoiding unproductiveness of consensus by delegating production to competent members in small self-forming groups. So far the organizational form has been a success, however, it is still new and any further development in CS will be exciting to follow. Another takeaway is the context to project management, and the support of contemporary literature. By intuition CS used the proposed methods of trial-and-error and parallel trail, uncertain situations were handled with learning and adaption, which suggests that these methods might be viable, and should be accepted in project management practice.

### *Robustness of Research*

The final section features a brief discussion of biased position in terms of preconceived knowledge, data interpretation, influenced sources, and methodological techniques.

According to Loosemore and Tan (2000), a researcher's stereotype perceptions cause ignorance or misinterpretation of data. Being a student/researcher of engineering management constituted a natural risk hereof; however, measures and conscious choices were made to limit preconceived influence. Firstly, all literature review was delayed until after the analysis, which limited the risk of direct academic prejudice. Secondly, by constantly reminding myself to preserve a receptive mind and listen to the data, I argue to have limited the influence of my knowledge, or at least stayed open to findings. Evidence of receptiveness is found in the central discussion about alternative methods of project management. Sources stated that CS did practice project management, which actually helped me to think: *OK, then what are the alternatives?* As a consequence hereof, the data collection and analysis emphasized the data and the research displayed the alternative methods: Direction and navigation. Conclusively, by delaying literature and maintaining a receptive position, I claim that influence from preexisting knowledge was limited.

It was previously described how interview questions were open-ended and non-judgmental. However, asking neutral questions in an interview did not guarantee that the interview actually was neutral (Charmaz, 2006). There was a risk of my origin alone influencing the research participants, causing them to act unnatural and answer in favor of themselves or me. To limit this risk, minimum was told to participants about my origin and the thesis; however, participants were aware that I was from DTU. I noticed how some participants seemed to underline how they really did not have project management, which, I assume, was because of my origin. This risk was limited most possible; however, the effect of it is difficult to evaluate. Approaching the end of the study, the analytical findings were presented to a source. He was positive to the findings and found them viable to explain the behavior in CS. However, even though a source was positive to the findings, it did not necessarily suggest all data to be valid. I argue that the subject itself will have difficulties to both accept and reject a study, as the subject will always have a biased position.

According to Charmaz (2006), grounded theorists have to follow the rules and guidelines in order to rightfully claim to have used the method. I argue to have shown my devotion to the techniques and rules of grounded theory, and by best my abilities distanced from the obvious pitfalls of biased data production.

## CONCLUSION

This paper offers a study with grounded theory in an unusual association. Grounded in the data, the analysis contributes with a balance model, suggesting initiative and consensus to be two opposing concepts, both vital to the subject. Using these concepts, the subject successfully decentralized their structure, and rejected all hierarchy. This created a form where the executive coalition is collective. Essentially, consensus promotes unity and agreement, and initiative creates individualism and activity, and the study suggests a balance to be optimal. The subject claimed to reject project management and the existence of managers, and the analysis identified alternative processes that combined consensus and initiative. Interestingly, the study shows that even though the subject claimed to reject project management, it was in fact using the same methods that contemporary literature states to be forgotten roots of the discipline. This supports the claim that project management standards are prohibited of alternative methods. The alternative methods identified with the subject, were highly congruent to methods of trial-and-error and parallel trails. Now, these were applied out of good sense, and not in relation to standardized project management. This suggests project management to use more intuitive methods in similar, and support claims that these methods should be accepted as viable in the practice.

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