Managing R&D – The eternal dilemma
- A study of how control is exercised in R&D operations

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ABSTRACT

Managing R&D is not an easy task for organisations to handle as it is often associated with uncertainty and high risk-taking. The purpose of this thesis was therefore to gain a better understanding for how management control is performed in a company’s R&D unit. The study has, based on previous research, identified four types of control (output, behavioural, personnel and cultural control). The empirical study aimed to investigate whether and to what extent each form of control was used in R&D projects. These controls were also expected to be used differently depending on whether it was a research or a development project. The results of the empirical study showed that all four forms of control were found to be present in the case company, in which output and behavioural gained the strongest support followed by cultural and personnel control. In line with the expectations, output and behavioural controls were found to be more present in development than in research, however no clear differences could be found regarding personnel and cultural controls. The findings furthermore indicated that employees felt somewhat restricted by the formal controls and desired less strict control in order to enhance their creativity and innovativeness.

KEYWORDS:

R&D; Management Control; Innovation; Uncertainty; Behavioural control; Output control; Personnel control; Cultural control
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1. INTRODUCTION

“Controlling R&D is a challenge. Managers have long struggled to develop effective control systems for directing and adjusting R&D behaviours and outcomes” (McCarthy & Gordon 2013).

In response to the changing environments companies need to explore new ways of doing things in terms of products, processes and ways of creating value (Simons 2010). Factors such as fast product-cycle times, increased competition, globalisation and product commoditisation have put greater pressure on organisations to continually innovate in order to survive on the market (Kennedy & Schleifer 2007). Thus, technological innovation has become critical for companies as they struggle to achieve and maintain competitive advantage. In order to develop innovative and high-quality products this has put a premium on companies to manage their research and development (R&D) operations in an effective and efficient way (Cardinal 2001). However, managing R&D has been found challenging as these operations are often unpredictable, risky and highly uncertain (van Ecker, Triest & Williams 2013). Hence, many R&D projects fail to meet objectives as they deviate from their planned unit cost, project cost and time-to-market and do not meet the expected customer satisfaction. Due to the risks and uncertainty facing these operations, managers may therefore be willing to cut R&D spending or de-prioritising projects with potential positive earnings in the long run, in order to ensure short-term results (Dunk & Kilgore 2001; Osma & Young 2009).

At the same time, managing R&D involves the challenge of balancing flexibility and efficiency (Jörgensen & Messner 2009). As R&D scientists may require a certain degree of freedom and autonomy in order to be innovative, their work have to be overseen and controlled by management in order to ensure that work is held within certain frames and is led in a profitable direction (Poskela & Martinsuo 2009; Randle & Rainne 1997; Silaen & Williams 2009). Hence, today’s companies have to establish management controls that ensure continuous innovation and which at the same time minimise potential surprises (Simons 1995). Balancing these two imperatives is however challenging and many times managers inadvertently design control systems that systematically kills creativity instead of fostering it (Amabile 1998).
The question of how to manage R&D in the best possible manner remains a dilemma for many organisations today and earlier studies indicate that there are clear dissensions about how management control should be performed in these settings. While some studies find that more formal control, in terms of expense budgets, rules and written procedures may stifle creativity in R&D activities (Amabile 1998; Ouchi 1979), others argue that this kind of control can enhance a company’s innovative performance (Davila 2005; Simons 1995). Another group of researchers argue for more informal control styles where emphasis is put on open communication and interactivity between employees, rather than strict control procedures (Abernethy & Brownell 1997; Bisbe & Otley 2004). Moreover, some research states that control should be exercised differently depending on the uncertainty involved in the R&D operations (Tatikonda & Rosenthal 2000; Ylinen & Gullkvist 2012).

1.1 PURPOSE

The aim of this study is to create a better understanding of how companies manage their R&D operations in order to guarantee for both efficiency and flexibility. Since the literature seems to give contradictory answers about the effectiveness of different management controls in R&D work, it is interesting to further investigate how these controls are used in practice and also how they are considered to affect the possibilities for creativity and innovation. Additionally, as earlier studies have highlighted the necessity of understanding the dynamic environment and the challenges surrounding R&D (Bart 1993; McDermott & O’Connor 2002), this further strengthens the reason to investigate the subject. The previous problem discussion leads to the following research question:

*How is management control exercised in R&D operations?*

This study will be examining the situation in one company’s R&D unit in order to gain deeper understanding of the situation in one single case. The company chosen for the study is a large multinational company active in the biopharmaceutical industry. The main reason for choosing the company is that it operates in a high-technology industry where the need for innovation is essential for survival and profitability (George, Zahra & Wood 2002). Moreover, companies in this industry are required to invest significant amounts in their R&D operations in order to be able to develop existing products as well as new ones (Cardinal 2001).
2. LITERATURE REVIEW

2.1 MANAGEMENT CONTROL

The definition of management control has been redefined several times since it was first studied in the late 1960’s. However, today it can be described as a way of developing and promoting desired behaviour of employees in order to ensure that organisational goals are fulfilled (Anthony & Govindarajan 2007; Merchant & Van der Stede 2007). In order to promote the desired behaviours organisations implement management control systems (MCS). A MCS can be defined as “the set of procedures and processes that managers and other organizational participants use in order to help ensure the achievement of their goals and the goals of their organizations” and includes both formal as well as informal controls (Bisbe & Otley 2004; Bart 1993). More specifically, the formal controls generally entail output and behavioural control while informal controls include personnel and cultural control and all these controls are considered to be vital parts of a MCS (Langfield-Smith 1997; Merchant & Van der Stede 2007). Furthermore, these systems need to be adjustable and flexible enough to cope with fast-changing environments in which creativity and employee initiative are required (Simons 1995). A visualisation of the MCS can be found in Figure 1.

![Management Control System](image)

Figure 1: Management Control System
2.2 MANAGEMENT CONTROL OF R&D
In contrast to organisational routine operations, which are ongoing and repetitive, R&D activities are often temporary processes in which conditions are often marked by some degree of uncertainty (Naveh 2007). Due to the unpredictable nature of R&D, researchers have stated that these operations should be managed differently than more routine activities such as production and sales (Jörgensen & Messner 2009; Poskela & Martinsuo 2009). This thought was revealed already in 1979, when Ouchi claimed that R&D units required other control systems than formal ones due to the limited knowledge of the input-output transformation and the inability to measure results timely. Consequently, formalisation through procedures, rules and manuals were not considered to be very effective in R&D and instead, the process of conducting these operations were rather said to depend on people with research or technical expertise, personal interactions and on creativity. (Kim, Park & Prescott 2003) However, more recent studies have proposed a different view and concluded that R&D and innovation in large firms need to be managed actively and have to rely on formal control systems to do so (Davila 2005; Davila, Foster & Oyon 2009). Hence, control mechanisms such as objective-setting, performance measurement and compensation schemes have been deemed vital in order guide the innovative process of R&D and thus effectively come up with new products. In line with this, formality and structure have been found to be positively correlated to the fulfilment of R&D project performance objectives (Naveh 2007). This was explained by the fact that when the work process is based on past experience and knowledge with controls, coordination and reviews it can provide a sense of structure and sequence to R&D operations (Naveh 2007; Tatikonda & Montoya-Weiss 2001).

At the same time, it has been suggested that management control of R&D should be performed differently depending on the degree of uncertainty involved in these operations (Ylinen & Gullkvist 2012). Tatikonda and Rosenthal (2000) concluded that formal control systems performed well when dealing with relatively straightforward and structured problems, but less when there was significant uncertainty involved in R&D operations. The reason was that since reliable information is missing in highly uncertain settings it makes the use of formal controls less feasible as these controls may provide subordinates with limited freedom and too few opportunities to deviate from actions and pre-determined project targets. Similar findings were
revealed in a study of R&D projects, where formal controls were considered to lack the flexibility that ensure creativity, new learning and adaptation in breakthrough or explorative projects (Schultz, Brentani & Kleinschmidt 2013). Instead, it has been suggested that uncertain operations should be guided by more informal means of control which facilitates frequent communication between subordinates, flexibility in the task execution process and creativity (Tatikonda & Montoya-Weiss 2001; Ylinen & Gullkvist 2012).

In line with the findings above, previous studies suggest that the various phases of R&D should be managed in different ways since the research phase is faced with more uncertainty and ambiguity than the development phase (Poskela & Martinsuo 2009; Ylinen & Gullkvist 2014). In accordance, Rothaermel and Deeds (2004) found that the uncertainty facing R&D projects drastically decreases once a project enters the development stage, which also Chiesa, Frattini, Lamberti and Noci (2009) agreed with, stating that earlier stages of R&D projects involved higher levels of uncertainty than later stages.

2.3 FORMAL CONTROLS
Formal control has been described as the more visible, objective components of a MCS and generally includes high levels of output and behavioural controls, which aims to ensure that certain outcomes will be achieved through monitoring, measuring and corrective actions (Das & Teng 2001; Langfield-Smith 1997). The purpose of formal control systems has traditionally been to reach efficiency through standardisation and risk minimisation (Davila 2005). Consequently, their use in high-innovative operations in which uncertainty, experimentation, flexibility and freedom are paramount have often been considered to be of limited value (Amabile 1998; Bonner, Ruekert & Walker 2002). However, this view was opposed by Davila (2005) as he found that formal control systems can actually be dynamic, flexible and adaptable to the unpredictable needs of innovation but stable enough to develop communication patterns, routines and actions.

2.3.1 OUTPUT CONTROL
Output control is an impersonal form of control, in which the purpose is to control the outcome of employees’ behaviour (Strauss & Zecher 2013). When applying output control companies set up performance goals, measure how well outputs corresponds to the predetermined standards and provide respective rewards and punishment for success and failure in goal attainment
(Merchant 1985). These performance goals can serve to create structure in R&D work as the targets inform what is expected from employees and also encourage them to do what is needed to reach the desired results (Carbonell & Rodriguez-Escudero 2011; Merchant & Van der Stede 2007). Moreover, as output control only monitors the target achievement itself, subordinates are free to use their own methods and ideas to pursue these targets (Hutzschenreuter 2009). Simons (1995) describe this type of control as “management-by-exception”, which allows the employees to achieve goals without constant management oversight. This means that superiors rely on the judgment and experience of those performing the tasks and the importance lies in reaching specific results, rather than trying to specify how these results should be accomplished (Snell 1992).

In order for output control to be efficient results need to be measured effectively and organisations must know what results are desired in the areas they wish to control (Hutzschenreuter 2009; Merchant & Van der Stede 2007). The original thought was that output controls were not well-suited in R&D units due to difficulties in measuring outcomes in a timely manner (Ouchi 1979; Rockness & Shields 1988). However, later research has suggested that the effectiveness of output controls largely depends on the routineness of R&D work. Abernethy & Brownell (1997) stated that when R&D tasks are more routine and certain it is possible to pre-determine and quantify desired outputs effectively. Contradictory, when tasks are complex and non-routine it is problematic to measure results accurately and also to set up output goals in advance as the nature of the task is difficult to anticipate (Abernethy & Brownell 1997; Poskela & Martinsuo 2009).

Cardinal (2001) revealed another aspect in a study of R&D professionals in pharmaceutical firms. She claimed that too much emphasis on outputs to evaluate and reward scientific work may create an atmosphere where scientists focus on project success or completion rather than developing new and revolutionary knowledge. In addition, output controls may also lead companies to focus on R&D projects with more predictable outcomes and faster returns, rather than riskier projects that may generate higher returns in the long run. Therefore, Cardinal (2001) suggested output controls to be more effective in contexts where desired results are shorter term and more easily measurable.
2.3.2 BEHAVIOURAL CONTROL
In contrast to output control, behavioural control (also referred to as structural, action and bureaucratic control) serves to directly regulate behaviours and activities through the setup of formal rules, routines and procedures (Anthony & Govindarajan 2007; Langfield-Smith 1997; Ouchi 1979). Behavioural control generally involves close surveillance and direction of employees, as superiors steer work activities and monitor the performance of their subordinates (Ouchi 1979). Due to the strict guidance of the subordinates’ work, this can help to alleviate a lack of direction and also motivate the employees as they know what is desired of them (Merchant & Van der Stede 2007). Further, to be able to utilise behavioural control the process that transforms input to output must be well-known, as superiors then can guide and plan the set of behaviours sufficient to complete a certain task (Das & Teng 2001). However, defining the preferred actions are sometimes difficult for organisations. In highly uncertain and complex task environments, such as those of research scientists, management may find it challenging to define the forthcoming work in detail and hence the relevant steps for target achievement which limits the use of these controls (Cardinal 2001; Poskela & Martinsuo 2009).

Since behavioural control involves the standardisation of work processes it may serve to reduce discretion among employees thus making rigid and cautious behaviour more likely (Snell 1992). Additionally, frequent monitoring can diminish the likelihood for experimentation among R&D professionals as they may be more willing to follow pre-established procedures in order to avoid making mistakes. Hence, this may cause R&D professionals to “play safe” and focus on small product improvements rather than pursuing non-routine and radical changes that involve higher risks of failure. (Cardinal 2001) On the other hand, it has been suggested that behaviour control might be necessary as autonomous R&D units may act opportunistically, pursuing own interests rather than the organisation's which in turn could reduce the innovative capability (Persaud 2005). Bailyn (1985) also claimed that less autonomy and more behavioural control might be necessary in the initial part of R&D projects. Her findings indicated that many scientists wanted to be told what to do and what is needed from the project while they required more freedom in solving the problems that they were assigned. Furthermore, Simons (1995) argued that restricting a certain behaviour does not necessarily have to minimise creative thinking in organisations. If managers set up boundaries for what subordinates are allowed to do and not to
do rather than dictating the individuals’ work in detail it could facilitate creativity as individuals will search for ways of creating value within these boundaries.

2.4 INFORMAL CONTROLS
Since work requirements have become more uncertain, complex and changing, greater requirements has been put on MCS to be flexible and dynamic rather than static and formal (Davila 2005). Therefore, firms need to employ informal control systems that enhance creativity, autonomy and flexibility among subordinates (Tushman & O’Reilly 1997). As previously mentioned, informal management control involves high levels of personnel and cultural control (Merchant & Van der Stede 2007) and are characterised by unwritten objectives, shared values, norms, training and strict personnel selections (Bart 1993; Langfield-Smith 1997). Moreover, informal controls are considered to be important aspects of MCS, as these controls may serve to improve the effectiveness of the formal systems implemented in a company (Langfield-Smith 1997). Some researchers have claimed that informal controls are not consciously designed but a product of the organisational culture (Langfield-Smith 1997), while others describe informal controls as a choice made by managers to steer employees in the correct direction (e.g. Rockness & Shields 1988).

2.4.1 PERSONNEL CONTROL
Personnel control (also defined as input control) builds on the idea that employees should control, monitor and motivate themselves (Strauss & Zecher 2013). To make this possible, the focus is on finding the right people for a particular job and to provide them with a good work environment and the necessary resources (Merchant & Van der Stede 2007). In R&D departments, researchers are therefore selected based on previous successful projects with the expectation that they will know the necessary steps for goal achievement. By ensuring that employees have the necessary skills and experience for a certain job there is less need to control their behaviour as the organisation can rely on the professionalism of these group members. (Hutzschenreuter 2009). Additionally, by selecting employees with different skills, backgrounds and perspectives this can facilitate the generation of new ideas and thus, improve the innovative potential (Cardinal 2001). To assist this employees are offered training and development. By providing initial job-training as well as training during the employment, employees will have information about what actions and results are expected and how the assigned tasks can best be performed (Merchant & Van der Stede 2007).
In a study examining the effectiveness of different controls in R&D settings, Abernethy and Brownell (1997) found that personnel forms of control had a significant positive effect on performance when uncertainty was high, while behavioural and output control showed poorer effects. The authors explained these findings by stating that behavioural and output control were difficult to utilise in highly uncertain tasks due to the high number of exceptions and to the limited knowledge about the input-output transformation and therefore, it was suggested that companies had to rely on personnel controls instead. In accordance, a recent study found that personnel control had a significant positive relationship with company’s innovative capability (Haustein, Luther & Schuster 2014). There are however potential drawbacks with using these types of controls as it only manages to control an employee’s potential while there is no guarantee that this will transform into performance (Snell 1992). Moreover, personnel control is not a viable option for all businesses since it is costly and may endanger organisational goals in favour of individual self-interests (Simons 1995).

2.4.2 CULTURAL CONTROL
Cultural control (also referred to as clan control and social control) is facilitated through the creation of a common view between employees on what constitutes proper behaviour and is considered to require social agreement on a broad range of values and beliefs (Ouchi 1979). In order to create this organisation-wide culture, employees have to feel loyal to the company and behave in accordance to the company “way” (Baliga & Jaeger 1984). Hence, by creating a strong organisational culture there is less need for policy manuals, detailed procedures or rules as employee behaviour is guided by the shared values (Merchant & Van der Stede 2007). The cultural control also requires managers to be interactively involved, meaning that they have to motivate and inspire employees and to serve as a role model for subordinates (Hutzschenreuter 2009). Further, to ensure that the same values and rituals are followed, monitoring is exercised continuously through interpersonal interactions, feedback and shared agreements between team members (Baliga & Jaeger 1984).

Cultural controls are often discrete as acceptable behaviours may be prescribed in the terms of “how we usually do things around here” without people reflecting that these behaviours derive from the shared norms and values (Merchant & Van der Stede 2007). These controls have been
considered to be suitable for more uncertain operations as they enable for experimentation and variety since organisations can tolerate wide differences in how performance is achieved, as long as workers follow the right values (Ouchi 1979). Rockness and Shields (1984) also concluded that cultural (social) controls enable for more timely monitoring than for example output controls, which make these controls more appropriate in R&D settings. The challenge with utilising cultural control is however that R&D scientists often prefer to serve professional norms over those of the organisation (Cardinal 2001). Zuckerman and Brajkovich (2003) explains this by stating that many R&D professionals consider themselves as scientists in the first place and as organisational members secondly. Hence, in order to manage the R&D employees effectively a deep understanding of the R&D professionals’ attitudes and perspectives is required (Zuckerman & Brajkovich 2003).

2.5 EXPECTATIONS ON HOW CONTROL SHOULD BE EXERCISED IN R&D

The literature review leads to the following expectations on how management control is performed in R&D operations.

From the literature it is expected that all control mechanisms are used to some extent in R&D management. Further, conclusions that can be drawn from the literature review is that management control in R&D should be exercised differently depending on the uncertainty involved in these operations. Moreover, previous literature has stated that research involves more uncertainty than the development phase. Based on these statements, this paper will expect output and behavioural control to be more prevalent in development than in research. For output control this is explained by the fact that more certain and routine tasks make it possible to pre-determine desired outputs and also to measure outputs timely and accurately. The same applies for behavioural control as certain tasks allows managers to define a clear set of actions for employees. Hence, the high uncertainty involved in research work leads to the expectation that output and behavioural controls are less applicable in these settings. Instead, informal controls in terms of personnel and cultural control are expected to be used predominantly in research as these controls are more dynamic and flexible and thus enhances experimentation and creativity necessary for coping with uncertainty.
3. METHOD

3.1 RESEARCH DESIGN
The aim of this study was to gain a better understanding of how organisations manage their R&D operations. More specifically, we chose to investigate the situation in one company in order to find out how management control was exercised in their R&D projects. Moreover, the intention was also to find out how the current control was affecting creativity and innovativeness among employees and what could be done to improve it. To be able to study the research area a literature review was conducted and the conclusions drawn in the literature review were used as a basis for the empirical study. From the literature four different control types were identified; output, behavioural, personnel and cultural control. Based on the identified controls the intention was to investigate how and to what extent these controls were applied in R&D projects. In order to study the use of these controls, a survey was distributed to scientists and interviews were conducted with managers and project leaders. Since data was collected from different levels within the organisation the purpose was to get a broader and more detailed picture of how control is performed in R&D projects.

To study our research area, a descriptive approach was considered most appropriate. Further, the paper was conducted in the form of a single-case study as this allowed for a more thorough understanding of the complexity and specific nature of our study object (Bryman & Bell 2005). A single-case study was also deemed appropriate since the chosen case company is a multinational organisation with an extensive R&D department which allowed us to examine different R&D projects with varying characteristics. A common critique against this study approach is the difficulty in generalising the findings from the study (Bell 2008). However, for the purpose of this paper it was considered more valuable to do an in-depth study in order to investigate a situation and dilemma that we believe is typical and applicable to other larger companies (Yin 2006).

3.2 COMPANY SELECTION
The case company is a multinational company figuring in the biopharmaceutical industry. The company has annual sales of approximately 7-8 billion SEK and yearly invests about half a billion SEK in R&D in Sweden (Annual report 2013). In order to find our case company there
Two main requirements had to be fulfilled. First, the company had to have an in-house R&D department big enough to have a large number of managers and scientists employed. Secondly, the company had to have several ongoing projects within both research and development as the idea was to reach employees who worked in different projects. Through an interview with our contact person at the company, it was ensured these requirements were met. Since one of the managers early in the interviewing process expressed the desire to keep the company name anonymous, we decided to name it BioCo. The desire to be anonymous was not surprising since R&D and innovation management are considered as a sensitive matter by many companies. Thus, anonymity was assured to all participants in the questionnaire as well as the interviews.

From our contact person, it was found that BioCo had a matrix organisational structure which meant that employees were accountable to more than one leader or manager. In the R&D department, this meant that scientists were reporting both to a project leader and a line manager. The managers were responsible for a group of employees with expertise in different areas such as early research, applied research, development, market support, and tech support. The managers’ main tasks were to support their subordinates by guiding and coaching their work in the projects, setting and following up on their personal goals as well as providing technical expertise if necessary. Moreover, they were also in charge of allocating resources to the projects. The project leader’s primary tasks on the other hand, were to steer and direct their projects in the right direction and to make sure that budget and time goals were held. Similar to the managers, their roles also involved helping and coaching project members to some extent as well as supporting with their own expertise.

3.3 EMPIRICAL FRAMEWORK
To be able to investigate the presence of the four identified controls, a number of characteristics were defined for each control. These characteristics derived from the findings in the theoretical framework and were used in order to formulate the questions and statements for our questionnaire and interviews. A summary of what questions in the questionnaire and interview template (see appendix 1 & 2) correspond to what control type can be found in Figure 2. Further, in order to be able to identify potential differences between how control was performed in research and development, survey respondents were asked to state whether they were
currently working in a research or a development project (if they were active in several projects at the time, they were asked to focus on one specific project).

Output control was operationalised by finding out if it was possible to define clear goals in the projects. This was elaborated through the interviews, but also by asking scientists if they were given clear goals and objectives in regard to their assignments or whether the complexity and uncertainty of their work made this difficult. Since output control means that employees are acting without constant management oversight it was deemed appropriate to find out if employees were allowed to choose their own ways to achieve goals and objectives. To measure the existence of behavioural control, it was necessary to investigate the presence of formal routines and rules in the scientists’ work. Further, since both behavioural and cultural control includes management involvement, it was of interest to know if managers/project leaders were formally present as in behavioural control, meaning that they were directing and closely monitoring the subordinates’ work, or more socially involved as in cultural control. Behavioural

Figure 2: Framework for topics and questions
control was also elaborated by asking if managers/project leaders were considered knowledge about the different phases of the scientists’ work.

The presence of **personnel control** was studied mainly through the interviews. This control was investigated by posing questions about the recruitment of employees and what was considered important when hiring, but also what was deemed essential when forming a project group. Additionally, this control was elaborated by asking if employees were offered initial training as well as training during their employment. **Cultural control** was operationalised by finding out if managers/project leaders were interactive and if they were motivating and inspiring employees. This was first studied through the questionnaire in which scientists were asked if they perceived managers and project leaders to be engaged and active leaders and if they encouraged project members to try new ideas and ways to conduct their work. Secondly, managers/project leaders were asked about their leadership style and involvement in the subordinates’ work. Furthermore, as cultural controls rely on shared values it was important to investigate how the company worked with values and whether scientists’ shared these values and followed them in their daily work. Additionally, since loyalty is an important facilitator for cultural control, questions regarding if scientists felt loyal to colleagues and to the company were included in the questionnaire.

**3.3.1 IMPROVEMENT AREAS**
The intention with this study was also to find out how the present management could be improved in order to enhance innovation and creativity. Therefore, survey respondents were asked how the management in their current project affected their creativity and what actions could be taken in order to improve it. This was further elaborated through the interviews where managers and project leaders were asked what they believed diminished creativity among scientists today and in what ways this could be improved.

**3.4 DATA COLLECTION**
To collect and analyse data for the case study a mixed methods approach was used. The reason for using this approach was that data collected from different sources can help the interpretation of our results and also secure that the data collected is understood correctly by the researchers (Teddle & Tashakkori 2003). Additionally, a combination of collection methods eliminates the weaknesses of using the methods alone (Johnson & Turner 2003). To conduct the study,
questionnaires were distributed to scientists and interviews were conducted with managers and project leaders in a company’s R&D department. The reason for using different data collection methods for the target populations was to broaden our collected data. Conducting in-depth interviews with the ones exercising the control (managers and project leaders) enabled a deeper understanding of how control is performed in R&D. The questionnaire on the other hand, made it possible to look at the research area from the perspective of those being controlled (the scientists) and in this case it was deemed appropriate to get a broader picture of how they perceived control in their R&D projects. Thus, a questionnaire allowed us to reach more respondents and the respondents were able to remain anonymous towards us (Mertens 2003).

3.4.1 QUESTIONNAIRE
As mentioned above, a questionnaire was considered to be appropriate for our study as we wanted to create an overall picture of how scientists perceived the present management in their projects. Hence, using a questionnaire made it possible to gather information from a broad number of respondents (Saunders, Lewis & Thornhill 2009). By collecting responses from a larger group of people, it was possible to minimise the risk that individual-level differences were affecting our analysis (Luft & Shields 2003). The questionnaire was designed to mainly include close-ended questions using a Likert-style rating scale. The Likert-scale was chosen because it allows respondents to answer many questions fast as the same type of scale is used to answer several questions (Saunders et al. 2009). We decided to use a five-point scale as too many answers can confuse the respondent but too few answers will make it harder to distinguish between answers when analysing the results. Another reason for using many close-ended questions was that respondents often find these simpler to answer as they do not have to narrate their own answers, but also because these questions are easy to program which enables for analysis and comparison of responses (Bryman & Bell 2005; Edwards, Thomas, Rosenfeld & Booth-Kewley 1997; Johnson & Turner 2003). One disadvantage with close-ended questions is however that they can force respondents to pick an alternative that may not actually reflect their view on the topic. Therefore a few open questions were included in the questionnaire in which respondents could choose to express their view on the matter in words (Bryman & Bell 2005). The questions were designed to be as short and direct as possible, since this reduces the risk for respondents to lose focus and misread the questions (Iarossi 2006; Trost 2012). Additionally,
both positive and negative statements were included in the questionnaire as this ensures that respondents carefully think about which option to pick (Saunders et al. 2009).

Before distributing the questionnaire a pilot study was conducted in order to ensure that the questions were easy to understand and answer and that all instructions were followed correctly (Iarossi 2006; Bryman & Bell 2005). The pilot group consisted of nine persons with previous employment in similar organisations as BioCo. In order to make the pilot study more realistic the test group was asked to complete the questionnaire as if they still worked within a R&D unit. They were also asked to give comments on the questions whether they were understandable and easy to answer and if they had any suggestions on how to improve the questionnaire. After the pilot test was conducted a few alterations were made to the questionnaire. The last step was to send the questionnaire to one of the R&D managers at the case company in order to ensure that the questions were understandable for the employees in the studied company. After a meeting with the manager a few changes were made before the final questionnaire was completed.

The questionnaire was created in an online survey tool and sent out electronically. The target population was scientists currently working in research or development projects at BioCo. Due to limited access to the company, it was not possible to send the questionnaire specifically to our target population. Instead, the questionnaire was first sent to one R&D manager which in turn distributed the questionnaire to everyone within the R&D department. At the time of writing the thesis the number of employees in the R&D department was approximately 400 in which 300 of them were scientists.

3.4.2 INTERVIEWS
Through the initial contact with our contact person it was found that management was executed both from project leaders and line managers in the R&D unit and therefore, it was deemed appropriate to conduct interviews with both parts. To select candidates for our interviews convenience sampling was used (Saunders et al. 2012). After having described the purpose with the study to our contact person, the person suggested a number of line managers and project leaders to interview. The suggested line managers had similar responsibilities but were responsible for different sections within company. As suggested by Bryman and Bell (2005), a smaller introduction of our research topic and purpose was presented through e-mail and
telephone in order to ensure that these persons were suitable candidates for our interviews. We also asked if they worked with research or development projects in order to get a mixture of both sides in the results. Out of the 11 contacted persons, 8 agreed on participating in an interview. The interviewees consisted of five line managers (one department manager and four section managers) and three project leaders. All the interviews were conducted face-to-face at the company’s office, which allowed us to have a more in-depth conversation with the respondents. By meeting face-to-face the idea was also increase trust between us and the interviewee as there is always a risk when doing interviews that respondents avoid more sensitive issues since the interviewers and interviewee have not met before (Myers 2009). The interviews were between 25 to 40 minutes long which was considered enough to capture all relevant topics. Information about the roles of the interviewees and what projects they were involved in can be seen in Table 1.

<table>
<thead>
<tr>
<th>Role in the company</th>
<th>Thesis name</th>
<th>Project involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section manager</td>
<td>Manager 1</td>
<td>Mostly D, previously more R</td>
</tr>
<tr>
<td>Section manager</td>
<td>Manager 2</td>
<td>Both R and D</td>
</tr>
<tr>
<td>Section manager</td>
<td>Manager 3</td>
<td>Both R and D</td>
</tr>
<tr>
<td>Section manager</td>
<td>Manager 4</td>
<td>Mostly D, some R</td>
</tr>
<tr>
<td>Department manager</td>
<td>Manager 5</td>
<td>Mostly R, some D</td>
</tr>
<tr>
<td>Project leader</td>
<td>Project leader 1</td>
<td>Both R and D</td>
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<tr>
<td>Project leader</td>
<td>Project leader 2</td>
<td>Only D</td>
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<tr>
<td>Project leader</td>
<td>Project leader 3</td>
<td>Both R and D</td>
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</tbody>
</table>

Table 1. Roles of the interviewees and their project involvement. R=Research, D=Development.

For our interviews we chose a semi-structured approach as we wanted to make sure that all topics were covered, but at the same time allow for new questions to emerge during the interview (Bell 2008; Myers 2009). Since the intention was to gain a deeper understanding of how control is performed in R&D operations, this interview approach was deemed suitable as the flexible environment of the interview enables the respondent to elaborate and explain topics further (Qu & Dumay 2011). Additionally, we also wanted the interviews to complement and validate the findings from the questionnaires. The risk with more unstructured interviews is however that they can easily go off-topic (Saunders et al. 2009), therefore we were careful to
keep some structure in the interview and thus lead the respondent back to the subject when we felt it was necessary. Another concern is that results may be affected by bias as the interviewer consciously or unconsciously tries to get answers that are in line with the interviewer’s own opinions (Bryman & Bell 2005). In order to minimise these potential biases we were careful to avoid leading questions during the interviews (Yin 2006).

All interviews were recorded and transcribed since this allowed us to go back and study the answers more carefully (Bryman 2012). By recording the interviews we could also pay more attention to what the respondents said which made it easier to ask follow up-questions and to take additional notes. During the interviews both of us were active as we wanted to make sure that all topics were covered.

3.5 DATA ANALYSIS
To analyse the collected data a mixture of qualitative and quantitative methods was used. Like in the case of data collection this eliminates errors and add to the validity of the case study (Onwuegbuzie & Teddlie 2003). A qualitative deductive approach was taken mixed with descriptive statistics. The answers of the questionnaires were programmed into Microsoft Excel, coding the answers as follows: 1 = “Strongly disagree” or “Not at all”, 2 = “Disagree” or “To a small extent”, 3 = “Neutral” or “To some extent”, 4 = “Agree” or “To a moderate extent”, 5 = “Strongly agree” or “To a large extent”. To analyse the answers of the questionnaires we used descriptive statistics in order to summarise and identify characteristics of the collected data. We used means and modes of the five point scale, as well as variation in form of standard deviation (Triola 2007). Frequencies were also analysed and visualised in different forms of graphs. The statistics were used both to better understand the data and to compare answers between groups with different levels of uncertainty. In addition, questions with open answers and interviews were transcribed and then categorised based on the empirical framework. Categorising the data helped us identify similarities and differences between respondents, as well as comparing interview and open question answers with data collected from the rating questions in the questionnaire (Brewton & Millward 2001). The empirical findings were then compared to the theoretical framework by trying to confirm findings of previous researchers and when contradictory, discuss why our findings diverted from previous studies.
Out of the 400 who received the questionnaire, 140 respondents started the survey and 107 either filled out the whole survey or skipped one question. Since we were not able to distribute the questionnaire ourselves we could not assure that only the target population received the questionnaire. Therefore we had to manually remove respondents who did not work as scientists either within a research or development project afterwards. After these were removed, 79 valid answers remained. To further describe our population is a bit difficult since we never had direct contact with any respondents. We did however find out in our first interview that the population consisted of equal groups of men and women and all employees had a five year university degree or a PhD. Moreover we found out that the company valued long-term employment and many employees had been there for several years. Within our sample the average time of employment was 14 years, ranging from 2 months to 37 years at the company. Our sample showed a similar median age as well as the division between men and women and we can therefore conclude that, with the limited information we have on the respondents, our sample is representative for the population. Therefore, the non-respondents seem to be at random.

Out of the valid answers, 53 worked within development and 26 within research. We are aware that smaller samples will lead to larger standard deviations and hence, it will be harder to find significant differences when comparing means. However we can still analyse indications the results give in terms of means. Since one question (question 8) was added to the survey after interviews with the first four managers, a few respondents had not answered that question. On all these cases we choose to use the method of hot deck imputation (Andridge & Little 2010) in which the five most similar respondents were identified for each non-response and a mean of these was used as the answer.
4. EMPIRICAL FINDINGS

4.1 OUTPUT CONTROL

4.1.1 CLEAR GOALS AND OBJECTIVES
Three questions in the questionnaire aimed to investigate if goals and objectives were clear or whether the complexity or measurability of work made it difficult to set goals. For the total group of survey respondents, a majority defined their goals as clear (76 percent). When comparing research and development, it was found that nearly all respondents (92 percent) in research agreed that they had clear goals and objectives, while a lower percentage thought so in development (70 percent). Regarding measurability and complexity, a majority of respondents in both research and development did not find these to affect the ability to define goals.

In the interviews a majority of the managers and project leaders mentioned that project goals were more easily defined in development than in research. The reason was mainly that it was more unclear what they wanted to achieve in a research project, which therefore made it difficult to define clear goals in advance:

“It is often not clearly defined what you want to achieve, which is always the case in development projects because then it is closer to the product release” (Project leader 2).

Therefore, when starting a development project it was often clear what the outcome of the project would be. These projects followed a detailed plan with milestones in which it was specified what goals had to be achieved before the project could move on to the next step.
Although defining goals was deemed challenging within research, it was important to set up goals in the beginning of a project since project members needed to have some idea about what is required to consider the project as successful (Manager 1 & 3).

Since it was less clear what the company wanted to achieve from their research projects it was sometimes problematic to evaluate the progress of work (Manager 3, 4 & 5). One manager explained: “What makes it challenging is the fact that innovation is very difficult to measure” (Manager 3). However, this could partially be solved by for example conversing with colleagues or customers in order to get their feedback about a certain idea or prototype and thus make sure that the project proceeded in the right direction. Hence finding ways to evaluate the progress in research was deemed important: “We don’t start up things if we cannot measure the benefits and in what direction we are going” (Manager 5).

In development projects, there were often clear procedures on how to evaluate and measure goal achievement: “If we develop a new instrument, then it should be able to go 150 straight hours for example. These goals are very easy to evaluate” (Manager 5). However one manager admitted that the company sometimes lacked the efficient measurement tools to evaluate results and that new methods therefore had to be developed (Manager 1).

4.1.2 AUTONOMY IN REACHING GOALS AND OBJECTIVES
Regarding if scientists could choose how to reach goals and objectives, most of the respondents (81 percent) said that they could. When separating research and development, the results showed that both parts considered to have autonomy in achieving goals, however a higher percentage in research (92 percent) thought so than in development (77 percent).
From the interviews it was revealed that scientists in general were relatively free in how they achieved goals and objectives:

“It is freedom with responsibility, absolutely. And it has to be. You cannot run around as a police officer for 17 people and see what they are doing every day. You have to trust your employees” (Manager 4).

This view was shared by another manager who explained that she did not have to know what her staff was doing every day since it would be unsustainable both for her and her employees (Manager 1). When interviewing project leaders similar thoughts were revealed. As people at the company were generally very competent and thus able to plan their own work, it was trusted that these employees would be able to attain their goals in the best possible way without constant oversight from project leaders and one stated:

“They are the experts, they are the ones having the knowledge in how to achieve the goals” (Project leader 1).

However, another project leader said that the level of autonomy in goal attainment was dependent on whether it was a research or a development project:

“If we talk about development and development projects, then it is relatively strict how you work and what you are supposed to do. If you are involved in a research project you have much more freedom, I would say” (Project leader 3).

Due to the relatively strict frames and procedures of development projects, one manager claimed that employees were maybe not free in how they conducted their work but rather how they planned their work (Manager 1).

4.2 BEHAVIOURAL CONTROL

4.2.1 FORMAL RULES AND ROUTINES

To study the prevalence of behavioural control, two questions were asked in the questionnaire which aimed to investigate the existence of formal rules and routines in the scientists' work. A majority of survey respondents felt that both formal rules and routines were highly present in their work since the answers were skewed to the two higher alternatives. The results also revealed that formal rules were more present in research than in development, as nearly half of
the scientists (46 percent) in research picked the alternative “to a large extent” while only 23 percent in development did the same. Regarding formal routines, similar tendencies were found as half of the respondents (50 percent) in research chose the highest alternative while a lower percentage (38 percent) did so in research.

From the interviews it was found that rules existed in terms of how to behave around the laboratory, for example regarding how to handle toxic chemicals. These rules could be inter-company policies as well as national or international standards and had to be followed in detail. Further, every project member had to regularly follow the routine of reporting how they had spent their work time and if they required more time to spend on a certain idea or project they had to contact their manager in order to justify this (Manager 1 & 2). Managers also explained that there were certain standardised operating procedures that always had to be followed in order to make results comparable between different projects, experiments and people (Manager 1 & 3).

Moreover, all development projects involved a detailed project plan in which it was described what project members had to accomplish before proceeding to the next phase in the project, however one manager said:

“It is not like project members read in a manual every day what needs to be done. But they often know what they have to do next” (Manager 1).
These project plans were described as very strict and formalised and there was a lot of documentation that had to be filled in on continuous basis (Manager 2, 3 & 4). However, research work followed a less structured procedure (Manager 3 & 5). Some of the managers mentioned that it was difficult to set up a clear plan of work in these projects:

“In research projects we do not have a clear framework for how to do things. In theory our thoughts are so different that we cannot do that. Therefore, people are freer to do things their own way. Instead the control comes from that no individual has the right to spend their own time or someone else’s time more than a day without getting it approved” (Manager 5).

4.2.2 FORMAL MANAGEMENT INVOLVEMENT
To further study the presence of behavioural control, survey respondents were asked if managers and project leaders were formally present in their work. The results showed that project leaders were formally present since they had an average of 3.9 (“to a moderate extent”). However, managers were seen as less formally present and had a mean of 2.6. When comparing research and development there were no clear differences for project leaders as the results were majority spread across the higher three alternatives in both groups. For managers, only small differences could be found in how present they were in research and development.

![Figure 6: Formal management involvement](image)

The project leaders’ claimed that their involvement in the projects depended on whether their own technical expertise lied within the project area. Hence, when they understood the technicalities they could be involved on a more detailed level, however when they lacked the
knowledge they took on a more formal role (Project leader 1 & 2). Although a higher expertise allowed them to be more involved, it was important not to encroach on the scientists’ work:

“My role is rather to facilitate for others. They do the work, make their own plans and they have the necessary skills. My responsibility is to make sure that the plans sync with the timelines, that we have a budget and that we are on-track” (Project leader 1).

Another project leader stated:

“I believe it is difficult to succeed with a project if you tell people ‘you should to that and you should do that’ while you are pointing with your whole hand” (Project leader 3).

Similar to the project leaders’, managers mentioned that their role was not to steer and direct their employees in detail but rather to facilitate their work by offering support and expertise (Manager 2, 3 & 4). One manager described his role:

“Kind of like a football coach, the scientists are experts on playing but I am constantly coaching them, asking them to think two or three times about something or advising them on who to consult about a certain project” (Manager 4).

Moreover, the interviews stated that their involvement in the projects varied depending on project type: “In development you need to make sure that you have the right documentation in place, that certain criteria are met and so on. When you are leading a research project you have more freedom” (Project leader 1). Hence, some project leaders and managers claimed to have less insight in what scientists were doing on a detailed level in research projects as subordinates were often given time to experiment around a certain idea by their own.

4.2.3 AWARENESS OF WORK PHASES AND PROCEDURES
Regarding the awareness of the different phases of the scientists’ work, survey respondents felt that both project leaders and line managers had good knowledge about these phases. When splitting the answers into research and development, project leaders and managers were more aware of the phases in development than in research, as a higher percentage in development chose the two higher alternatives (see appendix 3). Moreover, when comparing the awareness of project leaders and managers, project leaders were considered to be more aware (project leaders had an average of 4.1 and managers 3.8).
As mentioned earlier, the project plan for development projects was structured and often followed a clear procedure:

“In development projects we have very careful plans made regarding time, resources and activities” (Manager 5).

Hence, most of the interviewees described they had good knowledge about the different work phases in these projects and thus what their project members worked with on a continuous basis. The different phases in research projects were described as less obvious and a number of managers mentioned that it was often difficult to define clear procedures for these kinds of projects (Manager 2, 3 & 4). Although they often lacked a clear picture of the research process, most of the managers and project leaders admitted that they had relatively good insight in what the scientists were working with on a regular basis, however not on a detailed level (Manager 3 & 5; Project leader 1 & 2).

4.3 PERSONNEL CONTROL

4.3.1 RECRUITMENT

According to the interviews, managers were in charge of recruiting new employees. One of the managers admitted that the company puts a lot of effort in the recruitment process and that there were specialised people at the HR department who were focused only on recruitment (Manager 5). Competence as well as the right personality was essential when hiring people to the company:
“Managers put a lot of time on interviews and not just to check the technical skills but also to see if it’s the right person” (Manager 5).

Except from recruitment, line managers were also responsible for allocating resources to the project teams. This meant that line managers were in charge of deciding which person should work in what project. Project leaders on the other hand could request the kind of people and competences needed for the project, however there were no guarantee that these requirements would be fulfilled:

“I am supposed to ask for a resource, then it’s the line manager who gives me an available person” (Project leader 3).

Another project leader said that the project team was often a composition of what was available at the time and what the person had requested for (Project leader 2). This was considered to lead to some problems since one of the project leaders admitted that there was a risk that there would be too many people with similar competences in the project team (Project leader 1).

4.3.2 TRAINING
On the question concerning if survey respondents were offered initial training and training during their employment, almost half of the scientists (46 percent) stated to have received training initially while a third claimed the opposite (32 percent). When it came to training later during employment, a majority of the respondents (71 percent) said that they have had continuous training. When dividing results into research and development, only small differences could be found which explains why the results are not presented in the figure below (see appendix 3).
Managers stated that all new recruits were offered initial training in how to behave in the research lab and how to handle different instruments and machines. They were also given numerous of introduction packages and internet courses to accomplish before beginning their jobs. Moreover, initial support and training was seen as essential for new employees:

“People need all the support they can get in the beginning as they have been working at another company and then it is a new culture here, there are new systems and there are a lot of things that are new” (Manager 4).

Later on, employees had the possibility to apply for training courses depending on what personal skills they wanted or had to improve (Manager 2 & 4). One manager explained the importance of these training sessions:

“I mean of course, this company wants people to stay. So therefore it is a lot of focus on continuous training in order to make it possible for employees to develop themselves and to make a career within the company” (Manager 5).

However, another manager claimed that some courses were only available to the most high-performing employees which made it difficult for others to take part in these and hence develop their skills (Manager 1).
4.4 CULTURAL CONTROL

4.4.1 CULTURAL MANAGEMENT INVOLVEMENT

The first way to investigate the presence of cultural control was to find out if managers and projects leaders were considered to be engaged and motivating in their leadership. Most of the survey respondents felt that their project leader was active and engaged as the answers skewed towards the two highest alternatives. Managers were deemed less engaged as a majority of the respondents chose the third or the second highest alternative. In the question whether managers and project leaders were encouraging employees to try new ideas, both were considered to be relatively encouraging. However, project leaders scored a bit higher as their mean was 3.7 compared to 3.5 for managers. On all four questions, there were rarely any differences between research and development (see appendix 3).

All project leaders considered themselves to mostly be active and engaged in their respective teams and one said:

“I’m the kind of project leader who does not like to e-mail so much, so instead I go to people and talk to them. Then we both have meetings and lunch together and so. I like to know what they are doing” (Project leader 3).

Similar thoughts were revealed among managers. Although they were only meeting their subordinates occasionally, they considered themselves to be engaged when they met as they provided support and expertise to their employees and also helped to prioritise their work (Manager 2 & 4)
As brought up in the question about formal management involvement, project leaders mentioned that they avoided to interfere too much in the subordinates’ work. Instead their focus was mainly on encouraging and motivating people and one stated:

“I am trying to motivate the personnel, that’s the mission. It’s all about getting people to do their stuff in the best possible way and to get people to think it is fun” (Project leader 2).

In accordance, another other project leader explained that her most important tasks were to motivate people and to build up a team-feeling within the project group (Project leader 3).

4.4.2 LOYALTY & CORE VALUES

Four questions were posed regarding the scientists’ loyalty and their use of core values. When survey respondents were asked about their loyalty it was found that more people felt loyal to their colleagues (98 percent) than to the company (68 percent). Further, a majority of the respondents (65 percent) said that they shared the company’s core values, however only 40 percent considered these values to be important in their daily. The differences between research and development were small on the first three questions, however the core values were found to be used in daily work to a larger extent in development (47 percent agreed) than in research (36 percent) (see appendix 3).

From the interviews it was revealed that BioCo worked with their core values in different ways. Firstly, when defining individual goals and development plans employees were supposed to take these values into consideration and one manager explained why by saying:
“These values are supposed to permeate everything we do and to make sure that everyone goes in the same direction” (Manager 5).

Secondly, the company arranged workshops from time to time where employees could discuss and share their thoughts about the values with co-workers (Manager 5). However, it was also revealed that incorporating the core values into the organisation could be challenging due to the international width of the company. Therefore it was important that these values were communicated in a “Swedish” way in order for people to embrace them (Manager 2). Furthermore, none of the project leaders were actively working with values within their project group, however one project leader claimed that they maybe should focus more on doing it while another stated that it was the line manager’s responsibility (Project leader 2 & 3).

4.5 IMPROVEMENT AREAS
The last part of the survey intended to find out how respondents thought that their creativity could be improved. This included an open question in which respondents could leave comments on how they perceived the present management to affect their innovative behaviour and what could be done to improve it. Several scientists mentioned that they did not have the time for being creative. Tight timelines and the large focus on goal attainment in the projects restricted possibilities for innovation:

“The focus is on delivering as much functionality as possible within the stated time frame. Management has hence removed most possibilities for innovation in this project”.

Another respondent stated:

“There should be more focus on relevant output rather than milestones”.

Moreover, scientists desired more support from their managers in order to be creative and a few also mentioned that more communication could ease innovative behaviour. Lastly, some respondents said that they were pleased with the current management and others said that there was no need to be innovative within the project they currently were working in.

In addition, the questionnaire also included a question in which respondents were given three specific alternatives (more freedom, more training courses, more professional guidance) on how to improve innovativeness in their work, as well as an open alternative (“other”) in which they could leave their own suggestions. The most frequent answer was more training courses (37
percent), followed by more freedom (30 percent) and more professional guidance (16 percent). Among those who picked the alternative “other”, 10 respondents mentioned that they required more time:

“I need more time to be creative, I have been overbooked the last years”.

Three persons commented that they wanted more contact with end users of the products they developed, while a few required less administrative work and also the ability to attend more external conferences. Additionally, one respondent claimed that the focus from the whole business had to change: “from short term deliveries to long term innovation”.

In the interviews, managers and project leaders were asked what they believed diminished innovative behaviour today and what could be done to improve it. Most of the interviewees agreed with the survey respondents in saying that the limited amount of time decreased the possibility to be creative:

“When we work on a project we often have a tight deadline and therefore all focus is on working towards that. There is no time for doing other things” (Project leader 1).

In accordance, one manager stated that it was difficult to allow enough time for creativity because of the pressure to constantly deliver new products:

Our goal is to release as many products as possible in a short period of time. It is constantly a race against time” (Manager 2).
The pressure on releasing new products also lead to that development projects often became prioritised over research projects (Manager 2 & 4). One manager explained this by saying that it is was often more prioritised to get a finished product on the market as quick as possible than to focus on a research project that could possibly generate a product in a couple of years (Manager 5).

Further, some of the interviewees mentioned the importance of giving time and space for people to be creative and the company had recently started to schedule two weeks per year when employees could experiment and try their own ideas. Some of the ideas that arose during those weeks could then hopefully be transformed into actual research projects later on (Manager 1, 3 & 4). Despite having “innovation” weeks, both managers and leaders stated that a good and open work environment was essential in order to enhance the emergence of new ideas. People had to feel that they could ask the “stupid” questions and to share their thoughts and ideas without being judged (Manager 4).
5. ANALYSIS

5.1 OUTPUT CONTROL
Based on Abernethy and Brownell’s (1997) findings, it was expected that output control would be more present in development than research since the routineness and certainty of these activities made it possible to define desired outputs in advance and measure outputs effectively. Support for this was found through the interviews as it was stated that goals could be more clearly defined in development than in research. Hence, due to the knowledge of the desired results in a development project, this made it easy to set up clear targets in advance. Evidence for output control was also found through the questionnaire as goals were considered to be clear and neither complexity nor measurability made goal-setting problematic. In line with the characteristics of output control, the set-up of clear goals in development therefore made it possible to effectively measure outputs and to take actions if any deviations occurred (Merchant 1985).

Interestingly, this view was opposed by the scientists as a larger portion in research found their goals to be more clear than in development and moreover, a majority of the scientists in research stated that neither complexity nor measurability made it difficult to define goals. Hence, this contradicts the statement that it is difficult to pre-determine goals in advance in more uncertain environments (Abernethy & Brownell 1997; Poskela & Martinsuo 2009). However, a possible explanation for the opposing views may be that there are differences in what managers and scientists perceive as clear goals. Since scientists are considered to be the “experts” and the ones holding the critical knowledge (see 4.4.2), they may have a better picture of what needs to be done in a project which thus makes it easier for them to set up clear goals for their work. Additionally, the interviews revealed the importance of defining goals and measure the progress of work in research although it was challenging. Thus, it is possible that scientists consider these goals to be clear enough.

Further, output control was considered to include the freedom for subordinates to choose their own ways to pursue goals without constant oversight from managers (Hutzschenreuter 2009; Simons 1995; Snell 1992). From the empirics it appeared that scientists were relatively free in how to reach goals, and the interviewees revealed that it would be inefficient to run around and
monitor the subordinates work in detail. Hence, in accordance to Snell (1992), managers had to rely on the experience and expertise of their subordinates and thus expect that they would do their best to achieve goals. However, although scientists were not closely monitored by management, the possibility to achieve goals in their own ways was restricted by the formal procedures of development projects. This was also shown in the questionnaire as scientists felt they had more autonomy in research than in development projects. Hence, this limits the existence of output control in development projects as Hutzschenreuter (2009) stated that this control implies that employees can use their own ideas and methods to pursue goals.

Moreover, output control was also found to emphasise project completion and efficiency rather than the development of new ideas and knowledge (Cardinal 2001). From the empirical findings it was evident that the strive for accomplishing projects on time and budget diminished the possibilities for scientists to be creative and innovative: “When we work on a project we often have a tight deadline and therefore all focus is on working towards that. There is no time for doing other things”. Thus, looser timelines and less focus on goal attainment were suggested as improvement areas in order for more creativity to flourish. Moreover, managers explained that the pressure on releasing new products often lead to development projects being prioritised over research projects. This goes in line with Cardinal (2001), who stated that output control can make companies focus on projects with more predictable outcomes and faster returns instead of riskier ones that may generate higher returns in the longer term.

Overall, the analysis gave strong support for output control in BioCo. However, the analysis gave a rather complex picture about the differences of output control levels in research and development. Although the interviews revealed that more clear goals were used in development projects, scientists claimed to have clearer goals in research. In addition, scientists were considered to have more freedom in how to achieve goals in research. But in contrast to research projects, both managers and project leaders stated that development projects followed strict plans involving milestones and final goals, which therefore gives stronger support for output control in these activities.
5.2 BEHAVIOURAL CONTROL

Behavioural controls were expected to be applied mainly in development as more routine and certain tasks made it possible for managers to define the desired actions of their employees (Cardinal 2001; Poskela & Martinsuo 2009). In line with the characteristics of behavioural control, scientists considered management to be aware of the different phases of their work in both research and development. However, both project leaders and managers stated that a lack of clear direction of research work made it difficult to define the different phases of the scientists’ work. In addition, they claimed to have limited insights in what research scientists were working on at a detailed level, which is a premise in order to set up behavioural controls (Das & Teng 2001). Hence, in line with the expectations, the interviews stated that clear work procedures were more present in development than in research: “In development projects we have very careful plans made regarding time, resources and activities”.

In terms of formality, scientists considered project leaders to be formally present while line managers were seen as less formal. Although the questionnaire indicated small differences between research and development, the interviews stated that formality was more prominent in development as project leader’s had to regularly make sure that the right documentation was in place and that certain criteria were met. However, in contrast to the characteristics of behavioural control, neither project leaders nor managers were considered to monitor and direct the work of their subordinates (Ouchi 1979). As mentioned earlier in the analysis, scientists were provided with freedom and could most often choose how to perform their work, especially in research projects. In development however, the behaviours were restricted to some extent due to the formalised structure of the projects. According to the interviewees, certain procedures had to be followed and a significant amount of documents had to be filled in on a regular basis which gives support for behavioural control in these settings (Ouchi 1979). As indicated from the empirical findings, the strict process of development projects thus provided scientists with limited time for creative actions. This goes in line with Snell (1992) who stated that standardisation of work processes may serve to reduce discretion among employees and thus making rigid and cautious behaviour more likely. Moreover, the limited time and the focus on short-term delivery also implied that employees were more prone to “play safe” and focus on small improvements rather than pursuing radical changes that involve higher risk-taking
(Cardinal 2001). Thus, more freedom and less administrative work were requested from scientists in order to improve their innovativeness.

Scientists were monitored with rules and routines which gave further support for behavioural control (Anthony & Govindarajan 2007; Langfield-Smith 1997) in BioCo. Interestingly, the existence of rules and routines appeared to be higher in research work. This finding somewhat contradicts the expectation that behavioural controls would be less present in uncertain environments. However, the interviews stated that there were numerous rules and routines that had to be followed regardless of project type, which could thus explain why the presence of these were deemed high in both research and development. For example, routines such as time reporting were deemed important in the company in order to make sure that employees spent their time on the right duties. In line with Persaud (2005), these behavioural controls may be necessary in a company in order to diminish the risk that R&D employees pursue their own interests rather than the interest of the organisation.

Similar to output control, behavioural controls gained strong support in BioCo. As expected, behavioural controls appeared to be more present in development than in research. Although the presence of formal routines and rules was found to be higher in research, the formality of project leaders as well as the structured work processes implied that behavioural controls were used to a higher extent in development. Similar to output control, the analysis indicated that behavioural controls diminished the scientists’ creativity to some extent and therefore more time and freedom was required.

5.3 PERSONNEL CONTROL
Personnel control was expected to be used predominantly in research in which tasks were more uncertain and complex. Merchant & Van der Stede (2007) claimed that personnel control involves finding the right people for a job and provide them with a good work environment and the necessary resources. In line with this, BioCo was found to put a lot of emphasis on recruitment in which both skills and the right personality were considered important. In addition, the interviews stated that it was important to provide new employees with the right conditions when they started their jobs in terms of training and support. However, personnel control also involves the possibility to select employees based on their previous achievements.
(Hutzschenreuter 2009). According to the interviews, this possibility was restricted as project leaders were not able to choose their project members specifically. Hence, this also made it problematic to create a project group involving a mixture of skills, backgrounds, and perspectives, which according to Cardinal (2001) is essential in order to facilitate for innovation.

As previously mentioned, newly hired employees were given initial training which is a facilitator of personnel control (Merchant & Van der Stede 2007). This was the picture provided by the managers, however it gained weaker support when asking scientists as only half of the respondents claimed to have received training in the initial phase. But in line with characteristics of personnel control, most scientists were provided with training during their employments. However, the interviews stated that some training courses were only available for a selected few, which could thus explain why not all scientists felt that they had been offered continuous training. Interestingly, the empirics also revealed that more training courses was desirable among the scientists.

To sum up, the analysis gave partially support for personnel control in BioCo as employees were offered continuous training and managers put a lot of effort on recruiting competent and skilled personnel. Personnel control was however restricted by the inability to choose project members and by the limited training in the initial phase. Further, it was problematic to identify differences in the levels of personnel control in research and development since BioCo did not hire people as research or development employees specifically. Moreover, training was done individually and was not based on whether employees worked in research or development. Additionally, the questionnaire indicated no clear differences between the two groups.

5.4 CULTURAL CONTROL
Similar to personnel control, cultural control was expected to be used predominantly in research. In order for cultural control to work, this required social agreement among employees on a broad range of values and beliefs (Ouchi 1979). In line with this, a majority of the scientists claimed that they shared the company’s core values. Moreover, the interviews revealed that the company worked with their core values continuously by arranging different events and workshops. Additionally, the values were used when defining the employees’ personal goals. Although the scientists agreed with the values and the fact that the company worked actively with their values,
a rather small extent of the scientists considered these values to be important in their daily work. A possible explanation to this could be that scientists are unaware of that their behaviours derive from the core values (Merchant & Van der Stede 2007) and therefore, it could be difficult to state how present these values are in their work. At the same time, the interviews stated that it was challenging to incorporate the values into the organisation due to the international width of company. Thus, this may be a possible explanation to the limited use of values among the scientists.

Although the analysis of behavioural control gave some support for formal management in BioCo, project leaders and managers rather saw themselves as “informal” leaders. Their roles were mainly to support, motivate and encourage subordinates in order enhance their performances. Support for this was also found in the questionnaire as scientists claimed that project leaders and managers were encouraging new ideas to a relatively high level and that project leaders were considered to be active and engaged team members. This goes in line with the management style in cultural controls, in which managers are interactively involved and where the purpose is to motivate and inspire employees (Hutzschenreuter 2009). In BioCo’s case, monitoring is therefore facilitated through interpersonal interactions and shared agreements between management and the subordinates (Baliga & Jaeger 1984).

In accordance to the cultural control characteristics, nearly all scientists felt loyal to their colleagues while a majority felt loyal to the company. The fact that scientists felt loyal to the company gives support for cultural control as Baliga & Jaeger (1984) considered loyalty to be essential in order to create an organisation-wide culture. That scientists felt loyal to the company also questions the statement that R&D professionals consider themselves to be scientists in the first place and as an organisational member secondly (Zuckerman & Brajkovich 2003). In BioCo, the high loyalty to the company suggests that scientists would prefer to serve organisational norms over the professional ones, which opposes the findings in Cardinal’s (2001) study.

In summary, the analysis gave relatively strong support for cultural control in BioCo since employees were loyal and agreed with the core values. Additionally, project leaders were found
to execute cultural management, while managers did this to some extent. However, support for this control was restricted due to the limited use of core values in daily work. Similarly to personnel control, no clear differences could be found in the use of cultural controls in research and development. This was stated both through the questionnaire and the interviews.
6. CONCLUSION
The purpose of this thesis was to examine how management control is used in a company’s R&D unit. The study has, based on previous research, identified four forms of control and included an empirical study on a large company in the biopharmaceutical sector. The empirical study aimed to investigate whether and to what extent each form of control was used in R&D projects.

As expected, all four identified controls were present in BioCo, however output and behavioural control gained the strongest support followed by cultural and personnel control. In line with the expectations, the formal controls were also found to be used to a higher extent in development than in research as the projects followed more strict procedures and involved clearer goals. The findings in the personnel and cultural control analysis were more difficult to draw conclusions from. It was expected that these controls would be used predominantly in research, however the analysis provided no clear evidence for variations of use in research and development. Additionally, the analysis gave support for relatively high levels of formal controls in research in the terms of formal rules and routines, which makes it difficult to state whether the informal controls were the dominant controls in these settings. Further, from the analysis it is rather indicated that the four controls are used in combination in BioCo, where clear goals and targets, routines and rules are complemented with personnel and cultural forms of control.

Further, the large presence of formal controls in BioCo was not surprising as R&D and innovation in large firms need to be managed actively and have to rely on formal controls to do so (Davila 2005; Davila, Foster & Oyon 2009). Hence, it is evident that a company in the size of BioCo’s have to perform output and behavioural controls in order to effectively manage their R&D unit. This opposes Ouchi (1979) and Kim et al. (2003)’s statements that R&D units should not be managed by formal means of control. But in line with previous research (Schultz et al. 2013; Snell 1992), the formal controls were found to harm the possibilities for creativity and innovation in BioCo. This gives evidence for the problematic balance between flexibility and efficiency which was stated by Jörgensen & Messner (2009). However, in line with the improvement areas presented in the analysis, this suggests that cultural and personnel controls
should be used to a higher extent than today as these controls provide subordinates with flexibility and freedom to be creative.

6.1 FUTURE RESEARCH
Since the study investigates the situation in one company it may be of interest in future research to do a multiple case study involving more companies. This could make results more generalisable and also bring up interesting findings regarding similarities and differences in how companies manage their R&D activities. It would also be interesting to conduct a study with larger sample sizes in the research and development groups, as this would add more certainty to the results.
REFERENCES


Line Manager 1, Line Manager at Company X, Uppsala, April 10'2015, Company X, Uppsala. Personal Interview.


Line Manager 5, Line and Department Manager at Company X, Uppsala, April 2'2015, Company X, Uppsala. Personal Interview.


Project Leader 1, Project Leader at Company X, Uppsala, April 13 2015, Company X, Uppsala. Personal Interview.


APPENDIX 1: Questionnaire questions

Part 1:

1. What is your job title?

2. How long have you worked at BioCo?

3. Gender:
   Male                Female

4. Age:
   18-30              31-40              41-50              51-60
   60                 61+

Part 2:

5. The project I am currently working in is a:
   Research project   Development project   Other (please specify)

Part 3

6. Choose the most appropriate answer.

Alternatives:
Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

a) I have clear goals and objectives in regard to my work assignments.
b) I do not have clear goals and objectives because performance of my work is hard to measure in advance.
c) I do not have clear goals and objectives because my innovative work is complex.
d) I can decide how to conduct my work as long as goals and objectives are achieved.

7. To what extent do you follow…

Alternatives:
Not at all   To a small extent   To some extent   To a moderate extent   To a large extent

a) Formal rules in your work.
b) Formal routines in your work.
8. To what extent is your project leader…

Alternatives:
Not at all  To a small extent  To some extent  To a moderate extent  To a large extent

a) Formally present in your work.
b) Aware of the different phases and procedures of your work.
c) An engaged and active team member.
d) Encouraging you and your teammates to try new ideas and ways to conduct your work.

9. To what extent is your closest line manager…

Alternatives:
Not at all  To a small extent  To some extent  To a moderate extent  To a large extent

a) Formally present in your work.
b) Aware of the different phases and procedures of your work.
c) An engaged and active team member.
d) Encouraging you and your teammates to try new ideas and ways to conduct your work.

10. Choose the most appropriate answer.

Alternatives:
Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

a) I was offered internal training in the beginning of my employment.
b) I have been offered further training later during my employment.
c) I feel loyal to my colleagues.
d) I feel loyal to the company.
e) I share the company’s core values.
f) Following the company’s values is important in my daily work.

11. How does the management affect your innovative behaviour in your current project? How could the management be improved in your project?

12. In order to improve your creativity, which of the following options you perceive as most relevant?

More freedom  More professional guidance  More training courses (brainstorming, creative events etc.)  Other

13. Additional comments
APPENDIX 2: Question template for Managers/Project leaders

1. Please shortly describe your role.
2. What is your background?
3. How many projects are under your management? How many people?
4. Do you work exclusively with R or D projects or both?
5. How does uncertainty influence the way a project is controlled? Are there differences between R and D projects?
6. Are you involved in setting up milestones and final goal for the scientists? If not, who are?
7. Are project goals set the same way in research and development?
8. Are there any challenges with defining goals in R&D?
9. Are there any challenges with measuring and evaluating the progress of R&D work?
10. Would you say employees are autonomous in reaching their goals?
11. To what extent are formal rules and routines used in the scientists’ daily work? How strict are these? Do they differ between research and development?
12. How would you describe your leadership style?
13. How aware are you of phases and procedures of the scientists’ work?
14. Are you involved in recruitment in your division? If yes, what is important when recruiting a new employee?
15. When forming a project group, what do you believe is important regarding skills, backgrounds etc. among the scientists?
16. Are employees offered initial training? Are they offered training later in their employment?
17. Does the company have any core values?
18. How are these values implemented through the organisation?
19. How would you say the scientists’ creativity could be increased? What diminishes it today?
## Questionnaire results

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| Loyal to coworkers           | 0%            | 0%          | 1%               | 32%           | 67%  | 4,65  |
|                              | Development   | Research    |
|                              | 0%            | 0%          | 0%               | 26%           | 72%  | 4,7   |
|                              | 0%            | 0%          | 0%               | 44%           | 56%  | 4,56  |
| Loyal to company             | 3%            | 6%          | 26%              | 41%           | 24%  | 3,78  |
|                              | Development   | Research    |
|                              | 2%            | 8%          | 23%              | 42%           | 26%  | 3,83  |
|                              | 4%            | 4%          | 32%              | 40%           | 20%  | 3,68  |
| Share of core values         | 1%            | 3%          | 31%              | 53%           | 13%  | 3,73  |
|                              | Development   | Research    |
|                              | 2%            | 2%          | 23%              | 53%           | 15%  | 3,77  |
|                              | 0%            | 4%          | 36%              | 52%           | 8%   | 3,54  |
| Use of core values           | 5%            | 12%         | 40%              | 31%           | 13%  | 3,35  |
|                              | Development   | Research    |
|                              | 2%            | 13%         | 38%              | 32%           | 15%  | 3,45  |
|                              | 12%           | 8%          | 44%              | 28%           | 8%   | 3,12  |

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