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Consultant engagement in advanced technology transfers

An exploratory study in a new technological context

written by

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Master Degree Project in Accounting, Spring 2018

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Abstract

Background and problem: Organisations are increasingly aspiring to become digital leaders. At some point, organisations may consider bringing in external sources, such as consultants, to help establish technological competence and to implement new technology. Research has discussed both positive and negative aspects of bringing in consultants. However, much of this research was conducted during a time when technology advancements were dominated by production technology and techniques. Since then, technology has changed, and it is relevant to revisit consultant engagement in relation to advanced technology transfers.

Purpose: To investigate whether, and how, consultants are attentive to contextual complexities surrounding advanced technology transfers.

Research questions: I. From the perspective of consultants, what are potential issues in advanced technology transfers? II. How are contextual complexities surrounding advanced technology transfers managed?

Theoretical frame: A literature review on positive and negative perspectives on consultant involvement. In addition, research that shows the complexities in data science and big data, i.e. advanced technology, how organisations are affected by these, and how contextual complexities are constructed. The theoretical frame is completed with Hardy's (1996) power framework in order to assess whether consultants are aware of different powers in play in a change process, and thus attentive to contextual complexities.

Method and data: A qualitative study based on interviews with employees in a consultancy firm specialising in business intelligence, digitalisation, and data science. Three interviews with management consultants, two with data scientists, and one with the head of sales.

Discussion and conclusions: Advanced technology transfers are not accomplished by traditional consultants in isolation, rather it is executed and facilitated by interaction and continuous sharing of knowledge through a chain of people, including clients and consultants. While management consultants seem to manage traditional parts of projects, data scientists operate as a link between the organisational expertise and management consultants. Through investigating consultant involvement in this new technological context, this study can provide an alternative view of the role of consultants. Firstly, findings indicate that the simplistic view of consultants as simply handing over predetermined solutions have, in this new context of advanced technology transfer, lost its relevance. Secondly, the prevalent notion in prior research suggesting consultants are not engaging in technology transfers does not seem relevant in the context of advanced technology transfer. Thirdly, data scientists can provide a different view on the role of consultants.

Keywords: Consultants, technology transfer, digitalisation, big data, data science

Acknowledgements

First and foremost, we would like to thank our supervisor, Berit Hartmann, for once again guiding us on our quest to contribute to the academic discussion. Today, perhaps more evident than ever before, it stands clear that diamonds are made under pressure.

Also, we would like to express our gratitude for questions, ideas, and advice presented by opponents during project seminars.

We hope you enjoy our thesis.

Sincerely,

Sara Erixon Goliath & Jakob Tengver

Gothenburg, 3 June 2018

Table of Contents

1 Introduction

Organisations are increasingly aspiring to become digital leaders; however, many organisations are still unaware of digital opportunities and potential value that could be captured (Westerman et al., 2012). While technological competence can be developed internally, organisations may at some point consider bringing in external sources to help establish technological competence and to implement new technology. This process, often referred to as *technology transfer*, can be defined as when "technology moves from outside sources to the organisation" (Bessant & Rush, 1995, p. 97). Hence, technology transfer occurs when organisations bring in new technology via intermediaries, e.g. consultants. Even though there is extensive literature on the role of consultants as intermediaries of change, findings vary on whether consultants add value or not. Predominantly, research is critical to benefits related to bringing in consultants due to the probability of receiving universal advice (Abrahamson, 1996; Bloomfield & Danieli, 1995; Clark, 1995; Mitchell, 1994) and lacking expertise (Sturdy, 1997; Sturdy et al., 2008). However, there is research claiming consultants can act as change agents (Bessant & Rush, 1995) which can expedite change processes (Ginsberg & Abrahamson, 1991). In short, there is considerable research suggesting consultants provide "one size fits all" solutions, and there is research suggesting consultants are effective in supporting organisations in facilitating change.

Notably, a considerable portion of this literature is from the 1990s. This research was conducted in a time when technology advancements were dominated by production technology and techniques (Bessant & Rush, 1995), and access to data was the issue. Since then, the level of complexity has elevated through advanced technology under the new wave of digitalisation, i.e. "the adoption or increase in use of digital or computer technology" (OED, 2018b), and it continues to rapidly change the ways organisations are doing business (Löbel et al., 2016). Today, the largest issue may not be access to data but rather for organisations to ensure that valuable insights are harnessed (Constantiou & Kallinikos, 2015). Therefore, this leads to a new context where technology transfers occur, hereafter referred to as *advanced technology transfer.* In order to investigate the new context of advanced technology transfer, this study exploits *data science* and *big data*. The definition of data science is "combines machine learning models with advanced prescriptive modeling and predictive modeling to enable decision optimization" (IBM, 2018), and big data, i.e. "data of very large size, typically to the extent that its manipulation and management present

significant logistical challenges" (OED, 2018a). It is still a phenomenon on the rise and organisations are rather unfamiliar to the techniques (Westerman et al., 2012). Therefore, it is reasonable to believe that organisations are in need of external sources of expertise in this area. This type of advanced technology is too complex for traditional data processing applications (Syed et al., 2013). Furthermore, it creates organisational challenges (Arnaboldi et al., 2017b). Hence, issues in regard to advanced technology transfers do not only concern the complexity of the technology itself but also organisational issues and complexities (Bloomfield & Danieli, 1995). These complexities related to technology issues and organisational issues construct contextual complexities surrounding technology transfers. In this new perplexing technological context, it is relevant to revisit and challenge notions related to consultant engagement in advanced technology transfers. This is particularly interesting because prior research predominantly was conducted in another technological context, it assumes consultants to deliver pre-packaged solutions, and it tends to disregard whether consultants are attentive to contextual complexities surrounding technology transfers.

The purpose of this exploratory study is to investigate whether, and how, consultants are attentive to contextual complexities surrounding advanced technology transfers. This is accomplished by interviewing consultants and data scientists working for a firm specialising in business intelligence, digitalisation, and data science. This firm is particularly interesting since it offers advanced technological solutions which are driven by digitalisation and data science, hence are inherently complex. This constitutes a new technological context which offers a setting where issues related to contextual complexities can be expected, and through which consultant engagement can be assessed. Furthermore, organisations seem unaware of the possibilities (Westerman et al., 2012), thus it is reasonable to believe consultants in advanced technology possess the knowledge needed to reflect on complexities in this context. Results are analysed through a lens based on Hardy's (1996) powers for strategic change. Accordingly, this study aims to answer the following research questions.

I. *From the perspective of consultants, what are potential issues in advanced technology transfers?*

II. *How are contextual complexities surrounding advanced technology transfers managed?*

This study aims to contribute to literature on the role of consultants in technology transfers by investigating the interaction between organisations and consultants in regard to advanced technology transfers.

The introduction is followed by the second chapter that presents the theoretical framework. The first part provides a literature review on tensions between positive and negative views on the role of consultants. In addition, there is a section with literature on advanced technology, i.e. data science and big data, and how it affects organisations. Lastly, Hardy's (1996) framework of powers is presented and explained, covering how it is used to structure and analyse the empirical material. Thereafter, the third chapter explains the research design and motivates the methodology of the study. Chapter four contains results, which are organised following Hardy's (1996) framework. Based on previous literature, chapter five discusses results in relation to previous literature. Finally, this paper ends with conclusions, theoretical contributions, limitations, and suggestions for further research.

2 Theoretical framework

In this section, previous literature on the role of consultants is developed in relation to technology transfer. Additionally, research on complexities in data science and big data is elaborated. Lastly, the meta theory through which a lens for analysis can be constructed is explained. The theoretical framework is then summarised.

2.1 Role of consultants in technology transfer

There is extensive research expressing criticism towards the consultancy community, describing its members as actors selling universal advice (Abrahamson, 1996; Bloomfield & Danieli, 1995; Clark, 1995; Mitchell, 1994; Sturdy, 1997). A popularly adopted description of consultancy work is "one size fits all" which is supported by Bloomfield and Danieli's (1995) research on the role of consultants in the development of IT in organisations. Bloomfield and Danieli (1995) find consultants' inclination to make technical system adjustments to meet organisational needs often is low, instead consultants construct social realities where organisational issues are attributed responsibility for making it difficult to pursue system adjustments. However, the authors note that development of IT systems, and implementation of such systems, remain highly complicated, and, perhaps more importantly, that "IT is not just a technical issue but an organisational one as well" (ibid., p. 24). Furthermore, it is concluded that consultancy practices are a major source of expertise on IT and organisational change. On the same note, research suggests consultancy practices can provide resources that organisations do not have internally; Glücker and Armbrüster (2003) suggest that consultancy practices are delivering products and services that organisations cannot deliver without external assistance. This notion is further endorsed by studies exploring client-consultant relationships, stating that the most significant explanation for employing consultancy practices is the expertise and the competence within the firm (Poulfelt & Payne, 1994; Wood, 2002). Additional significant factors explaining employment of consultants are the perceived analytical and coaching skills (Ginsberg & Abrahamson, 1991). Moreover, Ginsberg and Abrahamson (1991) conclude that by bringing in change agents, i.e. management consultants, momentum for change is created through the introduction of new perspectives. For a long time, academics have been recognised as the main critics of consultancy practice (Collis, 2004). This assumption is challenged by Bouwmeester and Stiekema (2015) who do not find support for this notion, but rather found support for the notion that clients' employees are most critical towards consultancy practices and its

members. This contribution added nuances to the criticism, and enabled researchers to explore different stakeholders' opinions and views of the consulting community.

In addition, critics suggest that consultants utilise abstract and standardised models while lacking industry knowledge (Sturdy, 1997; Sturdy et al., 2008), and repackage old ideas in new formats (Redekop & Heath, 2007; Sturdy, 1997; Whittle, 2006). Similarly, some critics claim consultancy is "the absence of deeper knowledge, shallowness partly associated with fashions and fads as well as overpayment and an almost immoral attitude" (Alvesson & Johansson, 2002, p. 229). However, there is research acknowledging consultancy practices' sector competence due to repeated and continued exposure to clients operating in the same industry. Fincham et al. (2008) suggest that consultants being exposed to specific sectors develop a shared industry specific logic, language, and experience with the clients, which enable consultants to utilise these to become an outside expert. This is further emphasised by research describing the effects of information sharing and learning from clients, where significance is placed on client interaction for knowledge development (Føsstenløkken et al., 2003). Notably, this challenges the notion stating that competence is transferred in a one-way process, i.e. transferred from consultant to client.

In summary, there is extensive research suggesting that consultants lack expertise, sell "one size fits all" solutions, and rarely engage in technology transfer. However, there is research implying that consultants are competent, meaningful, and effective in facilitating and expediting change. Additionally, there is research claiming knowledge is developed through interaction between clients and consultants. Considering these different streams of literature, it is legitimate and reasonable to study the involvement and engagement of consultants in advanced technology transfers. These different streams in research will be mobilised in order to assess whether some of these notions on consultant involvement are applicable in advanced technology transfers, or if findings in this study can provide new knowledge.

2.2 Data science and big data

Data science has several definitions. This study adopts a definition presented in previous sections by IBM (2018) which states that data science "combines machine learning models with advanced prescriptive modelling and predictive modelling to enable decision optimization." Data science could therefore be understood as a technology harnessing big data and big data analytics to provide decision-makers with additional decision support. The last few years, big data has become increasingly popular to describe the immense amount of

data available due to digitalisation (Google Trends, 2018). In fact, research indicates increased productivity as an effect of data-driven decision-making (Brynjolfsson et al., 2011; Westerman et al., 2012), and it is claimed that organisations that utilise big data analytics to differentiate themselves are twice as likely to be top performers (LaValle et al., 2011). As stated in earlier sections, the Oxford English Dictionary (2018) defines big data as "computing data of a very large size, typically to the extent that its manipulation and management present significant logistical challenges." Big data can therefore be understood as collections of data which are too vast and complex for traditional data processing applications (Syed et al., 2013). In addition, big data can be structured or unstructured. Structured data refers to searchable databases structured by rows and columns, while unstructured data refers to data that has no identifiable structure, hence it cannot automatically be sorted in tables or spreadsheets. Structured data and unstructured data account for approximately 10 and 90 percent, respectively (Syed et al., 2013). Data collecting has traditionally been based on a deductive approach, however big data is created in real-time, making the flow of data more fluid than traditional data, thus expediting modification and alteration of processes and structures (Constantiou & Kallinikos, 2015). Harnessing big data for insights requires new tools and methods, hence data science constructs contextual complexities through the alteration of organisational processes and the governance of information resources.

2.2.1 Alteration of organisational processes

Applications of big data could relate to process capabilities, such as analysing detail rather than summary transaction data, integrating external data with financial data, and consolidating environmental data with accounting measurements (Vasarhelyi et al., 2015). This has resulted in possibilities for organisations to alter the speed of operations. Furthermore, emerging trends show that business intelligence increasingly originates from data produced in absence of economic flows (Bhimani & Willcocks, 2014), and that transactions are captured before they are recorded (Vasarhelyi et al., 2015). New information streams have given rise to the use of alternative sources in strategy and goal communication, operational planning, and performance evaluation (Warren et al., 2015). Additionally, the change in type of information sources and data collection has developed alternative views of powerful data (Bhimani & Willcocks, 2014). In fact, some consider non-traditional data to be more informative about the drivers of business processes in several areas, rather than financial transactions (Moffitt & Vasarhelyi, 2013; Warren et al., 2015). The different

streams of data allow for an integrated analysis of both external and internal data with financial data (Vasarhelyi et al., 2015; Warren et al., 2015). As big data is being harnessed and operationalised more efficiently, it is argued human interaction will be reduced, e.g. by shifting focus from causation to correlation (Cukier & Mayer-Schoenberger, 2013), and human judgement to be confined in the final phases of knowledge (Quattrone, 2015). Traditionally, causation has been essential to the development of knowledge, meaning knowledge has historically been developed by trying to understand how the world works (Cukier & Mayer-Schoenberger, 2013). Big data is challenging this perspective by introducing associations and correlations rather than causations. This is made possible by the extensive amounts of data available today, making it easier to focus on correlations rather than searching for root causes. Cukier and Mayer-Schoenberger (2013) argue "the possession of knowledge, which once meant an understanding of the past, is coming to mean an ability to predict the future" (p. 39).

Approximately 80 percent of the effort related to big data is linked to the process of making it usable, e.g. cleaning and structuring (Syed et al., 2013), and data is attributed by producers and consumers (Quattrone, 2015). This may cause biases, pressures and politics to reticulate data, thus preventing individuals from making rational decisions rather than enhancing their ability to make rational decisions. Arguably, this constructs a big data paradox in reality; it supports the notion that rational decision-making can be enhanced by more precise measurement and representation of data, while it reinforces ambiguity regarding assumed correlations that originate from large data sets (Quattrone, 2015). However, as big data analytics and correlations are becoming increasingly important, questions arise related to what role humans will have in decision-making. If organisations, processes, and people are only managed through correlations, perhaps the principal point of differentiation becomes unpredictability, i.e. human intuition, common sense, and risk taking (Cukier & Mayer-Schoenberger, 2013). This calls for space of human ingenuity and processes allowing risk taking, even at times when correlations are pointing in another direction. Seemingly, data science and big data, i.e. advanced technology, affect actions of individuals, which in turn suggest that issues may arise related to employees in organisations. Thus, in connection to the purpose of this study, it is relevant to assess whether consultants are attentive to how these employees' perceptions and experiences, i.e. contextual complexities, are affected by advanced technology transfers.

2.2.2 Governance of information resources

The challenge for organisations is to ensure the governance of valuable insights from big data, i.e. the information has to be "sufficiently assured and protected, yet able to be shared both inside and outside the organisation" (Arnaboldi et al., 2017b, p. 768). Data has to be transformed into information that enables action. To reach this stage, statisticians and data scientists first have to understand, transform and analyse the data (Warren et al., 2015). Accordingly, specific resources are needed to reap the actual benefits of big data. Several information technology researchers (e.g. Balahur, 2014; Shelton and Skalski, 2014) have concentrated on how data is collected and analysed, yet not many researchers have addressed how procedures need to be constructed to best support these new methodologies. Instead, it has been argued that researchers tend to interpret big data as a black box (Arnaboldi et al., 2017b; Ceron et al., 2013; Wang & Lin, 2011). Additionally, some studies seem to not give enough attention to the issue of data quality, which is imperative to take into account in decision-making (Arnaboldi et al., 2017b; Warren et al., 2015). As LaValle et al. (2011) argue "hurdles on the path to effective analytics use are highest right at the start of adoption" (p. 32), also practitioners emphasise that a common mistake is that organisations do not plan enough before going into action (Bughin et al., 2011). Evidently, a technological infrastructure able to capture this kind of data is a prerequisite. What can be more difficult however, is for the organisation to have the sufficient skills required to manage and analyse this type of data (Chui & Comes, 2011; Krahel & Vasarhelyi, 2014). Thus, an important question to be considered is whether data collection and analysis should be outsourced (Bughin et al., 2011; Warren et al., 2015), or if bringing in consultants can help develop this expertise. In turn, the issues of expertise and data quality construct contextual complexities in advanced technology transfers which can be used to assess whether consultants are attentive to these, and thus help fulfil the purpose of this study.

For organisations to seize the full potential of big data, Bughin et al. (2011) argue information has to cross internal boundaries. Although the idea sounds reasonable in theory, it can be challenging for organisations to accomplish in reality. Difficulties associated with the dissemination of information within organisations have been highlighted by researchers (e.g. Bianchi & Andrews, 2015; Boyd & Crawford, 2012). One common problem in large organisations are departmental silos (Brown et al., 2011). Thus, information sharing can be problematic if data is trapped in these silos. Failure to share information over organisational boundaries may prevent organisations from understanding links and developing coherent

views of issues (Brown et al., 2011). On the other hand, big data may have the possibility to transform relationships between different functions and change organisational boundaries. While research points to professional boundaries as a common problem in organisations (e.g. Kurunmäki & Miller, 2011), other researchers argue big data can establish bridges between different functions through a shared understanding of the usability and potential value of big data (Arnaboldi et al., 2017b, p. 768). While accountants understand the financial flows of certain activities, other functions are more familiar with operational data (Bhimani & Willcocks, 2014). Big data as a platform allows for meditations among different functions (Busco & Quattrone, 2015; Quattrone et al., 2016), and hence foster addressing issues collectively. Studies have for instance shown that while accountants still to some extent seem to appear in the background, other organisational actors, such as marketing and IT managers, are entering the territory of performance measurement (Arnaboldi et al., 2017a; Brivot et al., 2017). It seems departmental silos in organisations are obstacles to seizing the potential of advanced technology; thus, is an important issue to overcome to succeed with advanced technology transfers. Hence, consultants' knowledge regarding these contextual complexities and how they are managed can help accomplish the purpose of this study.

2.3 Power in the process of strategic change

Regardless of the intentions behind bringing in consultants, it can be assumed that organisations want to achieve some kind of change. Hence, technology transfer is related to change. To assess consultant engagement in technology transfers, it is therefore relevant to understand crucial aspects affecting change processes in organisations. Hardy's (1996) framework of power mobilisation helps illustrate vital powers in play which affect and facilitate change processes. More specifically, the framework tries to explain the role power has in enabling strategic action, and thereby strategic change. Hence, this framework illustrates the complexities of change, and through it technology transfers can be analysed and comprehended. Although this paper does not seek to explore changes in organisational strategy and contribute to this literature, Hardy's (1996) powers will be utilised to help analyse whether consultants are attentive to contextual complexities surrounding advanced technology transfers. Thus, the framework will be utilised to enable insights as to what could be complex in advanced technology transfers and will thereby be an analytical tool to assess whether, and to what extent, consultants are attentive in advanced technology transfers.

Hardy (1996) separates power into four dimensions; power over resources, power over decision-making processes, power over meaning, and power of the system.

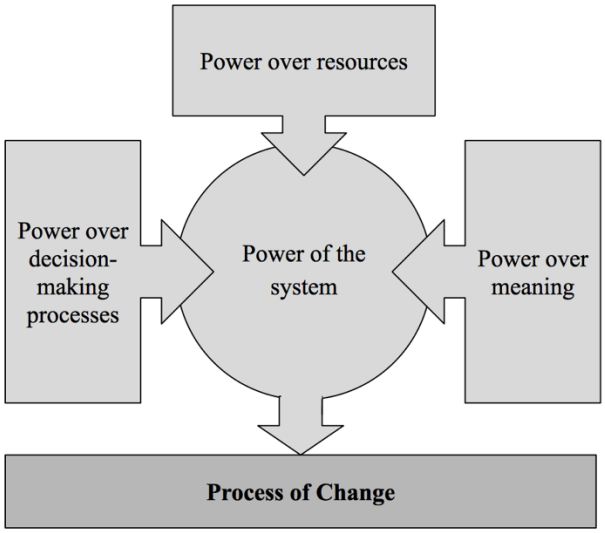

Figure 1. *Hardy's (1996) process of change.*

The first dimension, power over resources, is demonstrated when power is utilised to limit actors' access to key resources on which they depend. Such resources can be information, money, expertise, rewards and sanctions. Second, power over decision-making processes is demonstrated when powerful actors influence, manoeuvre, limit, or prevent subordinates' participation in the process of making decisions, especially important decisions that affect the organisation. This form of power is exercised from a distance; hence it is not easily recognisable or observable. Thus, the most visible actors in power are not necessarily the most powerful. Third, power over meaning is demonstrated when powerful actors, through influencing beliefs and perceptions, make subordinates accept the existing state of affairs or believe change is necessary. The fourth dimension of power is embedded deep within the system of the organisation. It is related to traditions, values and organisational structure taken for granted by the people in the organisation. In this system, a certain power distribution has already been established. The first three dimensions of power must be utilised in order to change parts in the already existing system. By doing so, the behaviour embedded in the organisational system can be altered to support change initiatives. Figure 1 provides an illustration as to how Hardy's powers relate and affect processes of change.

2.4 Summary of theoretical framework

Previous literature does not consider consultants as engaged in organisational processes related to change; rather, it assumes consultants to simply deliver a predetermined solution. In the 1990s, technology transfers were related to implementing IT solutions to collect information. Today, access to data is not an issue. Instead, parts of organisations' overarching systems need to be adapted, developed, or completely changed to allow value to be captured through the use of data. Undoubtedly, technology is not what it was in the 1990s. Hence, it is reasonable to assume that processes of change related to advanced technology transfers require new forms of knowledge and expertise depending on surrounding contextual complexities. Taking this new context into consideration, it is relevant to re-investigate whether, and to what extent, consultants are attentive to the contextual complexities surrounding advanced technology transfers. By utilising Hardy's (1996) framework of powers related to strategic change, this study aims to use a lens through which contextual complexities related to advanced technology transfer can be analysed. Finally, considering the tensions in previous literature and the new technological context, an interesting issue to research is whether, and how, technological competence simply can be transferred.

3 Methodology

In this section, methods for collecting and analysing data are described. The model through which empirics are analysed is elaborated on and developed further. Lastly, the research quality of this study is discussed.

This study adopted an inductive approach, meaning theory was mobilised and congregated during the research process, along with being utilised to understand and explain empirical findings (Collis & Hussey, 2014). This qualitative methodology was adopted since the study aimed to understand an old phenomenon in a new technological context in which interaction between the actors involved seemed to be essential. This is an established field of research; however, the study is exploratory because there is limited knowledge of the consequences of digitalisation, i.e. new technology in the form of data science. For exploratory studies it is suitable to investigate a case company to ensure the gathering of rich material on perceptions and explanations of the people involved (Bryman & Bell, 2011).

3.1 Data collection

The main source of data was gathered through interviews with professionals in management consulting, business intelligence, and data science. All respondents in this study work for a consulting firm (henceforth "CF") specialising in business intelligence, digitalisation, and data science. The CF was founded in 2006, has approximately 200 employees, and has operations in the Nordic countries. The CF offers services to private as well as public organisations. The CF has experience and expertise ranging from system and IT development to implementation and adoption of the services provided. This provided a unique opportunity for this study to capture a spread of experiences; from data scientists who work in joint teams with clients' employees, to management consultants who work with facilitating change and implementation. By capturing this opportunity, this study contributed to prior literature describing consultants as salesmen who go in, deliver a solution, and then leave. This study investigated to what extent consultants are engaged in contextual complexities surrounding advanced technology transfers by interviewing data scientists and consultants specialising in this new technology. Additionally, by capturing perceptions and experiences from those in fact affected by the receiving organisation's conditions and factors for change, this study nuanced consultants' role in technology transfers.

Interviewing is a flexible methodology for case studies, and an efficient approach for small-scale research (Drever, 2006). The interviews conducted were based on interview guides; however, these guides were not strictly followed but were rather used to set out general structures and principal question areas. Interviewing provides respondents with high degrees of autonomy, which in turn allows respondents to expand on personal observations and views (DiCicco-Bloom & Crabtree, 2006). Hence, this methodology can uncover valuable descriptive data, especially related to personal experiences of respondents (Bernard, 2000). Since the aspiration was to capture personal experiences rather than organised and well-planned responses, the interview guides were not made available in advance. The interview guides were focused on key aspects of the role of consultants in change projects identified in prior literature. Other principal question areas regarded challenges when facilitating change, and how change can be sustained. In addition, all respondents allowed follow-up questions either by e-mail communication or phone.

The main contact at the CF selected the respondents following suggestions as to what experience the respondents should have. Table 1 shows an overview of the respondents' business roles, and approximately how long the respective interviews lasted.

Interviews		
Respondent	*Position*	*Time (min)*
DS1	Data Scientist	75
DS2	Data Scientist	40
HS1	Head of Sales	65
MC1	Management Consultant	40
MC2	Management Consultant	80
MC3	Management Consultant	50

Table 1. *Summary of respondents.*

Even though the main source of data was collected through interviews, other sources of data were used to construct an understanding of the context in which the CF and its employees act. For instance, industry websites and the CF's official website were studied.

3.2 Data analysis

Technology transfers were assumed to be a type of organisational change process; hence this type of process is affected by the powers in Hardy's (1996) framework for strategic change. This study has therefore utilised Hardy's (1996) framework to analyse its empirics. The framework was not utilised to theorise findings, rather it was utilised to provide a frame of reference related to strategic change processes because the framework reflects the complexities of change. Part of Hardy's (1996) framework, specifically power of the system, was excluded from the process of analysis because this power is inherently organisational and dependent on the remaining three powers established in the framework. Thus, analysing changes in power of the system, i.e. the actual change, requires access to the organisation which the methodology in this study does not provide. Instead, this study's focus for analysis has been the remaining powers of the framework; power over resources, power over decision-making processes, and power over meaning. In this study, complexities surrounding advanced technology transfers were assumed to be mirrored in these powers. By comprehending complexities of change through these powers, this study was provided a frame for analysis through which it could investigate whether consultants were engaged in advanced technology transfers. Determining from consultants' awareness of these powers, it could be assessed whether consultants were attentive to organisational complexities surrounding advanced technology transfers.

Methods for data reduction were (1) transcribing, (2) coding, (3) aggregating coded material in separate documents, (4) restructuring data, and (5) construction of themes. These are effective approaches for reducing the amount of data, hence making it more easily examined (Collis & Hussey, 2014). Additionally, the process of coding, aggregating coded material, restructuring data, and construction of themes were conducted twice, on two separate occasions, allowing reflection and contemplating during the data reduction process. Themes were constructed based on the analytical framework, allowing this study to draw conclusions through this lens.

3.3 Research quality

To establish the research quality of this study, Lincoln and Guba's (1994) four criteria for evaluating research quality, namely credibility, transferability, dependability, and confirmability, have been employed. In this context, credibility can be described as the degree of confidence in the findings (Collis & Hussey, 2014). To increase the credibility of

this study, the authors, before the interview phase started, processed literature to be fully immersed in the field of study. Prior literature included management accounting change, digitalisation, big data, client-consultant relationship, and consultants as actors of change. Additionally, all respondents are professionals in the field of business intelligence, digitalisation, and data science, either as data scientists or management consultants. To further increase credibility and in an attempt to reduce the risk of rehearsed answers, interview guides were not made available to respondents in advance. Transferability focuses on whether findings can be generalised, i.e. be applied to similar situations and settings (ibid.). Although many examples of data science are captured through this unique combination of respondents, i.e. data scientists and management consultants specialised in business intelligence, digitalisation, and data science, this study remains a single case study. This means it supplies only one perspective, hence it is not generalisable for the whole industry. However, there are not many firms specialising in data science, and organisations are only starting to embrace this new technology, hence this study provides an exploratory understanding of the subject rather than trying to generalise its results. Dependability is concerned with whether the research process is consistent and well-documented, and therefore could be repeated (ibid.). To increase dependability, this chapter has described how the research process developed and how it was conducted. Additionally, tables with information on respondents and their professions have been provided to elaborate on the context of this research. This allows the reader to understand the context in which this study was conducted, hence allowing studies to be conducted in similar manners. Confirmability can be described as a degree of neutrality; whether findings are shaped by respondents and not researcher bias (ibid.). To increase confirmability of the study, the process of transcribing and coding were made independently and separately. The coding was then aggregated, restructured and reviewed. Additionally, the process of coding the results was made twice, allowing further reflection. However, there is subjectivity in all qualitative research and it is reasonable to question whether the results have been sufficiently reviewed. Qualitative studies need balance between subjectivity related to this methodology and richness of data. Since this study aimed to explore a relatively under researched phenomenon, and sought to capture rich descriptions, a qualitative approach was more valid.

An additional aspect that affects research quality is language. Interviews were conducted in Swedish, as well as the process of transcribing, coding, and the creation of patterns and themes. Potentially, there are quality risks related to the process of translating results. This

was managed by applying a four-eye principle to translations which were vague in terms of message and meaning. There were only a handful of cases which needed double-checking.

4 Results and analysis

In this section, results from the data collection process is presented. The structure of this section follows the model for analysis which was presented in previous chapter. Analysis is embedded in the presentation of results.

4.1 Power over resources

Challenges related to advanced technology transfers are often found at the top of the organisation in question, a respondent says, claiming *buy in* is most important for facilitating and adopting new technologies. This is endorsed by several respondents; however, emphasis is placed on management communicating the value of the technology and the change, i.e. the potential benefits of adopting the new technology. Additionally, it is stressed that benefits related to data science are rarely obtained by simply going live with new technical solutions, which some clients seem to assume. Rather, it is when new solutions go live organisations can start working with data and information, new decision-making processes, and thus start reaping benefits. However, it seems clients do not always comprehend what can, respectively what cannot, be done.

> Usually, the greatest challenge is to make clients understand what is possible and what is not possible. For me at least, there are two scenarios. Either clients believe you can solve all their problems, or they are suspicious as to whether this new technology even works. – DS2

Furthermore, it seems some clients are not always prepared to adapt to new solutions. Even though efficiency gains are identified, and technical solutions are ready to be deployed, not all organisations have the resources or structure to manage solutions operationally.

> We found that an additional batch could be processed per day [25 percent increase in efficiency]. That is a lot of money, adding a batch per day. The thing was though, if this was to be executed, the additional batch per day could not be managed operationally. – HS1

Still, change projects related to new technology are questioned, resulting in limited funding, another respondent states. However, this could be explained by organisations' fairly complex and expensive system solutions already in place, decreasing organisations' inclination to explore new systems and technologies.

> [We] work with extremely tight budgets while CRM projects can get millions and millions in funding. It is close to embarrassing considering the value it can provide. – HS1

> Many organisations have lots of legacy. When it comes to these areas, these decisions and support systems related to them, organisations have invested heavily. The road to where many are today has been rather expensive. […] The consequences might be severe if systems are questioned. – MC3

Seemingly, there is a frustration related to a lack of understanding of new technology. For example, management knows what they get from an application developer, or what a CRM system is. However, data science is more abstract. Hesitation towards such projects could suggest uncertainty and doubt related to claimed benefits. A respondent underscores the importance of courage to venture in new technology to begin the technological change. In this regard, senior management, as well as middle managers, need to take responsibility for making these decisions.

> Either senior management is gutless, or middle managers are gutless because senior management has not comprehended the potential of this technology. – HS1

> To succeed, you need access to people with power, money, and knowledge of organisational processes. – HS1

In summary, in advanced technology transfers, access to managers with power to make decisions, managers with access to resources, and knowledge of operations and processes are needed. The general perception among the respondents is that many organisations lack the competence to adopt new technologies. Many organisations start working with new technologies and techniques, however many have no strategy addressing how to facilitate the advanced technology, data scientists say.

> They do not really know what they need it [the technological solution] for, and it could be simple to say 'of course, we will build that for you,' but I need to question 'why?' – MC2

It is often someone from operations that recognises lacking competence, communicates this to someone who is responsible, and thereafter contacts external actors for assistance. Projects are often initiated this way, and the second phase is often characterised by data scientists exhibiting possibilities of utilising data with new technology.

> Usually, it is someone from operations that contacts us. They are experiencing a problem. So usually it is not IT that is contacting us. – DS1

> You have lots of knowledge, we want to tap in. – DS2 was once told by a client

Initially, clients often need assistance to comprehend what can be done with data. Therefore, consultants and data scientists frequently make use of *proof of concepts* to show new technological possibilities related to data science. During such small-scale projects, consultants are often provided data and invited to present results later. There is a low degree of interaction until results are presented, data scientists say. In addition, many organisations require results almost instantly, making this a valuable technique to both clients and consultants. Consultants and data scientists have to own this part of the process, showing and elaborating on benefits and opportunities, respondents argue. This is further endorsed by other respondents, who are emphasising the critical aspect of identifying business cases and potential solutions in this phase. Seemingly, this method allows organisations to quickly take in new perspectives and ideas while it allows consultants as well as data scientists to engage with organisations and get a glimpse of future project opportunities.

> In one case, some employees understood that this had to be done on a larger scale, and they went around preaching until a manager contacted us for help. – DS1

If proof of concepts are successful, and comprehensive projects are undertaken, usually data scientists work at clients' offices to get a holistic understanding of the business. Normally, data scientists sit close to teams working with analytics and IT. The important thing is proximity to operations, a respondent says, because data scientists do not know the business sufficiently enough. Today, proximity to operations is often provided by operational specialists accompanying data scientists to provide expert competence about operations and processes.

> You have meetings with everyone at IT, with the ones in your team, and you have many meetings with operations. – DS1

> Of course, I also work with specialists. This is important because I do not know the business that well. I need to sit and work with them. – DS2

Seemingly, data scientists work closely with clients' employees to gather knowledge and to build familiarity with operations. In this sense, it seems technological solutions are facilitated and constructed through collaboration between clients and consultants. This collaboration indicates interaction between the parties and could therefore suggest sharing of knowledge to be elemental to the conception of acceptable technical solutions, i.e. enabling advanced technology transfer. Usually, IT is more acceptable towards suggestions, data scientists state. This is expected due to similar educational backgrounds, enabling IT professionals to

conceive technical solutions to a greater extent. Additionally, being able to express thought and ideas in the same *language* could expedite trust among clients and consultants. This could make data scientists a channel between clients and other consultants.

> People from IT are easier to manage, even though we might not agree on everything. […] IT does not need to ask follow-up questions because they know we understand this better, they accept our suggestions. – DS2

However, all respondents address the issue of data quality. It seems many organisations have collected data for a long time, and collection processes were initiated without strategies addressing how to utilise data to better run operations, data scientists explain. While this notion is supported by other respondents, it is also emphasised that many organisations have not experienced need for this kind of IT strategy until recently. In addition, there is a need for people with the right mindset for making use of new technology. This is endorsed by other respondents, claiming skills in problem solving and procedural changes to be vital for addressing changes related to new technology.

> Now, when many organisations want to utilise data they have collected during a long period of time, they notice that it has been incorrectly collected. It is bugged. It is chaos, more or less. Additionally, when it is supposed to be utilised, it is noticed that it is infinite and unstructured. – DS2

> Challenges are access to data; correct data, but also the right people in operations. – MC1

Apparently, organisations have either predicted opportunities related to data utilisation without knowing exactly how to exploit it, or organisations have simply collected data because others have started doing it. When data is collected without a strategy addressing how to exploit data, it is generally collected incorrectly, resulting in time and resources being spent on data preparation before it can be utilised in new models and techniques. This part often requires external help, respondents argue. This is a major and common challenge related to advanced technology transfer, respondents state, claiming *finding time* is difficult for organisations. Employees, who need to be involved and engaged, are often busy with daily operations, leaving little time to be spent on additional projects, such as introductions of new technologies. Many organisations are increasingly being slimmed down, causing the ability to change and adapt to new technologies to decrease, a respondent says.

> You have to make sure there are time and resources available to follow through. [...] You need engagement, which is difficult to maintain when organisations are increasingly becoming slimmer. – MC1

> Many organisations want to acquire this competence but have not been able to do that yet. So, right now, organisations need external help. […] For many organisations, this is perhaps the most efficient way of doing this, bringing in consultants who take selective action between times. – MC3

Simply, management has to dedicate time to overcome this issue, respondents claim. Even though making time available seems to be essential for advanced technology transfers to occur, it is also acknowledged that bringing in external assistance from time to time historically has been an adequate strategy for organisations to adapt to new technology. Additionally, respondents recognise that organisations' administration of IT systems, where new needs have been solved by making adjustments of current systems, has been an adequate approach historically, too. Conceivably, in this regard, a paradox could exist related to organisational readiness of adopting new technology. Since organisations historically have been able to take in external assistance when new technologies are to be introduced, and have done so quite successfully in the past, funding to processes other than operational core processes have possibly been limited and restricted, which in turn has decreased organisations' ability to adopt new technologies, such as data science. Since technical solutions of this character require operational knowledge and familiarity, a decreasing ability to adapt is crippling to advanced technology transfer processes. A respondent identified two important factors for creating and sustaining engagement which seemingly increase the probability of successful adoption, namely coaching and support.

> You need an idea about how to best coach and support. You also need to consider how this affects individuals. From that you might gain more input on how things change and perhaps could be improved further. – MC3

How to best coach and support are closely related to project methodology, respondents state, claiming that understanding how technical solutions affect individuals is essential in change projects. To be able to provide clients with several logics and to be able to communicate effectively in clients' organisations, the CF has adopted a specialised approach.

> I believe we have a unique profile due to the fact that we invest heavily in employing different competences which are able to discuss with clients on different matters. We are economists, developers, and engineers. – MC2

Naturally, the CF provides competences in several professional capacities by employing individuals with different backgrounds and experiences. The CF has specialised in an area rather than an industry, which provides expertise in driving projects within that area instead of having expert knowledge in relation to specific industries.

4.2 Power over decision-making processes

While resources in terms of time, money, and expertise need to be mobilised in order to achieve advanced technology transfers, the respondents also claim powerful decision-makers need to be involved. The importance of having a strong project group is emphasised by a respondent, claiming control is needed during initial phases of the process to set boundaries. This indicates an ambition to regulate decision-making, and thus the magnitude of the process. Furthermore, since changes of this magnitude often implicate comprehensive changes in the organisation and revisions of processes, it is beneficial to be supported by individuals with mandate to make crucial decisions, respondents explain. These individuals are generally employees in senior positions. However, since these processes can change how decisions are made in organisations, and therefore affect decision-makers themselves, it seems vital to establish broad project groups to incorporate several perspectives and domains.

> You need buy in; someone with a bag of money, but also a powerful decision-maker, otherwise it is completely pointless. – HS1

> A big part in the change management process is the transition from making decisions based on gut feeling to data-driven decision-making. This is often an integral part, and it should not be ignored. Usually you talk about the HIPPO, Highest Paid Person's Opinion, that has to be broken down in some way. – MC2

The head of the function mostly exposed or involved in the change process acts as main representative in the project group, respondents say. Additionally, finance functions seem to be involved in processes like these. It is rather common that finance employees get involved and assume responsibility, even if the planned changes are not meant to affect their function, a respondent explains. This could be explained by common traits among individuals in finance departments, such as responsible. In addition, these individuals are perhaps more used to working in projects, and therefore more used to assuming responsibility for processes. Nevertheless, the respondents agree that having this kind of people involved adds momentum to the change process by making use of their experience.

> For natural reasons, we need the certain function in question involved. But if we also get a controller or CFO involved, we can get the whole organisational picture since they have the responsibility to connect links and make sure we do not build any sub-optimisations. – MC2

Senior decision-makers are not always familiar with the details of how procedures and processes are actually performed. For instance, a particular procedure may require small adjustments that are only known to the employees that are in fact performing it. According to a respondent, such details can have considerable impact on how to proceed with the change process, since these can affect other procedures in the organisation. Hence, if employees with this knowledge are dismissed or prevented from participating in the change process, important details may not be revealed. This could have crippling effects on the success of the advanced technology transfer. Therefore, it is crucial to identify and involve process owners which are employees close to the procedure, respondents state.

> It is very seldom they [senior decision-makers] are familiar with details […] on how you actually perform procedures. Sometimes you notice these details too late in the project, 'well, then it was not successful'. We want to discover these [details] as soon as possible, and then we need to get down to the process owners, people in fact on the floor. We need to find them, and we need to identify them in the early stages of the project. – MC2

The role of management consultants in projects is often referred to as project leader. This role incorporates and includes tasks related to managing dialogue with senior managers in organisations, and to assume utmost responsibility for delivering what has been agreed. It is emphasised that the management consultants have a more significant role in initial phases of change processes but takes on a less significant role during stages of development. Instead, data scientists take on a more significant role when ideas are to be translated into technological solutions and techniques. Depending on the case and how comprehensive it is, data scientists work with different, sometimes several, functions. Notably, data scientists seem to work closer to specialists in organisations, which could be explained by data scientists' need to acquire specialist expertise and knowledge of procedural technicalities. Respondents acknowledge that sometimes there is tension since specialists can be reluctant to letting data science become part of organisational processes. However, it is vital that data scientists gain access to specialist knowledge, which means tension has to be averted, usually by emphasising the value and importance of specialists' expertise. Generally, these specialists work in analytics or IT teams, which data scientists mainly work with.

> As soon as we have found something, we ask them [the experts] if it is reasonable. – DS2

Even though some organisations are less hierarchical in structure, and used to cooperate over organisational boundaries, a common challenge are departmental silos, the respondents say. These departmental silos are especially noticeable in large organisations. Despite ideas and ambitions to organise organisations in processes rather than functions, the responsibility over these processes is often limited by the borders of these departmental silos.

> When you mix operational data and financial data, you also need to mix these people. – MC3

> We build a component for the organisation as one unit, not a silo; it's supposed to generate effects in other parts of the organisation too. – MC2

Generally, change processes related to data science involve integration of data from different departments, hence they involve interaction between employees in different functions. When organisations are structured in silos, it is often time-consuming for consultants to find the correct employees for conducting and managing projects. Seemingly, it is not always clear who is responsible for cross-departmental procedures and processes. Furthermore, it can be challenging to combine employees with different mandates since there could exist different political agendas among departments. Hence, change management and decision-making need to be exercised in a manner which integrates different mandates.

> We can create the technological solution, we are actually really good at that. The difficult part is that you have to adapt the organisation and make sure everything fits. – MC2

> Data already exists. Systems and techniques already exist. Then, we have humans that have to translate it, use it, understand it, and decide about it. – MC3

> We do not have to educate them in the how the tool works, but rather in: 'when you see this type of pattern, what do you do?' – MC2

Employees who are involved in decision-making are not always involved in utilisation of technical solutions, respondents claim. Seemingly, decision-makers generally set guidelines but are relatively distant from practical solutions. However, for advanced technological solutions to be transferred successfully, dedicated employees have to be given responsibility, respondents claim. Most of all, employees have to be given the possibility to make decisions related to the process, which could influence the perception of change and create awareness.

4.3 Power over meaning

Change processes are affected by how decisions are made and how these processes are structured. However, only practices that are consistent with underlying values and norms

seem to withstand the test of time. Therefore, it is essential to address preferences, cognitions, and perceptions, so that individuals either accept or dismiss change. By doing this, organisations can construct chosen strategies as desirable, rational, and legitimate. Creating narratives, i.e. meaning, seems to be important in advanced technology transfer.

> In one case, some employees understood that this had to be done, and they went around preaching until a manger contacted us for help. – DS1

> How you make change happen? You need an ambition to change. You need support. Courage and determination. Willpower and ambition. And money, of course. Projects cost money. – MC1

It is often management who sets the narrative but individuals who are personally interested in new technology, i.e. interested in becoming data-driven, can help set the narrative. One way of doing this is by communicating the significance of the chosen course of action, or by utilising symbols emphasising the urgency for change. Respondents have experienced an increase in appointments of *Chief Digital Officers*, which could be seen as a symbol of significance.

> It is very evident right now that organisations increasingly appoint CDOs. The title varies, but it is an individual responsible for the organisation's digitalisation. [...] This person sometimes works in operations but can be part of the IT department as well. – HS1

Similarly, one client arranged a full day event on artificial intelligence, trying to communicate the value of new technology and now it would affect employees. Seemingly, meaning is mainly constructed internally, however construction of meaning can be expedited through external assistance. For instance, external actors can conduct workshops and perform small-scale proof of concepts to display what can be done if new technology is introduced. Additionally, even though external actors are involved to engage in change processes, resistance among clients' employees can cripple momentum. Hence, for external consultants, adding legitimacy to the chosen narrative can be challenging.

> I cannot explain the most complicated parts since no one knows how it really works. Imagine buying in on that. It is very challenging. You need to be instructive and pedagogic. – DS1

Seemingly, meaning is important for the facilitation of change which enables organisations to accept and adopt new technology. If the narrative is not set correctly, external actors can experience difficulties gaining goodwill from clients' employees, which some of the respondents have experienced.

> The experts are sceptical because they have 20-30 years of experience in the industry, and they do not believe a computer can be this smart. Management is simply sceptical because they do not know how this works. – DS2

> He was very hesitant to our model and our analysis. One time, he even asked if we were orange farmers. 'No, we are not,' I replied. 'Good,' he said, 'then you know nothing about selling oranges.' – DS2

In change processes, and especially when new technology is introduced, resistance is expected. Finding ways to construct bridges seem vital for external actors to be able to complete projects. However, in many change processes, a significant amount of resources seems to be spent on making people understand why change is needed.

> Generally, to be honest, people are not so inclined to change. People are addicted to safety. [...] IT projects are believed to be the difficult part, and the rest to be simple. In reality, it is the other way around. [...] There is tremendous amounts of work with getting people onboard, and believe me, organisations are huge. Reality is often more complex than people think. – MC2

> Organisations have tremendous amounts of knowledge. They know all the details. But you get blind to flaws. [...] I believe most people are receptive to new perspectives when presented by external actors. In a sense, it is like the saying 'you cannot see the forest for all the trees.' – MC1

> You need to constantly remind them not to think in silos. To be honest, that is the reality. We know what we need, and our clients know it, too. But it takes time. [...] Perhaps a business case needs to go up to senior management, but at least they can make a decision. Without such a decision it is very difficult, you have your patterns and do what you have always done. – MC2

Lacking awareness could be an indication of poorly communicated narratives, hence making external actors, such as consultants and data scientists, carry the weight of transmitting the chosen strategy internally. In this sense, consultants seem not only to be expediting the process of adopting new technologies but seem comparatively vital to the process. Notably, several respondents state, being reluctant to change is seldom intentional.

> There are not organisational silos intentionally. Often, it is a historical pattern of how to do things which has become second nature, rather than people consciously trying to cripple the process. [...] The vast majority is professional when you understand that you are part of something bigger. [...] As long as you are not getting fired, you are professional enough to work with it. – MC2

> It is challenging to think freely around these issues. It is important to broaden our clients' views. That is our job. And since this is new for us too, we need to find the best way of establishing a new mindset. – MC3

> We are so focused on delivering new technology, but organisations are not only focused on this. Organisations have lots of initiatives going on the whole time, and our project is only one of many. Sure, this is revolutionary, but I think we often forget that organisations have other initiatives going on simultaneously. – DS1

Seemingly, reluctance towards change projects is related to the comprehension of the new technology, to not feeling dismissed by it, and to not having time to care for it. Employees' fear for losing employment due to introduction of new technology seems to, at least in some cases, cause severe slowdowns in change processes.

> When a competitor fires 200 employees from the marketing department due to the fact that they are no longer needed, well, you can imagine what people think. Of course, they get scared. – DS1

> At one of our clients, employees thought AI would replace them and make them unemployed. People were frightened, and the initiative was intensively opposed [...] until all employees were gathered, and management communicated what the initiative was all about. 'This is not a cost saving program. This is a revenue program,' the vice President said, 'this is about becoming more creative and increase revenue.' This message was really important. – HS1

> There was one person within the sales organisation who previously had done all this manually. Every year, hundreds of hours of work were allocated to this. Evidently, this person was extremely important to the organisation. – MC2

> However, at another client, no one thought they would lose their jobs because new technology was introduced. People will still make decisions; however, it will be based on data. Decision-making will not be replaced by AI. – HS1

Notably, fear is not present in all organisations who introduce new technology. There are organisations in which employees are not worried. This could suggest a better communicated narrative by internal advocates, or possibly a better collaboration between client and consultant which assured employees in the process of change. Additionally, it seems external actors carry weight in bringing individuals onboard.

> What can we learn from each other? I need to facilitate that dialogue. Projects are not only filled with gathering and preparing data, they are also filled with soft issues. When the technical solution is getting ready, the parts involving change management begins. How are we driving change? – MC2

> It is about making people feel listened to. It about sharing progress, asking for opinions and advice, wanting to know how to proceed. [...] In a sense, it is about making people feel valuable. – MC2

It seems all respondents are aware of ‘soft’ issues related to change management. After all, the respondents’ job is to deliver and execute change. However, several respondents accentuate that change can only be successful if ‘hard’ and ‘soft’ issues are managed together. Not only together as in interaction and interplay between the parties, but together as in constructing solutions together. To be able to construct solutions together, trust must exist. This seems particularly evident when data scientists share experiences related to the production of technical solutions.

> How are we making people understand? We are doing this together. – MC2

5 Discussion

In this section, findings and analytical conclusions are discussed in relation to previous research on consultant involvement and data science. The sections cover issues related to advanced technology transfers and surrounding complexities.

5.1 Consultants in advanced technology transfers

Previously, negative and positive elements of bringing in external assistance in forms of consultants have been discussed. Predominantly, prior literature is negative towards consultant involvement in change processes (e.g. Alvesson & Johansson, 2002; Bloomfield & Danieli, 1995; Clark, 1995; Mitchell, 1994; Redekop & Heart, 2007; Sturdy, 1997; Sturdy et al., 2008; Whittle, 2006). However, there is literature showing and acknowledging consultants' contributions to organisations and change processes (e.g. Bessant & Rush, 1995; Fincham et al., 2008; Føsstenløkken et al., 2003; Ginsberg & Abrahamson, 1991). Overall, previous research simplifies the role of consultants in technology transfers and reduces consultants to mere suppliers of finished products (e.g. Bloomfield & Danieli, 1995; Glücker & Armbrüster, 2003). While this notion seems to be partially supported by the consultants in the traditional sense, it is questionable whether this notion holds in this advanced technological context as its complexity makes a simple one-way transfer unrealistic. Additionally, research has emphasised data science solutions as too complex for traditional systems (Constaniou & Kallinikos, 2015; Syed et al., 2013). Thus, it is reasonable to challenge the simplistic view of consultants in technology transfers since it seems it has lost its relevance as advanced technological advancements have made technology more complex.

Despite extensive critique, consultants are evidently still being engaged by organisations when issues arise. Judging from the collected experiences of respondents in this study, the main reason why organisations decide to turn to external sources for facilitating advanced technology transfers is lack of internal expertise. Hence, this indicates support for prior literature suggesting consultants are brought in because of their expertise (e.g. Poulfelt & Payne, 1994; Wood, 2002). Additionally, data quality seems to be an issue where consultants need to step in with expertise. In this respect, some support can be found for Glücker and Armbrüster's (2003) suggestion that consultancy practices are delivering products and services that organisations cannot provide without external assistance. However, the tasks are still being executed together with clients. This gradates the claim made by Bughin et al. (2011) and Warren et al. (2015) that these tasks should be considered to be outsourced, when

organisations could conduct these tasks together with external actors. Interestingly, finding time is also emphasised by respondents, claiming this to be a major challenge in change processes because when employees cannot focus on more than daily operations, engagement in organisational development seemingly fades. However, it is also explained by respondents that bringing in consultants between times has been an adequate approach to adopting technology historically. Yet, data science as a technology aims to capture value from data which is collected in exceedingly vast amounts, making it too complex for traditional data processing applications (Syed et al., 2013). This implies that data science is more advanced than previous technologies, making it likely that this advanced technology demands more from developers and users. For instance, data science increasingly makes use of data generated in absence of economic flows (Bhimani & Willcocks, 2014) and transactions are increasingly being captured before they are recorded (Vasarhelyi et al., 2015). Seemingly, the complexity in change processes related to technology transfers is increasing. Consequently, it can be questioned whether historical approaches of selective action, i.e. quick fixes, are adequate today, or if this advanced technology demands more in terms engagement and commitment, perhaps from both consultants and clients' employees. In a similar sense, there are clients who seem to expect consultants to simply hand over solutions that will automatically solve problems in the organisations, while other clients seem to doubt if data science even works. This indicates that there are discrepancies between client expectations and project capabilities, hence client expectations do not correspond to the complexities related to advanced technology transfers. This can be further noted by the fact that organisations do not always have a strategic plan necessary to support this type of advanced technological solutions, which also Bughin et al. (2011) emphasises as a common problem. Furthermore, it seems organisations cannot always comprehend what resources are needed to reap the benefits of technology. Hence, consultants bear responsibility to find a balance between fulfilling clients' desires and available resources, and thereafter present an appropriate solution.

While consultants can contribute with additional resources and demand for key employees to be involved in the development phase, the creation of meaning seems especially difficult. If no clear narrative for change has been set by management, consultants may have to carry the weight to convince reluctant employees. Data scientists work closely with employees at the heart of the process in which advanced technology is to be introduced and adopted. The respondents acknowledge difficulties related to getting certain employees involved and

engaged in this process, and tensions and conflicts can occur. For a long period of time, academics were recognised as main critics of consultancy practises (Collis, 2004), however this is challenged by Bouwmeester and Stiekema (2015) who instead conclude employees to be most critical towards consultants. Seemingly, as the respondents in this study recognise, advanced technology makes people feel worried because it is easy to think it will replace people and make them unemployed. Naturally, this feeling affects employees in relation to consultants. Therefore, conflicts and tensions should be expected in advanced technology transfer. Cukier and Mayer-Schoenberger (2013) claim data science solutions will have implications for human interaction and judgement in decision-making, however respondents claim data science to be a tool providing decision-support. Yet, it is evident that when this advanced technology is implemented it may result in considerable changes for some employees. Consultants, may it be management consultants in a traditional sense or data scientists, need to find methods to counter employees' worry and help alleviate anxiety. For instance, well-developed social and coaching skills are vital when undertaking change processes. The respondents seem to have recognised the importance of this by acknowledging the importance of internal expertise and competence, as well as the goodwill of key employees. Notably, coaching is one of the reasons organisations engage in hiring consultants (Ginsberg & Abrahamson, 1991). Seemingly, there is a limit to what external actors can do in terms of meaning. Management is therefore responsible to provide a narrative which is communicated to the organisation. It seems, if the narrative is adequately communicated, advanced technology transfers will happen more quickly.

5.2 The sum is greater than its parts

Research states that consultants are becoming outside experts through continued exposure to clients in the same industry (Fincham et al., 2008). Continued exposure to similar problems clearly leads to experience, and probably also expertise. Even though this is true, respondents emphasise characteristics of organisations as well as specific organisational complexities when constructing solutions. It is evident that respondents are aware of issues which make advanced technology transfers complex, and it seems a great portion of the work involves understanding specific organisational complexities. This knowledge is not satisfied by continued exposure to the same industry, rather it is achieved by bringing in specialist expertise from the specific organisation. Apparently, additional knowledge of this kind is not only desirable, but essential for the project to provide value. These projects seem to be developed jointly by clients and consultants, where clients provide the specific organisational

expertise. For this reason, it is reasonable to question whether consultants and data scientists really need to possess specific industry knowledge for advanced technology transfer to occur. Ultimately, these projects seem to heavily depend on information from the individual organisation and it is questionable whether it is even possible to obtain the required knowledge only from repeated practical exposure to the same industry. Hence, specific industry knowledge may not be as relevant in advanced technology transfers due to organisational complexity and the complexity of data science itself. Furthermore, this can be seen in opposition to research that argues consultants use standardised models and rather repackage old ideas in new formats (Redekop & Heath, 2007; Sturdy, 1997; Whittle, 2006).

The introduction of advanced technologies is affecting organisational procedures which in turn requires specific organisational knowledge, which may not be known to decision-makers. Employees are not always included in the decision-making process when guidelines are set for projects, however certain employees, for instance process owners, can be identified as vital to the process. Management consultants are aware of this and emphasise the need of operational competence to be involved, which is often provided by specialists working in client organisations. However, data scientists go further, claiming this specialist expertise is essential to these projects, and accordingly, the success of advanced technology transfers depend on input from specialist expertise in organisations. This is consistent with the view of Føsstenløkken et al. (2003), namely that client interaction is a source for knowledge development. Furthermore, this finding suggests that consultants today, as an isolated group, cannot facilitate advanced technology transfers. Interestingly, this is not only endorsed by consultants, but also supported by data scientists who work together with clients' employees to integrate advanced technologies. In this context, it seems advanced technology transfer projects are designed jointly by clients and consultants, leading to the construction of bridges allowing advanced technology transfers to occur. This transfer seems to take place through a group of people; through an interplay of shared expertise between consultants, data scientists included, and clients' employees.

Departmental silos seem to be a common issue in these projects. The issue of sharing information among departments is well-researched (e.g. Bianchi & Andrews, 2015; Boyd & Crawford, 2012). In this regard, departmental silos may prevent organisations from comprehending the 'big picture' (e.g. Brown et al., 2011; Bughin et al., 2011). The respondents acknowledge this challenge and accentuate the need for cross-departmental sharing of data. In this sense, this advanced technology could help build bridges, as discussed

by Arnaboldi et al. (2017b). Data science solutions need to cross departmental boundaries since data needs to be integrated from many departments and areas in the organisations. However, departmental silos can make it difficult to spot the necessary people to involve for successful integration. Management consultants have the task to map out these people; however, data scientists are the ones that work in close contact with them. A part of the criticism towards consultants is that they lack industry knowledge (Sturdy, 1997; Sturdy et al., 2008), and this seems to be the case also in advanced technology transfers. Due to this scepticism, people may exert ownership of the process, be hesitant to let in data scientists, and thereby resist integration. Furthermore, these people are crucial to get onboard as they can influence attitudes. Through proof of concepts, data scientists can be seen as salesmen under disguise gaining confidence and convincing reluctant process owners. This shows nuances to previous research which is portraying consultants as shallow salesmen (e.g. Bloomfield & Danieli, 1995). It seems data scientists can be some kind of extension for management consultants in facilitating projects. Accordingly, data scientists can bridge the gap between management consultants, i.e. the project leaders, and employees with expertise in operational processes. This is further recognised by data scientists' ability to communicate in the same language, in terms of technology, as clients' IT professionals, allowing data scientists to establish credibility and understanding of local processes. This supports the findings presented by Fincham et al. (2008).

5.3 Summary of discussion

The respondents show a high degree of awareness of several issues that make technology transfers complex and problematic. However, the perception that consultants do not take on major roles in advanced technology transfers seem, to some degree, justifiable as management consultants in this study mention this too. Management consultants take on leading roles in projects and handle the dialogue with high-level decision-makers, however advanced technology transfers have many phases. Hence, it seems some kind of duality exists. The traditional interpretation of consultants in research as the sole actor to deliver a solution should not remain undisputed. In contrast to previous research, this paper discusses how the role of consultants has developed in relation to advanced technology transfers. While management consultants seem to manage traditional parts of projects, data scientists are enabling advanced technology transfers. Seemingly, data scientists operate as a link between the expertise in organisations and the management consultants. Additionally, projects rely heavily on involvement of employees, i.e. process owners, from clients. Clearly, contextual

complexities demand for mutual dependencies in this kind of technology transfer. Consultants can contribute with knowledge and expertise; may it be only to a certain extent. However, the projects also rely on powerful decision-makers in the organisation to devote resources, allow for key personnel be part of decisions, and create a narrative for change. Hence, contextual complexities in technology transfers are addressed in cooperation between clients and consultants. This adds a duality to prior literature claiming organisations are hiring consultants since organisations cannot deliver solutions without external assistance (Glücker & Armbrüster, 2003). Simply, in this new technological context, consultants delivering data science solutions would not be able to deliver specific organisational value without the expertise found in organisations. Still, support is found for claims by Poulfelt and Payne (1994) and Wood (2002) which state that organisations hire consultants due to their expertise and competence within the firm, but this study identifies notions suggesting value is created together, since little value would come from only external assistance.

6 Conclusions

In this section, the research questions are explicitly answered, theoretical contributions and practical implications presented, and future research proposed.

The purpose of this exploratory study is to investigate whether, and how, consultants are attentive to contextual complexities surrounding advanced technology transfers. This purpose is divided into the following research questions:

I. *From the perspective of consultants, what are potential issues in advanced technology transfers?*

II. *How are contextual complexities surrounding advanced technology transfers managed?*

From the perspective of consultants, several issues in advanced technology transfers are identified. Issues can be related to organisational structures and processes, and employees might need to adjust when transfers occur. Thus, organisational issues are connected to contextual complexities. A central aspect in advanced technology transfers is that information has to cross internal boundaries, and that solutions rely on key information and employees with access to this information. Given the complexity of the advanced technology itself, specific expertise is required. When the level of complexity goes up, consultants need to adapt to this new context. Accordingly, advanced technology transfers are not accomplished by traditional consultants in isolation, rather it is executed and facilitated by interaction and continuous sharing of knowledge through a chain of people, including clients and consultants. While management consultants seem to manage traditional parts of projects, data scientists operate as a link between organisational expertise and management consultants. These findings add to prior literature on consultant involvement in change processes and nuances the established understanding of consultants as actors of change. Ultimately, it seems advanced technology transfer does not only move from outside sources to organisations, rather advanced technology is constructed jointly by external and internal sources. Seemingly, Bessant and Rush's (1995) definition of technology transfer may need some reconsideration in relation to advanced technologies.

Through investigating consultant involvement in this new technological context, this study can provide an alternative view of the role of consultants. Firstly, findings indicate that the simplistic view of consultants as simply handing over predetermined solutions have, in this

new context of advanced technology transfer, lost its relevance. The findings suggest that technology has become more complex, resulting in increasingly complicated processes in which advanced technology transfers are to be facilitated. This implies that additional competences as well as higher levels of engagement are needed to facilitate advanced technology transfers today. Consequently, this kind of advanced technology transfers cannot be delivered by a single group of consultants, instead consultants are engaging with new competences within the firm to co-develop transfers. Secondly, the prevalent notion in prior research suggesting consultants are not engaging in technology transfers does not seem relevant in the context of advanced technology transfer. This kind of advanced technology transfer is enabled by several actors, including consultants and employees alike. These transfers seem to demand interaction and sharing of expertise through continuous exchange of knowledge. This suggests that two-way communications are present within these transfers, permitting experiences to flow to clients from consultants as well as to consultants from clients. This implies that technical solutions are constructed and developed in collaboration consisting of clients and consultants. Thirdly, data scientists can provide a different view on the role of consultants. This study incorporates experiences not only from consultants in a traditional sense, but also from consultants specialising in data science solutions, i.e. data scientists. This enables the study to contrast traditional consultant perspectives with data scientists' perceptions and experiences. Since these consultants are close to operations when developing new technological solutions, and work closely with clients' employees, this study includes a perspective not thoroughly researched.

6.1 Managerial implications

This study has managerial implications related to advanced technology transfers. It sheds light on strategic resources related to advanced technology transfers as well as how issues are managed by external actors. In combination, these findings can provide management and managers with insights as to how execution of advanced technology transfers can be accelerated. Lastly, the findings could provide general implications for change processes executed with external assistance.

6.2 Limitations and further research

Even though the study is limited to the perspective of consultants, it provides insights to how external actors can assist in strategic change processes. This is a small-scale research paper exploring consultant participation in advanced technology transfers. It is therefore

acknowledged that findings are not generalisable for all consultants, instead findings can be appreciated as indicators to what can be further explored in relation to new technologies and how to implement such systems, and how involved external actors are.

This is an exploratory study; hence more research is needed to further investigate the role of consultants in this new technological context. For instance, a quantitative study could be conducted to include a greater number of consultancy firms. Alternatively, the perception of consultant involvement could be examined in an organisation. Organisations' employees seem to influence the development phase of the projects to a greater extent today. It may be reasonable to assume these negative views to be rooted in how relationships traditionally have been formed, i.e. merely between consultants and high-level decision-makers. Although this study does not have the information necessary, and neither does seek, to expand on clients' views of consultant involvement, this is an interesting approach for future research since the new technological context provides a new setting for research.

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