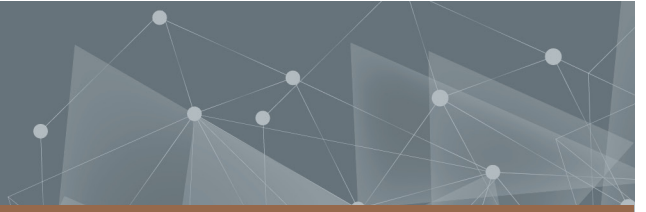




CHALMERS
UNIVERSITY OF TECHNOLOGY



Swedavia Airports

Building a Data-Driven Culture A Case Study in the Airport Industry

Master's thesis in Management and Economics of Innovation

EDVIN BROGELAND
MARTIN WAHRÉN

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISION OF SCIENCE TECHNOLOGY AND SOCIETY

CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2024

www.chalmers.se

Building a Data-Driven Culture

A Case Study in the Airport Industry

EDVIN BROGELAND
MARTIN WAHRÉN

Department of Technology Management and Economics
Division of Science Technology and Society
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2024

Building a Data-Driven Culture:
A Case Study in the Airport Industry
EDVIN BROGELAND
MARTIN WAHRÉN

© EDVIN BROGELAND, 2024

© MARTIN WAHRÉN, 2024

Department of Technology Management and Economics
Chalmers University of Technology
SE-412 96 Gothenburg
Sweden
Telephone +46 (0)31-772 1000

Cover: Swedavia.

Gothenburg, Sweden 2024

Acknowledgements, dedications, and similar personal statements in this thesis, reflect the authors' own views.

Abstract

More and more firms are adopting data-driven practices, where decisions are made efficiently and with high accuracy by relying on data. This requires a data-driven culture, that supports and encourages the use of data for decision making. This master's thesis explores the success factors and challenges in implementing a data-driven culture within a firm with heterogeneous operations, focusing on the Swedish airport operator Swedavia. Through a case study, the research compares barriers and enablers for a data-driven culture from theory with identified factors at the case company. The factors are presented in seven areas: *management & leadership, resistance to change, vision & strategy, skills & competence, data management & technology, culture & communication, and results measuring & incentives.*

The result is that the challenges and success factors found at the firm aligns with factors found in theory to a high degree. Some prominent challenges that were found at the case company include lack of a tangible data strategy, lack of data literacy, and missing data governance practices. Opportunities that were identified include top management commitment, a fact-based mindset, and data democratization. Some factors were identified at Swedavia that has not been discussed in previous research. For instance, Swedavia has success factors related to collaboration with other airports and multi-competence among employees, which are not covered in existing literature. Conversely, barriers such as inter-functional communication issues, limited access to computers for operational level employees, and a perception of older coworkers being reluctant to adapt to new practices present challenges that are also less discussed in theory. In addition to contributing with empirical depth to existing literature, this thesis provides actionable recommendations for building a data-driven culture at Swedavia and similar organizations. These recommendations include ensuring clear commitment from both top and middle management, formulating and effectively communicating a data strategy and vision, building robust data governance practices, and promoting cross-functional collaboration.

Keywords: *Data-Driven Culture, Data-Driven Decision making, Cultural Transformation, Airport Industry, Change Management*

Acknowledgements

We would like to express our gratitude to Swedavia and its employees for consistently being welcoming and eager to share their wisdom and insights with us. All of the individuals at Swedavia we got the chance to meet treated us very kindly and were enthusiastic about our work. Specifically, we would like to thank our supervisor at Swedavia who guided us throughout the project and gave us the opportunity to visit and see the “behind-the-scenes” operations of Sweden’s two largest airports.

Secondly, we would like to thank our Chalmers supervisor, Catharina Landström, for continuously providing us with the support we needed to conduct this thesis project. You have shown a genuine interest in our work, offered invaluable advice, and allowed us the liberty to develop this thesis in line with our own vision and ideas. It has been a pleasure working together with you.

Edvin Brogeland & Martin Wahrén
Gothenburg, May 2024

Contents

1. Introduction	1
1.1 Background.....	1
1.2 Previous Research and Knowledge Gaps.....	2
1.3 Aim & Objective	4
1.4 Research Questions.....	4
1.5 Delimitations	4
2. Methodology.....	6
2.1 Research Strategy & Design.....	6
2.2 Interviewing.....	7
2.3 Sampling.....	8
2.4 Literature Review.....	8
2.5 Data Analysis.....	9
2.6 Research Quality	9
2.7 Ethics.....	10
3. Theoretical Framework.....	11
3.1 Management & Leadership	11
3.2 Resistance to Change	12
3.3 Vision & Strategy	12
3.4 Skills & Competence.....	13
3.5 Data Management & Technology.....	14
3.6 Culture & Communication	15
3.7 Results Measuring & Incentives.....	16
4. Findings.....	18
4.1 Company Overview.....	18
4.2 Interviewing.....	19
4.3 Perception of Management & Leadership.....	19
4.4 Resistance to Change	20
4.5 Vision Awareness & Strategy Tangibility.....	21
4.6 Employee Competence & Skills Development.....	22
4.7 Employees' Access to Data & Technological Systems.....	24
4.8 Employee Attitudes & Information Sharing Practices.....	26
4.9 Systems for Results Measuring & Incentives.....	27
5. Analysis.....	29
5.1 Management & leadership.....	30
5.2 Resistance to Change	31
5.3 Vision & Strategy	31

<i>5.4 Skills & Competence</i>	32
<i>5.5 Data Management & Technology</i>	33
<i>5.6 Culture & Communication</i>	34
<i>5.7 Results Measuring & Incentives</i>	35
<i>5.8 Factor Prevalance Summary</i>	35
6. Conclusions & Recommendations	38
<i>6.1 Conclusions</i>	38
<i>6.2 Recommendations for the case company</i>	39
<i>6.3 Future Research</i>	41
References	43

1. Introduction

This master's thesis project was conducted in order to analyze what success factors and inhibiting factors exist for firms trying to create a data-driven culture, where data is used as basis for decision making. The project was conducted as a case study of the Swedish airport operator Swedavia. The case study contributes to knowledge of the subject by providing a case study of an airport operator, which previously has been missing.

In the first chapter, a background is presented, followed by research aim and objectives, problem analysis, and the research questions. Finally, delimitations of the research is discussed.

1.1 Background

In today's business environment, data is growing in importance quickly, and data is high on the agenda for many organizations. Anton et al. (2023) describes data as the fuel and product of the digitized world. One way that firms try to stay competitive in this environment is by increasingly utilizing data for their decision making. In fact, a study by McAfee and Brynjolfsson (2012) showed that data-driven companies on average showed significantly higher productivity and profitability compared to their competitors.

The use of data has the potential of creating competitive advantage in several ways. A significant part of this is the improvement in decision making. Using data for decisions has the benefits of making more informed, accurate, and fast decisions (Berntsson Svensson & Taghavianfar, 2020). However, firms often collect large amounts of data, without actually using it for decision making (Davenport, 2020). As Anderson (2015) describes, having data is not enough to become data-driven. An important part of this change towards data-drivenness is to create a culture that is compatible. A data-driven culture is defined by Herden (2020) as a culture throughout the organization that supports, embeds and promotes decision making, acting and thinking in an analytics-driven way, and accepts that data is critical for success.

Having a data-driven culture is identified as a significant factor behind strong firm performance by Chatterjee et al. (2021), but according to NewVantage Partners AWC (2022), over 90% of executives point to culture as the greatest impediment for becoming data-driven. Many organizations fail at this point, with only around 20% of firms managing to successfully establish a data culture. Deal and Kennedy (1982) emphasize that company culture is the most important thing for long-term success of a firm. With these things in mind, it's clear that if a transformation of an organization towards more data-driven decision making is to be successful, the company culture has to be at the top of the agenda.

The challenges of transforming towards data-drivenness are experienced by many organizations. Previous research has looked into the challenges in many different industries, such as real estate, construction, banking, automotive, trucking, and telecom (Storm & Borgman, 2020; Esteller-Cucala et al., 2020; Rogers, 2020). One industry which has not yet been covered in research is the airport industry. The company Swedavia is one such firm facing this shift. Swedavia is a Swedish airport operator, with the mission of operating the airports in Sweden's national basic infrastructure. Like many other firms, Swedavia generates a large amount of data throughout their operations, but experiences a lack of utilization of this data. Many decisions are still taken based on intuition, rather than data. In the daily operations, Swedavia sees the potential of data-utilization increasing their productivity by helping decision making become faster and more accurate. Thus far, Swedavia has been, and is currently working on ways of making the data more easily available and useful for daily operations.

1.2 Previous Research and Knowledge Gaps

Griffin and Holcomb (2023) presents success factors for transitioning towards a data culture, and presents some learnings from several case studies. The authors take a wide scope and discuss several different components necessary for the data culture, based on characteristics of the organization. These components are strategy, leadership, governance, data literacy and skills, embedding data into decision making, communication, and measuring. Anderson (2015) analyzes data from several sources, including surveys about attitudes towards management in the context of a data-driven culture. The author finds several actions that firms should do to be successful in implementing a data-driven culture, including data quality

improvement, design of metrics, storytelling with data, and implementing a culture that is trusting, learning, and goals-first.

Storm and Borgman (2020) conducted a case study examining the challenges and success factors for firms attempting to establish a data-driven culture. They find that the main challenges include resistance to new technology, rigid organizational structures, and insufficient focus on usable analyses. Success factors include clear communication, showing relevant and clear results, and openness to experimentation. Rogers (2020) also conducted a case study to map what firms can do to succeed in their attempts to build a data-driven culture, resulting in recommendations including management commitment, change agents, and business intelligence teams. Similarly, Berndtsson et al. (2020) investigate 13 organizations' attempts to become data-driven, and present barriers to data-drivenness. The barriers presented are lack of understanding and skills, organizational misalignment, lack of top- and middle management support, and issues regarding accessibility of data.

Another case study was conducted by Esteller-Cucala et al. (2020), which looked into data-driven culture at a Spanish automobile manufacturer. The study used a unique theoretical approach, focusing on change management and analyzing risks in each step of the change process. Berndtsson et al. (2018) presents a research in progress, in which a literature review was conducted to map out enabling factors for data-driven culture. The important enabling factors mentioned are data, organization, tools, decision-process, and management.

While insightful, previous research on the topic of data-driven culture is limited. Both regarding quantity of studies and comprehensiveness of existing studies. Additionally, much of the research that has been made is limited by the specific context of the cases being studied. The study by Rogers (2020) is bounded by its context, being a single medium-sized US trucking company. This study is generally focused on a higher level in the organization, with limited focus on the operational level. The paper also points out the importance of looking at firms in different phases of the transformation towards becoming data-driven to better understand the progression, and Swedavia may be a firm in an earlier stage than the company analyzed by the author. Furthermore, Anderson's (2015) recommendations are general, and not adapted to a specific context. Storm & Borgman (2020) also recommend further research to test whether their findings can be generalized to a broader population of

firms - airport related firms being an industry that has not yet been examined. Airport operators have very heterogeneous operations, as they provide a wide range of services and collaborate with a large number of different external actors, which may provide other conditions and require different activities than more homogeneous firms. Another shortcoming of previous research is a lack of depth in explaining the different factors identified. This is not the case for all previous research, but many of the papers simply provide a short description of the factors without any further discussion. This thesis project strives to contribute to filling these research gaps by studying the operational level of an airport operator and answering the research questions below.

1.3 Aim & Objective

The aim of this thesis project is to contribute to the body of knowledge surrounding data-driven cultures within organizations by filling gaps in the current knowledge.

The research objective is to analyze how Swedavia, a Swedish airport operator, can build a data-driven culture.

1.4 Research Questions

RQ1: What are the challenges with implementing a data-driven culture on an operational level for a firm with heterogeneous operations?

RQ2: What opportunities for implementing a data-driven culture on an operational level can be identified for a firm with heterogeneous operations?

1.5 Delimitations

This research was conducted as a single-case study, and the scope was therefore narrowed to one company. The focus of this study was on challenges and opportunities for implementing a data-driven culture, mainly on an operational level. Therefore, it did not look into strategic level data-drivenness, but rather data for operational and tactical decision making.

Furthermore, this study explored the cultural aspect of data-drivenness, and technical aspects

were not explored thoroughly. Interviews were held within a range of roles, departments, and levels at the organization which were deemed relevant for the aim of the research. Although the ambition of the project was to be comprehensive, the study was not exhaustive, as the number of interviews was limited by the project's time frame.

2. Methodology

The general process of this thesis project is described in figure 1. First, a literature review was conducted to provide a theoretical framework, along with an understanding of previous research. This was used to formulate interview questions, which were used in interviews at the case company. The interview data was analyzed using thematic analysis, in combination with the theoretical framework to provide results and answer the research questions. These results were also compared with previous research. After this had been done, some general recommendations for the case company were composed.

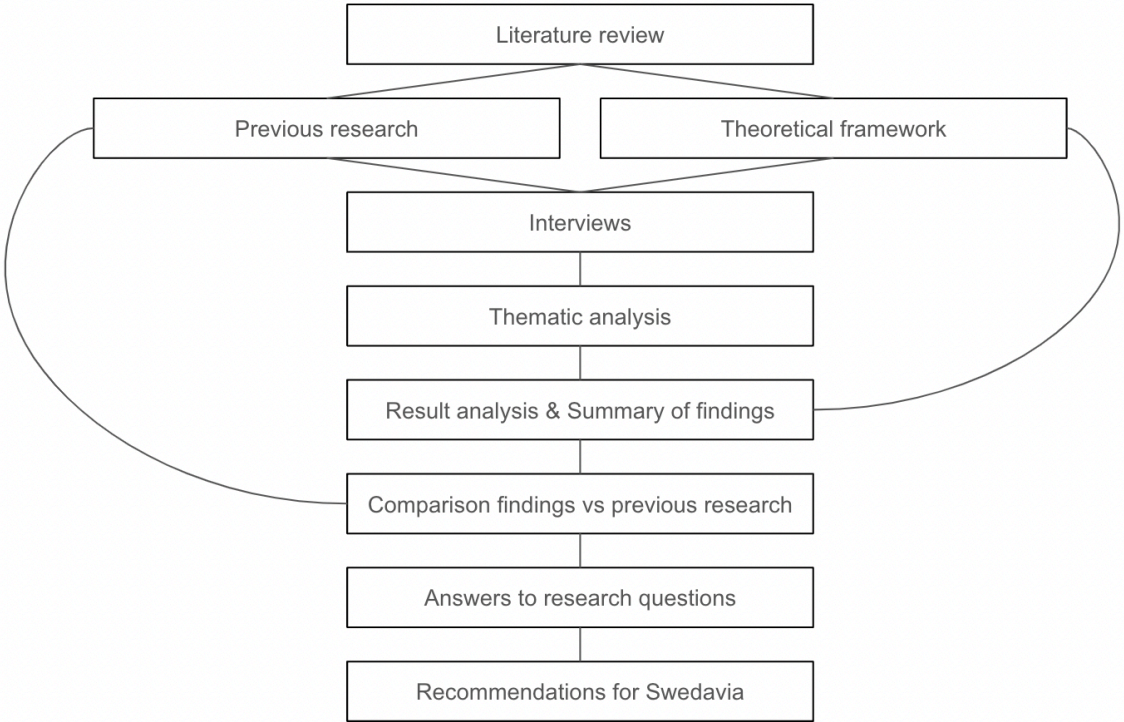


Figure 1. The thesis project process

2.1 Research Strategy & Design

This study answered research questions related to a context that had not yet been explored in the literature, and aimed to create results with significance beyond this single case. This aligns with Bell et al. (2019)'s description of an inductive study which, in contrast to a deductive study, focuses on drawing generalizable conclusions from a set of observations rather than on

testing hypotheses based on previous theory. Thus, this thesis project was inductive in nature, aiming to create theories based on empirical evidence. The project used qualitative research methodologies to answer the research questions - for example, semi-structured interviewing and thematic analysis. The qualitative approach was used since the research area is broad, and contains many elements that were difficult to quantify. It was also the best suited for the inductive research approach.

For this research, a case study was conducted on the company Swedavia. Flyvbjerg (2011) labeled case studies as “intensive”, meaning they allow a great depth of detail, variance, and richness. Because of this, a case study was a suitable method, as it allowed for an in-depth understanding of the case organization and its context.

2.2 Interviewing

Semi-structured interviews typically refer to a context in which the interviewer has a general form of interview schedule, but is not limited to exactly following the schedule. Instead, the interviewer can vary the order of questions and ask follow-up questions (Bell et al., 2019). Semi-structured interviews, in contrast to unstructured interviews, are suitable if the researcher has a fairly clear focus which is the case for this study. Semi-structured interviews are also both flexible and standardized (Bell et al., 2019). This balance is suitable for this study, as it is important that answers are gathered that relate to the question at hand, while also capturing the more nuanced perspectives of the interviewees.

The interviews were conducted following a pre-formed interview guide. In line with Bell et al. (2019), the interview guide contained a set of questions to cover specific themes, but allowed for some leeway in answers and potential follow-up questions. The interview guide was continuously revised, based on new empirical findings from previous interviews. The interviews were recorded which made it possible for the researchers to re-listen and transcribe the interviews.

2.3 Sampling

Bell et al. (2019) explains that most qualitative research entails some sort of purposive sampling. That is, sampling made with reference to the goal of the research. One kind of purposive sampling is generic purposive sampling. This type of sampling involves purposively choosing interviewees, but not necessarily doing so based on theoretical categories (Bell et al., 2019). According to the authors, this is a suitable strategy when looking to gain an understanding from a broad range of roles, which is aligned with the goals of this thesis project. Furthermore, the criteria for selecting interviewees can be formed *a priori*, be contingent, or a mix of the two. For this project, the criteria for selecting interviewees was formed *a priori*, so that it could be ensured beforehand that all relevant parts of the organization get represented in the study. However, the choice of interviewees was altered during the data collection process when deemed necessary. To determine an appropriate number of interviews, Bell et al. (2019) suggest searching for theoretical saturation - interviewing until no new data emerges, and existing data is well validated and developed. Despite the limited timeframe of this project, some degree of theoretical saturation was reached, as the later interviews mostly confirmed what had been shown in earlier ones.

2.4 Literature Review

The literature review was conducted throughout the entire research process. In the beginning, it was used for gaining a first level of understanding of the research topic. Exploring previous research also helped with the formulation of research questions. Furthermore, the findings of the literature review were used together with the empirical findings in order to answer the research questions. Since literature review was conducted throughout the research process, it allowed agility in the form of adapting the literature search approach depending on the empirical findings. The search terms that were used in the literature review were: *Data-driven Culture*, *Data culture*, *Data-driven decision making (DDDM)*, *Change Management*, *Organizational Culture*, and *Organizational Design*. The databases used for this search include Scopus, Google Scholar, Chalmers Library, Emerald, Web of Science.

When conducting the literature review, two methods were used in order to find a wide range of literature, namely *backward snowballing* and *forward snowballing*. As described by

Wohlin (2014), backward snowballing entails looking for relevant literature in the references used by a specific work, whereas forward snowballing instead entails looking at other works having cited the work at hand. Using these methods enabled the finding of literature which were not discovered in the initial searches.

2.5 Data Analysis

Thematic analysis is one of the most common approaches to qualitative data analysis (Bell et al., 2019). Thematic analysis can be done in many different ways, but usually, it involves searching for relevant repetitions to form common themes based on collected data. The authors do, however, emphasize that repetition per se isn't enough to warrant a theme. There must be a relevance to the research questions to create a theme. For this thesis project, this means that the gathered interview data was searched for common repetitions that were relevant to the research questions. Thematic analysis can be suitable with a limited timeframe (Bell et al., 2019), which made it appropriate for this study. The analysis was summarized in a figure, where the relative influence of each theme is qualitatively assessed, with the purpose to illustrate which themes have the most positive or negative impact.

2.6 Research Quality

The quality of qualitative research can be evaluated on a few different criteria. Bell et al. (2019) describes *credibility*, *transferability*, *dependability*, and *confirmability*. Credibility is described similarly to internal validity, meaning how well the empirical data that is collected matches the theoretical ideas that are developed from the research. As this study was carried out by two researchers, both researchers analyzed the collected data independently before discussing the findings. This corresponds to the concept of *investigator triangulation*, which is described by Thyer (2009) as a means of increasing validity. Transferability regards how well the results of the research can be transferred to other contexts, and can be improved by providing a detailed description of the studied case (Bell et al., 2019). Since this is a single-case study, the case company was explored in depth and a description of the case company and its context was provided. The dependability of the research regards how trustworthy the research is, and can be increased by thoroughly keeping record of the research process (Bell et al., 2019). In accordance with this, this research process was explained in detail to allow as much transparency as possible. Bell et al. (2019) describes confirmability as the measure of

the objectivity of the researchers in the process. It is of course not possible to remove subjectivity altogether when conducting qualitative research, but we tried to minimize it as much as possible throughout the project. By continuously allowing our supervisor and our contacts at the case company transparency into our research, subjectivity was decreased. Also, the use of tools such as thematic analysis could reduce it as well.

2.7 Ethics

The risk of harm to participants, including harm to career, was minimized by ensuring anonymity of answers. Furthermore, the questions were formulated in a way that does not create a feeling of incompetence among the respondents, which could be a potential risk in the area of data usage, given its complex nature.

To ensure informed consent, all participants were informed of their right to refuse to answer questions, and were given the opportunity to refuse to have the interviews transcribed or recorded. There is however a risk that interview subjects who were asked to participate in the interviews by their superiors participated despite not wanting to. Although this risk could not be completely mitigated, the interviewees were informed that participation was individually voluntary and that, should they refuse to participate, their superiors would not be informed.

Privacy was ensured, once again, by ensuring anonymity of answers from respondents, and storing the interview data in a secure location. Answers were completely anonymized to ensure that respondents could not be identified - even by those who have helped us set up the interviews. To ensure confidentiality of the company's internal material, any information that was considered as internal to the firm was stored in the company's internal MS Teams. Careful consideration was also given to avoid including sensitive data in the report.

3. Theoretical Framework

In this chapter, the theoretical framework will be presented. The framework consists of the success factors and barriers that have been identified for firms attempting to create a data-driven culture. The different factors have been classified into themes, as shown in table 1 at the end of the chapter. Some of the factors are present as both success factors and barriers, which indicate their possibility to affect both positively and negatively, whereas other factors only can influence either positively or negatively.

The factors found in theory will be presented in the following themes: *Management & Leadership, Vision & Strategy, Skills & Competence, Data management & Technology, Culture & Communication, and Results measuring and Incentives.*

3.1 Management & Leadership

When creating a data-driven culture, much of previous research highlights the importance of top management commitment. Top management commitment manifests itself in several different ways, such as leading by example, communicating advantages of data-drivenness, providing resources, and actively encouraging data-oriented behavior among employees (Schlegel et al., 2023). Another important part of top management commitment is the allocation of enough resources to data related efforts such as training, software tools, external consultants, and workshops (Lawson, 2018; Schlegel et al., 2023). Insufficient management involvement and executive support is identified as a major barrier to a data-driven culture (Halper & Stodder, 2017; Schlegel et al., 2023). Lack of middle management adoption and understanding is also a barrier identified by Berndtsson et al. (2020).

Top management commitment is of importance, because although data-drivenness can be implemented bottom-up in an organization, it is most often championed by executives (Lawson, 2018). Top management commitment must be continuous and actively support data initiatives in the organization, which requires top management to be educated on data and its uses, which could be done through workshops led by the organization's Chief Data Officer (CDO) or a similar role (Díaz et al., 2018). The CDO role is of great importance for creating a data-driven culture, and there are certain success factors which help the CDO in its mission to

increase data-drivenness (Anderson, 2015). The CDO needs to have a mandate to influence, which includes having enough staff, a large enough budget, and having sufficient organizational support, and should also possess technical skills, people skills and business knowledge. Preferably, the CDO should report directly to the CEO, and be part of a standalone department, or the CDO's organization should be part of a strategy organization within the company (Anderson, 2015; Griffin & Holcomb, 2023). It is also of value to have a Chief Analytics Officer (CAO), who focuses more on the actual use of the data, and drives strategic initiatives within analytics (Anderson, 2015).

When starting to become more data-driven, organizations and their leaders should support experimentation and see project failures as learning opportunities rather than something purely negative (Schlegel et al., 2023). It is often a good idea to start small when trying to implement a data-driven culture, and many times, simple and robust proofs of concept can be tested and later improved with more functionality and scaled over time (Halper & Stodder, 2017; Waller, 2021).

3.2 Resistance to Change

Another common barrier is organizational resistance to change. Resistance can occur when employees have difficulties imagining themselves in the new organizational structure (Schlegel et al., 2023). Resistance often occurs among middle-management in organizations (Berndtsson et al., 2020). The reasoning behind this is that there often is a lack of understanding of the data-driven approach and a fear of its impact on the role of people in middle-management roles. Resistance to change does not have to be visible. Passive or covert resistance often affects the final result of the change initiative (Esteller-Cucala et al., 2020).

3.3 Vision & Strategy

Another factor that is critical for successfully implementing a data-driven culture regards vision and strategy. Creating a vision for data-driven culture and an overarching and tangible strategy for all parts of the organization is critical, as all employees at all levels must know what is expected from them in terms of data-drivenness (Buvat et al., 2017; Schlegel et al., 2023). Vision and strategy can also have a negative effect on creating a data-driven culture. A

prominent barrier when trying to build a data-driven culture is not having a corporate vision that provides tangible guidelines to operational levels in the organization (Schlegel et al., 2023). In fact, a common barrier is that there often is a discrepancy of employee's and management's perception of the firm's digital vision (Buvat et al., 2017). Middle management has a vital role in spreading the vision and the strategy into lower levels of the organization, and transforming the vision and strategy into tangible and understandable objectives for all employees (Buvat et al., 2017). A data strategy should contain certain elements, namely *business objectives*, *data governance*, *data architecture*, *data management*, *data analytics*, and *data culture* (Katzenbach et al., 2012). Alignment is critical as well. The data strategy must align with overall strategy, and the desired data culture must align with the strategy (Griffin & Holcomb, 2023; Katzenbach et al., 2012). On the same note, a common barrier to building a data-driven culture is a lack of strategy (Berndtsson et al. 2020; Halper & Stodder, 2017; Schlegel et al., 2023).

3.4 Skills & Competence

Another success factor of great importance is skills development. Data literacy contributes to the creation of a data-driven culture as it is the foundation that makes employees confident enough to make data-driven decisions (Griffin & Holcomb, 2023; Schlegel et al., 2023). Data literacy and an evidence- and fact based perspective should not only be limited to analysts, but rather be spread widely in the organization (Anderson, 2015). One definition of data literacy is the ability to understand and use data in order to make informed decisions (Wolff et al., 2016).

A major barrier to a data-driven culture is not filling the knowledge gap, which means that employees aren't properly trained for the new data-driven ways of working (Schlegel et al., 2023; Esteller-Cucala et al., 2020; Halper and Stodder, 2017). Lack of skill can particularly be a problem at relatively data mature companies (Storm and Borgman, 2020).

There are several ways to achieve data literacy within an organization. One way is by focusing HR management and recruiting efforts on acquiring data literate candidates (Schlegel et al., 2023; Lawton, 2021; Díaz et al., 2018). Another way is to provide training initiatives for employees, which is also of big importance when building a data-driven culture (Waller, 2020; Halper & Stodder, 2017; Lawton, 2021). It's also important that specialized

training initiatives happen at the correct time - right before the new system is implemented, not months before (Waller, 2020).

3.5 Data Management & Technology

Having a data-driven culture also requires certain aspects in terms of data management and technology. A fundamental aspect of this is the data quality. Poor data quality is a significant barrier for a data-driven culture (Sdiri et al., 2023; Halper and Stodder, 2017). There is a need to have data that is accurate, complete, and consistent in order to reduce the amount of poor decision making (Lawton, 2021; Schlegel et al., 2023). One way of ensuring data quality is through data governance. Data governance entails procedures, standards and policies that are used for managing usage and creation of data in an organization (Griffin & Holcomb, 2023). Although data governance spans beyond data quality, one of its usages is data stewardship which means allocating accountability and responsibility for data in order to ensure high quality (Lawton, 2021). Another success factor is the use of data governance for managing sensitive data, as it can balance wide access to data with risk minimizing (Halper & Stodder, 2017). Data governance and security concerns can cause significant barriers if not managed properly (Halper & Stodder, 2017; Sdiri et al., 2023).

Similar to the requirement of high quality data, one success factor for creating a data-driven culture is the democratization of data, meaning making the data more accessible to people across the organization (Schlegel et al., 2023). Access should be created quickly, for example by gradually making different data accessible throughout the organization (Waller, 2020). Similarly, it is reasonable to begin with a centralized analytics function, and then gradually decentralizing it over time (Díaz et al., 2018)

Furthermore, using self-service enables and drives decision making as it empowers workers outside of the IT/BI department (Halper & Stodder 2017; Schlegel et al., 2023). Examples of self-service include giving workers across the organization the possibility to query data and create their own visualizations, which can be achieved successfully with the help of easy-to-use solutions (Halper & Stodder, 2017). Software solutions are however not only needed for self-service. Having different kinds of accessible and well functioning software tools for visualizing and analyzing data is a hygiene factor for becoming more data-driven (Lawton,

2021; Schlegel et al., 2023). If accessing relevant data is difficult, this can be a significant inhibitor of a data-driven culture (Halper and Stodder, 2017; Berndtsson et al., 2020). However, the right tools for data can be both expensive and difficult to find, which can also cause barriers (Sdiri et al., 2023).

3.6 Culture & Communication

Cultural aspects and communication are highly important for creating a data-driven culture. To create a culture that sticks, it's important to honor the strengths of the firm's existing culture, and grounding change in local experiences and contexts (Katzenbach et al., 2012; Alvesson & Svenningsson, 2016). One important part of creating a data-driven culture is the appointment of some sort of super-users. These super users are key individuals who can bridge the gap between data science and operational roles, help employees make data understandable, and show others that the new types of behaviors are not a risk (Díaz et al., 2018; Halper & Stodder, 2017; Buvat et al., 2017). Firms should also have an inquisitive, questioning culture where employees make each other objective and push for additional information and challenge assumptions (Anderson, 2015). Lack of sense of urgency can be a barrier for a data-driven culture, and can negatively affect the motivation among employees (Esteller-Cucala et al., 2020; Schlegel et al., 2023). Thus, it is important to make sure a sense of urgency is established at the firm.

Lack of communication is a barrier to a data-driven culture (Schlegel et al., 2019). To overcome it, leaders must communicate and explain what benefits data-drivenness will bring (Windt et al., 2019). Collaborative learning and information sharing will reduce silo thinking and foster a data-driven culture, and communication is necessary to create an organization with a strong focus, which is a key to a data-driven culture (Schlegel et al., 2023; Griffin and Holcomb, 2023). It is particularly important to build an open culture with mutual trust among employees, where employees collaborate and share data with one another without one party "owning" the data, or being afraid of sharing the data with the other party (Anderson, 2015). In a study on organizations' attempts at becoming data-driven, one barrier that is identified regards collaboration among employees and across departments and functions (Buvat et al., 2017). The study finds that management often perceives their organization as much more collaborative than the employees do. Furthermore, good communication is a way to reduce

resistance to change (Esteller-Cucala et al., 2020). Communication beyond company walls is also important, and that companies should not view data as an asset that is best utilized by keeping it a secret from the outside world (Díaz et al., 2018). It is also important to start small in terms of cultural change, meaning changing a few key behavioral traits at the time, in order to create a long lasting cultural change (Katzenbach et al., 2012).

3.7 Results Measuring & Incentives

Change management is integral to successfully creating a data-driven culture (Griffin and Holcomb, 2023; Halper and Stodder, 2017). One factor that is mentioned widely in research is the use of appropriate metrics for tracking data-drivenness. Metrics and indicators have a key role of showing direction and making sure the organization is progressing towards a data-driven culture (Waller, 2020; Griffin & Holcomb, 2023; Katzenbach et al., 2012). Good Key Performance Indicators (KPIs) should relate to for example the degree to which data is used for decisions, or data literacy, such as number of completions of training programs, data utilization rates, and the actual impact of data-driven decisions on business outcomes (Lawton, 2021). It is also beneficial to measure cultural change by looking at business performance, critical behaviors, milestones, and underlying beliefs, mind-sets and feelings, as these measurements show a more practical perspective on whether change is actually happening (Katzenbach et al., 2012).

However, designing measurements should be done carefully, as misaligned metrics can have negative consequences, and KPIs should be aimed at behaviors rather than measuring successes and failures, for example by measuring what new behaviors are being adopted (Buvat et al., 2017). Apart from measuring progress, an important cornerstone in creating a data-driven culture is the use of incentives. Although there is a risk that reward systems do not create long-term commitment among employees (Lawton, 2021), using either or both non-monetary and monetary incentives can help communicate the importance of becoming more data-driven (Lawson, 2018), and aligning the goals of the employee with the organizational goals (Galbraith, 2011; Schlegel et al., 2023).

Factors
Management & Leadership
Resistance to change
Vision & Strategy
Skills & Competence
Data Management & Technology
Culture & Communication
Results Measuring & Incentives

Table 1. Factors affecting the creation a data-driven culture

4. Findings

The following chapter will present the empirical data that was collected through the interviews. First, a short overview of the case company will be provided, followed by a presentation of the findings. The findings will be presented in seven themes.

4.1 Company Overview

Swedavia is an airport provider active in Sweden. The firm is fully owned by the Swedish Government and its purpose is to own, run, and develop a base offering of airports in Sweden (Swedavia, 2024). The firm operates ten airports in Sweden, of which four are international airports with flights to all over the world. Swedavia divides their airport operations into two parts: *Aviation business*, including processes for passengers and airplanes, and *Commercial services*, including partnerships with restaurants and stores, parking, and advertisements. Besides this, Swedavia also own, develop, and manage real estate in connection to their airports. In short, Swedavia has a high heterogeneity with regards to both activities performed and people employed. The airport operations are not solely run by Swedavia, instead it involves a large number of external actors performing different activities. For example, restaurants and shops conduct their own business within the airport, security companies are responsible for security, and airlines administer flights. There are also ground handling companies, who perform operations such as aircraft services, ramp handling, fuel and oil handling, and general ground administration and supervision (Civil Aviation Authority, n.d).

Swedavia also divides their operational activities into two main processes, namely the passenger process and the flight-operational process. These two processes are governed by one main-process owner respectively, and within the processes, there are several sub-processes which are governed by process owners. The passenger process contains sub-processes such as check-in and bag drop, luggage-handling, security check, and boarding, whereas the flight operational process involves among others landing, taxing, & parking, and turnaround. Additionally, there are other functions that are not directly connected to the operational processes, such as IT, Business Intelligence, and Strategic Initiatives.

4.2 Interviewing

The data collection consisted of interviews, visits at two of Swedavia's airports, and discussions with the thesis supervisor at Swedavia. The interviews constitute the majority of the findings, whereas the visits and discussions with the supervisor helped us understand the surrounding context. In total, 17 interviews were held with employees across different departments and levels of Swedavia. Approximately half of the interviews were conducted with individuals within Swedavia's operational activities, and the other half with individuals belonging to departments outside of the operational activities. These departments include, among others: Business Intelligence, Operational Excellence, Facilities Support and Maintenance, and Call Center. A majority of the interviewees within the operational departments belonged to the passenger process, and spanned from individuals at the most operational level, to main process owners. However, the majority were middle managers in charge of different processes within the two main processes. Similarly, the interviews held outside of the operational processes were also mainly with middle management. The interviewees will be referred to as Interviewee 1 - Interviewee 17. The interviews were held in Swedish, and citations have been translated to English.

4.3 Perception of Management & Leadership

Respondents in middle management positions generally perceive that top management at Swedavia have a high understanding of the purpose behind becoming data-driven. They are also generally perceived as committed to the ambition of becoming data-driven. One of the respondents stated that "*They are very committed and are absolutely carrying the banner here*" (Interviewee 5), and another stated "*Historically it definitely could have been better, but our current executives understand the importance entirely and are very committed.*" (Interviewee 10). More operational levels have less insight into the work of top management and are therefore less aware of its level of commitment. Middle management, on the other hand, are seen as ambitious, committed and understand the purpose of data. Their general attitude is also positive. However, some managers provide less support than others when faced with data initiatives, or don't understand the purpose to the same degree as their middle management colleagues. One of the respondents stated that "*In the end it all depends on the interests of the individual with the manager-role*" (Interviewee 17).

Regarding resources allocated to becoming data-driven, some experience that they are given enough, whereas others believe they are in need of more. One of the respondents believes resources is not the main issue, but states that process coaches and business developers often are busy and that it takes time to get their help. Others express that they would like to do more but are restrained by budget or time constraints. There is a department dedicated to data-driven development, which reports to a role in top management. This department has sub-departments such as Business Intelligence.

At Swedavia, change management procedures appear to be largely dependent upon the individual middle managers' capabilities. Initiatives linked to data-drivenness often require the middle manager to drive the project and acquire enough resources. Progress has however been made and resources such as "process-coaches", "business developers" and the strategic development department can help with initiatives. Although, these resources are often occupied and it can take some time to get help from them.

Regarding projects and initiatives linked to the company's transformation towards becoming more data-driven, a concern is expressed from middle management regarding how the projects are conducted. One of the interviewees states that "*projects are often conducted with waterfall-methodology [...] which often results in something the individuals in the operations did not ask for*" (Interviewee 3). The interviewee also expresses concern that top management does not understand the ways of working agile, which according to the interviewee is necessary for becoming more data-driven. The reasoning behind this is that working agile and quickly going from idea to testing phase would be beneficial for the company's transformation. One of the interviewees also explained that "*the company is quite good at starting a lot of initiatives, but we're not as good at finishing them*" (Interviewee 17), indicating that they also believe the firm is lacking in its ability to drive projects to the end.

4.4 Resistance to Change

At the Swedavia, many express a positive attitude towards becoming more data-driven across the organization. There are however instances where individuals display reluctance towards changing their ways of working. In these instances, the reluctance appears because of a

comfort in doing things the way they have been done previously, or a lack of understanding in what ways the changes will benefit the individual. There may also be some fear regarding what happens to an individual's role in which the person has developed experience and intuition over time. However, the firm is already using data to a relatively high extent in their operations, and employees are used to data as a basis for decision making across the organization. For example, staffing and scheduling is usually done based on historical data, and gut feeling is mostly used when the decision is of low importance, such as during periods with lots of excess capacity. One respondent stated that managers may be reluctant to change their ways of working due to fear of losing their job.

Several of the interviewees stated that the high age of employees can pose a problem when becoming more data-driven. Older employees are in this regard both meant as people of older age and people who have worked for a long period of time at the company. Respondents believe many of the older employees are less prone to changing their ways of working. Similar to the reasons presented above, this is because they are comfortable with the way things have been done previously, and don't see the purpose of the new ways of working. This can also be because of fear of becoming replaced. For example, this is mentioned in the context of multi-competence where young employees are more open to learning additional tasks. The older employees are also perceived to be less experienced with using technology such as software programs in computers and mobile phones. This can for example express itself in a fear of accidentally deleting things while using programs, or a general reluctance to use it. However, not many respondents perceived themselves in this way, but rather this was a perception from respondents about others.

4.5 Vision Awareness & Strategy Tangibility

The firm has a clear strategy and vision for 2030, and one of three strategic initiatives to reach this vision is digital transformation. Within this initiative, there are four cornerstones: data-driven business, digital customer experience, digital collaboration, and automatization and resource optimization. Within the data-driven business, there are some principles decided by top management. However, there are no more concrete strategic steps than that. Swedavia has begun work on developing a data-strategy. The vision has also not reached everyone in the organization. For example, one operational level employee stated that "*This is the first time*

I'm hearing about Swedavia's mission to become more data-driven" (Interviewee 4). Additionally, several middle-managers had the perception that many operational workers were not aware of Swedavia's mission to become data-driven. Those whom the vision has reached, feel that it isn't tangible enough to provide sufficient guidance to their department. A middle manager described that *"We have to make it more concrete, right now it's very open to one's own interpretation."* (Interviewee 9). Similarly, not everyone in the organization understands why they should become data-driven. One respondent says *"I think there is a general lack of understanding of the benefits of becoming data-driven"*. Another respondent asked *"In what ways are we not data-driven today? And what is top management's understanding of what we are doing? That we are using pen and paper for work?"* (Interviewee 4). However, many of the respondents appear to share a similar view of the purpose behind becoming more data-driven. The main idea of why the organization aims to become data-driven is to increase efficiency, which is done by making more accurate decisions with data rather than intuition. Data also helps making the future more predictable and allows the employees to work more proactively. One respondent also stated increased customer-satisfaction as the purpose of data-drivenness, and another respondent stated increased employee wellbeing.

4.6 Employee Competence & Skills Development

Swedavia is already using a lot of data in their day-to-day operations, meaning employees are somewhat familiar with data, and comfortable with using data as a basis for decision making. There is a dedicated Business Intelligence (BI) department from which employees can request reports and assistance. Most middle-managers regularly use these reports, for example for forecasting which helps optimally schedule staff. However, the data literacy is very centralized to BI and a few other departments, and the data literacy in other parts of the organization is more down to talented individuals than to broad department-wide capabilities. There have been some local training initiatives at a few departments, but once again no widespread initiatives. Several interviewees pointed out the need for training initiatives. This regards both data literacy in the form of understanding the data, but also training initiatives for specific software tools. Specifically, one interviewee pointed out that *"Not just an online course [...] someone showing in real life how to use it"* (Interviewee 6). Many of the respondents believe the BI-department's current size is too small, which results in employees

not getting help as fast as they would like to. The BI-department is located within a data-driven development department, whose head is part of the executive team of Swedavia. The company also has a dedicated IT department, but it appears some operational employees experience difficulties in communication. One respondent stated that *“We may need someone responsible who understands both the operational needs but also the technical aspects to help the two parties communicate”* (Interviewee 11), and another stated that *“IT does not understand our roles, as they are used to using a computer daily [...], but it is difficult with the technical terms”* (Interviewee 4). Another mentioned that individuals may limit their use of certain tools in fear of “breaking” something.

An initiative that is ongoing at the Swedavia is the implementation of multi-competence, meaning employees being able to perform more than one task in different parts of the organization. One of the interviewees states that this is of importance when the organization becomes more effective from data-drivenness, *“We don’t want people just to sit around, then we won’t have won anything from becoming more data-driven”* (Interviewee 7).

Many of the firm’s employees have strong competences in other areas than data, and have been recruited based on factors such as stress tolerance, ability to make decisions in stressful situations, or have developed a strong gut feeling for how to run their respective parts of the organization. Some respondents feel that this will lead to a major competence shift in the organization, where old competences will become less useful, and new competences, for example related to data literacy, will be more useful. This is believed to be a major cause of resistance to change. Respondents also emphasize that changing competences isn’t the only thing, as a change of mindset is of equal importance. A lot of individual pride is based on being experienced, and being able to manage tough situations based on this experience. The need for a competence shift is believed to be possible to accomplish partially using training, but some respondents are convinced that recruiting of new competences is necessary to accomplish enough change. It is emphasized that new hires should be hired based on skills relevant to a data-driven organization, such as problem solving ability and data literacy, rather than abilities like stress tolerance. However, several of the interviewees mentioned that there already are certain individuals within the organization with strong knowledge and interest in different types of initiatives linked to data, who are far ahead on the data literacy journey than others.

4.7 Employees' Access to Data & Technological Systems

During the study, some data governance issues were found. There were ambiguous answers regarding the data quality. Some users found that the data was reliable, while others didn't trust the data to the same degree. Sometimes there are multiple versions of the same data, showing vastly different values. Some users also perceived it as difficult to determine whether data is reliable or not. Some respondents also pointed to ineffective processes for data handling. Many times, lots of manual work is needed to collect, reformat, or transfer data when it could be done much easier with the right tools.

It can also be troublesome to get the data that you want. There are many systems, and it can be difficult to know where to look for the data that you need. A high variety of data formats can also mean that data needs to be converted to become useful. When you do finally find the right data in the right format, oftentimes it can be restricted for security reasons. The company faces security regulations, given their industry, which is one reason for the strong security restrictions. However, once employees get help with finding and accessing the data they are looking for, most think that the availability of data is high, and that it's rare that the data they are looking for doesn't exist. The process of getting access to data is also manual and somewhat ineffective, as it generally relies on contacting a person within the BI department, who manually creates a report with the requested data, and sends it. Several interviewees express a wish for more easy to use tools for using data. What type of software tools are used vary across different departments, and some departments experience difficulties with having several different tools that need to work with each other.

There are however a lot of initiatives ongoing within this area. There is a lot of work related to data governance and data ownership, which will likely increase the control and quality of the data. Furthermore, initiatives are ongoing related to democratizing data, meaning that more data will be made available to more people, removing the need for as many security restrictions. In fact, a type of self-service portal where employees should be able to retrieve data and reports themselves is currently being developed in-house at the firm. However, one of the employees stated that the current state of the portal is not very useful, and does not achieve what it was promised to do, but believes it will be further developed and more useful in the future.

One of the interviewees highlighted that the airport industry often lags behind in adopting new technological advancements, primarily due to its strong emphasis on security. One of the interviews stated that *“We still have many old systems, which I’ve come to understand is because of safety and security, we cannot work like Google or Spotify, as we have rules and regulations we have to adhere to”* (Interviewee 7). Another interviewee stated that there is a low IT maturity at the company, *“Looking at ourselves, and at our ground handling companies, many have a mobile phone and that’s it, and many do not even read e-mails”* (Interviewee 10). Often, at operational levels, many of the employees rarely have the opportunity of using a computer. This could be either because their work does not require or allow it, or because a large number of employees share one computer that for example can be used during breaks. One operational level respondent highlighted that *“There are a large number of operational workers who are dependent on information but do not work near a computer”* (Interviewee 4). Much information regarding new initiatives are communicated through the Swedavia’s internal network, which can be accessed through computers, or through smartphones that only certain employees are given. The same respondent also stated that *“I often experience friction when communicating with other departments who assume what my department has and can do, and they must not forget that many of us operational level workers don’t have access to a computer”*.

Being a company owned by the Swedish Government, certain rules surrounding procurement apply, potentially slowing down the process. One of the interviews stated that *“... public procurement, that may be why procurement of the new system takes time so we will have to wait...”* (Interviewee 4).

Some respondents underscore the importance of aligning the development of tools and solutions with the actual needs of the daily operations, to ensure that the tools will be practically beneficial, rather than being products pushed by the IT department without any real application. One interviewee described how sometimes the choice of data has been made on the basis of how well it fits the software tools, *“This results in us measuring what we can rather than what we should”* (Interviewee 7).

4.8 Employee Attitudes & Information Sharing Practices

Regarding the company's general culture surrounding data-drivenness, several factors were identified. There is generally a very positive attitude towards data initiatives, and employees are looking forward to working more with data. Some respondents emphasized that even though there might not be a data-driven culture yet, there is a strong culture of problem solvers, which one respondent means can be a strong asset in implementing more data-driven ways of working.

A concern that was found was some instances where initiatives regarding data were unexpectedly shut down at a late stage. One of the interviewees stated that *"there are occurrences where one has made an analysis or has formed an idea of how to move forward with a problem, and suddenly someone who you have not understood has a saying in the project comes along and says no"*. The interviewee has also experienced some friction between individuals and departments because different individuals have different truths, rather than a unified view.

One of the interviewees pointed at the need for a more inquisitive/challenging culture where for example the need for certain reports are challenged. *"But why do we need it, and what will it result in?"* (Interviewee 15). Similarly, another interviewee stated *"What information do I want and why do I want it?"* (Interviewee 2). A similar aspect was highlighted by another interviewee who stressed that the company has a lot of data, which the firm should look at better utilizing rather than just investing in new software technology. Data sharing within the firm is also limited, and a major reason is technical, as different parts of the organization have different systems, and might need to do extensive reformatting to be able to use data from other departments.

Another finding is that the company collaborates to a large extent with other airport operators. For example, one of the interviewees regularly collaborates within a certain forum for airport operators. The airport operator's heterogeneous operations involve a large number of different actors, including external companies. These different actors collect data, which can be shared and used by other actors. However, several of the interviewees highlight the problem of different actors not wanting to share data with each other. This is a problem as the

interviewees can see a lot of benefits in increased sharing of data between actors. One of the respondents stated that “*External actors often do not want to share data with other actors even where we believe the data would be useful for us and that it definitely is not sensitive data*” (Interviewee 13). For example, some airlines do not share the number of passengers on their planes, or the number of passengers in need of special assistance at the airport. One of the reasons behind actors being reluctant to share data appears to be because of competition. Many of the external actors present at the airport have the same or similar roles which means they are competing against each other. For example, airlines or ground handling companies may be reluctant to share data with the airport operator in fear of the data becoming available for their competitors. This means that the company often doesn’t get access to information that would be useful for them. One example given by a respondent was that because of this, they often do not know the number of passengers on an arriving airport which reduces their ability to work proactively. Another reason for not sharing data is that limited transparency can benefit some actors. It allows them to conceal their liability, for example in situations involving delays or related issues.

4.9 Systems for Results Measuring & Incentives

Regarding measurement of the change process, not much appears to be measured. Usage of specific reports is measured by the BI-department, and there are some high-level KPIs related to the firm’s 2030 goals. Apart from this, there are no KPIs or measurements used to track the company’s progress towards becoming more data-driven. It is also not discussed or evaluated to which degree data is being used for decision making. Respondents also experience a flawed incentive system. It is emphasized that, since you only get noticed doing something good if you stop a crisis, it’s hard to get praised for doing the right thing from the start, and preventing the crisis from ever happening. This is described as a problem when it comes to facilitating a data-driven culture, as the respondent believed that a big use for data was to stop the crisis from ever happening at all, which would indirectly decrease the positive recognition of the individual.

Incentives for employees to become more data-driven seem to be somewhat existing in the form of non-monetary incentives such as getting support from managers when proposing data initiatives. However, there are mixed opinions about this, and some respondents find that

there is a lack of feedback regarding what happens to initiatives. It is described as “*putting an idea into a bottomless pit*” (Interviewee 1), where it is put and never heard of again. Another interviewee explained how ideas and initiatives are investigated centrally to see if they are valuable on an organizational level and not just in the specific department. This however can have the result that the individual who started the initiative gets less feedback than they would have gotten otherwise. This can also vary depending on what manager you approach, and there appears to be no formal incentive structures for increasing data-drivenness, neither monetary nor non-monetary incentives.

5. Analysis

In this chapter, the empirical data collected is analyzed, and compared to the theoretical framework presented earlier. The analysis will be structured according to the themes used in the previous chapter. Figure 2 below shows the estimated positive or negative effect that each of the factors inflicts on Swedavia's mission to become data-driven. It should be noted that the values presented are qualitatively estimated and represent relative influence. For example, Resistance to change has a net negative impact on the data driven culture, but less so than Vision & Strategy. Management & Leadership on the other hand has a net positive effect.

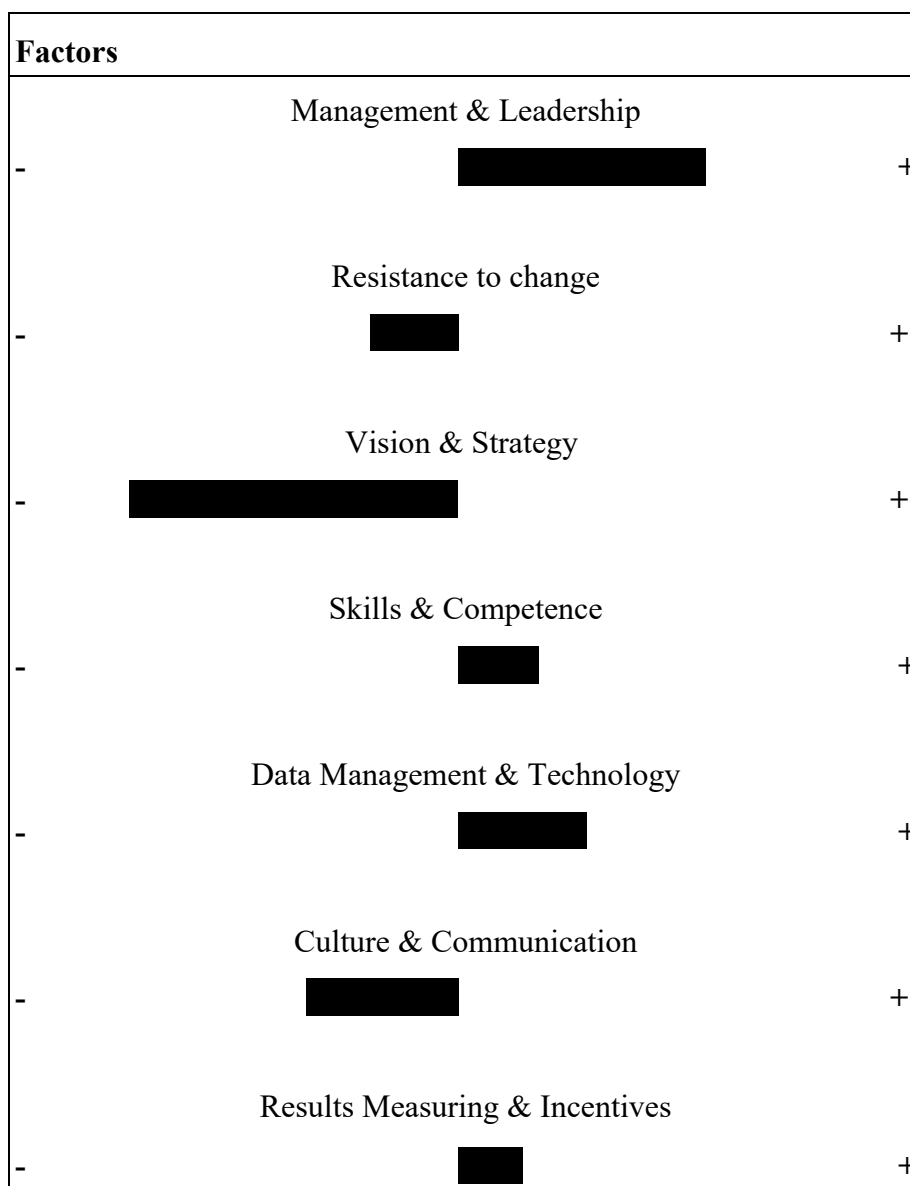


Figure 2. The effect of each factor on Swedavia's attempt at creating a data-driven culture

5.1 Management & leadership

One of the drivers for creating a data-driven culture according to theory is having top management commitment. This factor is clearly evident at Swedavia as well, although to varying degrees. The company's top management encourages data-oriented behavior, but could allocate more resources to support data-driven practices. They have communicated the advantages, but it has not reached the more operational levels, and it has reached middle management to varying degrees.

Theory also points to the importance of having a Chief Data Officer role with certain attributes, such as mandate to influence, organizational support, and enough resources at their disposal. Likewise, a Chief Analytics Officer role is recommended. At Swedavia, versions of these roles are present, such as the head of data-driven development, and the heads of its sub-departments. The head of data-driven development reports directly to a member of top management which could ensure proper support and resource allocation, but they are not located in accordance with theory's recommendations of directly reporting to CEO or being part of the strategy organization.

One driver that was identified in theory but partially missing from Swedavia is working with experimentation and starting small with simple proof of concepts. The company is good at starting a lot of initiatives, but with the result of many of them being drowned out. Also, waterfall methodology is often used for projects which could lack the agility needed for quickly moving from idea phase to testing.

In theory, the two barriers related to management and leadership concerns insufficient management involvement and support, and lack of middle management involvement and support. Both of these can partially be seen at Swedavia. Management involvement and support, as discussed earlier, is present but falls short in some areas. The middle management barrier can also be seen at some parts of the company, as managers' commitment varies between departments.

5.2 Resistance to Change

A barrier that is identified in both theory and at Swedavia is resistance to change. It is not present throughout the entire organization but among certain individuals. Theory also points out that it often occurs among middle management, which also can be seen at Swedavia, but to a small degree. An interesting finding that is not evident in theory, but prominent at Swedavia, is the strong perception that older co-workers are reluctant to change their ways of working. This could either be because this is the case, but it could also be a prejudice among employees, which in itself could be a cause for resistance, and hamper decision making because of incorrect assumptions.

5.3 Vision & Strategy

Vision and strategy is of great importance according to theory. More specifically, the creation of a vision and a strategy that is overarching and tangible for all parts of the organization. Swedavia does have a vision but its strategy is not tangible enough for operational levels of the organization. Therefore, this success factor is largely absent at the company. Connected to this success factor is middle management's important role of spreading the vision and strategy to lower levels and making it into tangible objectives. This is also missing to a large extent from the company, and could both be a result of varying levels of middle management commitment, but also that the overarching strategy and vision are too abstract which makes it difficult to translate into tangible objectives.

Theory highlights the importance of having a data strategy and what parts it should contain. Swedavia has a somewhat abstract vision of how the firm will start working with data, but there is no strategy that is tangible enough to provide guidance for how to get there. Theory also emphasizes that the data strategy should be aligned with the overall strategy of the organization, and this is one aspect that Swedavia has done well, as the data vision is integrated with the firm's overall 2030 vision. In general, the firm appears to need a more tangible strategy for their data transformation. The vision not being tangible enough for lower levels of the organization aligns well with the barrier found in theory. Theory also emphasizes lack of strategy related to the data-driven transformation, which is the case at Swedavia, as there doesn't appear to be a clear strategy for how the transformation will be conducted.

Swedavia does have some guidelines and have begun work on creating a data-strategy. However these guidelines appear not to have been communicated properly throughout the organization.

5.4 Skills & Competence

Data literacy is highly important according to theory. Data literacy is described as the foundation which makes employees confident enough to make data-driven decisions, which seems to be lacking at many parts of the company, given that Swedavia is still early in its data transformation. The widespread evidence- and fact based perspective that is emphasized in theory is however quite present at Swedavia. Although a lot of competence is centralized to the BI-department, the overall mindset is quite evidence-driven at the firm as a whole. Focused recruiting efforts have been found to a degree at the firm, but this area could certainly be stronger. The training aspect, which is emphasized thoroughly in theory, is also talked about a lot at the company, but not many trainings have been conducted, which indicates that this opportunity is not present at the firm. This doesn't however have to be something negative, as it is important in theory to time training initiatives right before systems are implemented, which the firm has the opportunity to do. The initiative related to multi-competence can also be positive for the firm, as it may help them capitalize on efficiency gains from working data-driven. This is an aspect which is not discussed in theory to a high degree.

It is described as highly important to fill the knowledge gap, and not doing so can be a major barrier according to theory. This is a challenge for Swedavia, as they have lots of coworkers with vastly different competences from the ones needed to work with data. Given that the firm isn't that far along on the data maturity journey, this barrier is still possible to overcome using training and recruiting, as this challenge is the most troublesome for firms in a later stage of data maturity. Another barrier that was found at the firm was related to the difficulties communicating between IT and other operational functions, which is not something that is discussed in theory.

5.5 Data Management & Technology

In terms of data, there was no clear consensus of the data quality at the firm, but it is clear that more work could be done to improve this area. The data is perceived by some to lack in terms of both accuracy and consistency, which are both important in theory. Thus, Swedavia cannot be considered to fully have this success factor, and instead, this can be considered a challenge in certain areas, which aligns with the barrier in theory. This can be related to the data governance processes and procedures at the firm, which are also lacking. Undefined processes for data governance is a barrier also in theory. However, the firm is improving in the area of data stewardship and accountability, and has procedures for managing sensitive data, which are both important success factors in theory. These may also help improve data quality going forward, as it is emphasized in theory that data governance is a tool to ensure data quality. Security concerns are also mentioned as a barrier, but it has not been identified as a major challenge specifically at Swedavia. However, the strong regulations in the industry mean that the firm may be forced to spend more resources on governance than had been needed otherwise.

One barrier in theory is difficulty accessing relevant data. This barrier is prominent at Swedavia, and will be an important focus point to overcome. Tools to make data more easily accessible can also be expensive and/or difficult to find. However this barrier hasn't been found at Swedavia, possibly due to them developing their tool in-house. Theory also emphasizes democratization of data, which is another area that the firm is improving at. Theory suggests starting centralized and spreading access more broadly, which is exactly what the firm is currently doing. There is also work ongoing to implement tools that allow for self-service, and better visualizations of data, both of which are success factors in theory. Another barrier that is found at Swedavia but not in theory is that many operational level workers rarely have access to a computer which makes it difficult for them to read internal company communications and take part in online training initiatives. This could pose an issue for creating a data-driven culture, as management communications and online education in data might not reach operational levels. Additionally, these employees may not be confident using a computer which could pose a problem later in the data transformation process. All in all, the data management and technology factors at Swedavia are at a somewhat low level currently, but they are improving in almost all of the aspects within this area.

5.6 Culture & Communication

A data-driven culture should be grounded in the strengths of a firm's existing culture, according to theory. Swedavia has a culture of problem solvers, which could be a great opportunity to use as a basis for a data-driven culture. It is also emphasized in theory that super-users should be appointed. Swedavia has certain individuals who have strong competences and interest in data, who could be used as change agents, which is another opportunity that the company has. However, the inquisitive, challenging culture that is described as a success factor in theory is a potential area of improvement.

Furthermore, a culture of openness and information sharing where employees share data without any sense of one party "owning" the data, and without silo-thinking is emphasized in theory. This type of culture is not present at the firm, and forms an area of potential improvement. Lack of cross-functional collaboration is also a challenge to a data-driven culture in theory. There appears to be limited collaboration about working with data between different functions at the firm, which according to theory would constitute a barrier. These factors are however partially down to technical factors more than culture per se. The communication beyond company walls is very good related to competitors, as the firm has several collaborations with other airports. There is also good collaboration with other partners, even though the data sharing aspect is limited due to confidentiality and competition aspects. This area is not perfect, but still a strong opportunity for Swedavia.

Lack of sense of urgency is another barrier in previous research, which may lead to a low motivation among employees. This barrier is not as prominent, as there seems to be a positive mindset and understanding of the need to become data-driven in most parts of the organization, although not all. A cultural barrier that was found at the firm was that initiatives often can be shut down unexpectedly at a late stage from unexpected individuals that are not directly involved in the project. This can make employees less motivated to pursue initiatives, and is another barrier that is not discussed in theory.

5.7 Results Measuring & Incentives

There are several factors connected to measuring progress and incentives that are highlighted as important in theory. The first one, which is almost entirely absent at Swedavia, is using metrics for measuring the progress of the cultural transformation. It appears it is only the BI department that does some kind of measurement but only to a small degree. When it comes to the use of incentives, theory suggests using either monetary or non-monetary incentive structures. Swedavia does not use monetary incentives, and only non-monetary incentives to some degree.

5.8 Factor Prevalance Summary

Below are two tables, Table 2 and Table 3 in which the themes are divided into their fundamental factors. The tables summarize which barriers and success factors that exist in theory and at Swedavia respectively.

Barriers	In Theory	At Swedavia
Management & Leadership		
Lack of Management Involvement & Support	x	(x)
Middle Management Commitment	x	(x)
Resistance to Change		
Resistance to Change	x	(x)
Perception of Resistance from Old Coworkers		x
Vision & Strategy		
Abstract Vision	x	x
Lack of Strategy	x	x
Skills & Competence		
Not Filling Knowledge Gap	x	x
IT & Operations Communication Problems		x
Data Management & Technology		
Difficulty Accessing Relevant Data	x	x
Expensive Tools	x	
Poor Data Quality	x	(x)
Undefined Processes	x	x
Security Concerns	x	
Lack of Access to Computers (Operational level)		x
Culture & Communication		
Lack of Cross-Functional Collaboration	x	x
No Sense of Urgency	x	
Projects Shut Down Unexpectedly		x

x: found

(x): partially found

Table 2. Barriers identified in theory and at Swedavia

Success Factors	In Theory	At Swedavia
Management & Leadership		
Top Management Commitment	x	x
Top Management Encouragement	x	x
Resource Allocation	x	(x)
Communicating the Advantages	x	(x)
CDO & CAO Role	x	
Starting Small	x	(x)
Working Agile	x	
Vision & Strategy		
Data Vision	x	(x)
Tangible Strategy	x	
Middle Management Communicating Vision	x	
Strategic Alignment	x	x
Skills & Competence		
Data Literacy	x	
Evidence- and Fact-Based Mindset	x	x
Recruiting Data Competence	x	(x)
Trainings	x	
Correctly Timed Trainings	x	
Multi-Competence		x
Data Management & Technology		
Data Quality	x	(x)
Data Governance	x	(x)
Stewardship & Accountability	x	(x)
Data Democratization	x	(x)
Starting Central, Then Expanding	x	x
Self-Service	x	(x)
Culture & Communication		
Honoring the Strengths of the Existing Culture	x	(x)
Super-Users	x	(x)
Inquisitive Culture	x	
Information Sharing Internally	x	
Information Sharing Externally	x	(x)
Collaboration with similar actors (other airports)		x
Results Measuring & Incentive		
Measuring the Transformation	x	
Incentives	x	(x)

x: found

(x): partially found

Table 3. Success factors identified in theory and at Swedavia

6. Conclusions & Recommendations

In this chapter, the conclusions of this research project, recommendations to the case company, and recommendations for future research will be presented. The conclusions will be structured in accordance with the two research questions that were used as the basis for the research:

RQ1: What are the challenges with implementing a data-driven culture on an operational level for a firm with heterogeneous operations?

RQ2: What opportunities for implementing a data-driven culture on an operational level can be identified for a firm with heterogeneous operations?

6.1 Conclusions

The conclusions for the first research question are presented in table 2 in the previous chapter. Many of the challenges identified in theory can be found at Swedavia as well. In addition, the heterogeneous operations of the airport operator experienced a few challenges that have not been discussed in previous literature on the subject. Firstly, a perception that the firm's older co-workers are less prone to changing their ways of working was discovered. Whether or not these perceptions are accurate, this may pose a barrier either way. Secondly, some experienced issues with communication between the IT-department and operational-level workers, and thirdly, instances of unexpectedly shut down initiatives were identified. Lastly, many operational level workers lacked regular access to a computer for staying up to date on internal communications and online education.

The conclusions for the second research question are presented in table 3 in the previous chapter. Just like the challenges, many of the success factors identified in previous research were either present or partially present at Swedavia. Apart from these, two additional success factors were identified for the heterogeneous operations of the firm. Firstly, Swedavia is currently driving a multi-competence initiative for increasing the benefits of data-drivenness, where employees whose work tasks are reduced by the increased use of data and technology learn a wider range of tasks. The second success factor not found in theory is collaboration

between similar actors to Swedavia, namely other airports, which allows them to learn and take inspiration from each other.

Apart from this, the findings of this report add to the empirical depth of the success factors and challenges that are presented in previous research. As discussed earlier, many success factors and barriers presented in research papers on the subject are only briefly explained. By providing empirical examples of these factors, this paper helps mitigate these shortcomings of previous research.

6.2 Recommendations for the case company

From this study, it is possible to discern the drivers where Swedavia is currently performing well, and those with potential for improvement. Although Swedavia does have a highly committed top management, improvements must be made within *management & leadership* in order to make the driver positively contribute to the creation of a data-driven culture. Firstly, top management commitment should be shown more clearly, for example through better resource allocation towards data initiatives and the departments who drive the transformation. Furthermore, middle management commitment should be ensured throughout the organization. This will make sure that the transformation towards data-drivenness will be sufficiently promoted, and local managers can drive small scale data initiatives. Additionally, the firm should perform some organizational changes, such as appointing a CDO being part of top management, with the mission of driving the transformation.

The driver *resistance to change* should be addressed by Swedavia. As discussed earlier, there is a perception that older employees at Swedavia are reluctant to change, which needs to be investigated further. If the perceptions are accurate, this needs to be addressed by talking to these individuals to understand the reasons behind their resistance, and to find ways to make them want to join the change. On the other hand, if the perceptions are not accurate, work needs to be done to change these perceptions to ensure an inclusive working culture and data-driven transformation. If faulty perceptions are left unchanged, decision making based on these assumptions can have negative consequences. Therefore, investigating resistance throughout the organization is of great importance. For example, if the reason behind the resistance is fear and uncertainty regarding the future of the individuals' roles, the resistance

can be mitigated by better communication and transparency surrounding the change initiatives.

For the *vision & strategy* driver, Swedavia has a vision that has been communicated to a large part of the organization, however, the firm's ambitions to become more data-driven should be communicated further to reach all parts, and a concrete data strategy with tangible guidelines for all departments should be formulated. Middle management should be tasked with communicating the vision, and should be involved in the creation of the strategy to ensure their support.

As discussed previously, regarding *skills & competence*, Swedavia has an appreciated BI department with lots of competence in data, but data literacy should be more widespread. Although not everyone at Swedavia needs to be data analysts, a certain level of data literacy would ease the creation of a data-driven culture. Specifically, training sessions should be held for helping employees to learn role-specific software tools, and equipping the employees with data terminology could help communication between different departments.

Within *data management & technology*, the firm needs to address barriers related to data quality, processes, and governance, which can be done by further continuing their work in establishing data ownership and other governance functions. On a similar note, the firm should continue developing their data portal, with a particular emphasis on supporting democratization of data, and allowing employees to access data with self-service, rather than having to ask the BI-department. It is also important that the portal is easy to use, and allows for easy access of data. The firm should also consider that workers who don't have access to a computer also don't get information about internal news, and don't have access to any data at all. This should be addressed, by ensuring that all workers have access to channels where they can receive internal news, and to data that is appropriate for their role.

For the *culture & communication* driver, some barriers should be addressed. First of all, collaboration and information sharing within Swedavia should be improved, which for example could be done by conducting cross-functional workshops where knowledge is shared between different functions of the firm. As the firm has many employees who are enthusiastic and skilled in data, they should appoint super-users to act as change agents who can drive the

transformation. Similarly, the issue of unexpectedly shut down initiatives should be investigated and solved, as it can make employees less inclined to drive initiatives. Additionally, Swedavia would benefit from accessing data from the external actors operating on the airport, and therefore attempts should be made to increase the external actors' willingness to share their data. This could be done through discussions where the different actors can voice their concerns and a mutually beneficial solution could be reached.

Regarding *results measuring & incentives*, Swedavia should perform some changes in order to successfully create a data-driven culture. When a data-strategy is created, the firm should establish metrics and KPIs that track the progress of the cultural transformation to make sure they are heading in the right direction. These metrics could for example track the results of training initiatives, but also the mindsets and beliefs among employees to ensure they are accepting of the new culture. Furthermore, incentive-structures, either non-monetary or monetary, could be used to incentivize employees to work in a more data-driven way.

6.3 Future Research

Data-driven culture is still a fairly new subject, and therefore the possibilities for future research are abundant. Given that this case study was conducted on a single firm, with a specific structure, context, and in a specific phase of its transformation towards data-drivenness, the possibilities to compare the findings to other companies are limited. Therefore, performing case studies on other firms with similar characteristics could contribute to the findings of this study. Specifically regarding the positive and negative factors that were identified in this study but not present in previous literature on the subject. This could confirm whether these factors are relevant to other firms and contexts. A more comprehensive study with a longer time frame could provide more factors, and explore each factor in more depth. It would allow capturing the views of a wider range of individuals in the organization, from operational level to top management. A recreation of the case study on Swedavia could be made for confirmation of the results of this study. Research should also be made with different case companies that are in different phases of their transformation, to explore whether the challenges and success factors differentiate between the phases. Furthermore, as this study is of qualitative nature, quantitative research methods could be

used to provide new perspectives on the prevalence of the different factors that were identified.

References

- Anderson, C. (2015). *Creating a Data-Driven Organization: Practical Advice from the Trenches*. O'Reilly Media.
- Anton, E., Oesterreich, T., Aptyka, M., & Teuteberg, F. (2023). Beyond Digital Data and Information Technology: Conceptualizing Data-Driven Culture. *Pacific Asia Journal of the Association for Information Systems*, 15, 1-36. 10.17705/1pais.15301.
- Berndtsson, M., Forsberg, D., Stein, D., & Svahn, T. (2018). Becoming a data-driven organisation. In 26th European Conference on Information Systems (ECIS2018), Portsmouth, United Kingdom, June 23-28, 2018.
- Berndtsson, M., Lennerholt, C., Svahn, T., & Larsson, P. (2020). 13 Organizations' Attempts to Become Data-Driven. *International Journal of Business Intelligence Research (IJBIR)*, 11(1), 1-21.
- Berntsson Svensson, R., & Taghavianfar, M. (2020). Toward becoming a data-driven organization: challenges and benefits. In *Research Challenges in Information Science: 14th International Conference, RCIS 2020, Limassol, Cyprus, September 23–25, 2020, Proceedings 14* (pp. 3-19). Springer International Publishing.
- Buvat, J., Solis, B., Crummenerl, C., Aboud, C., Kar, K., El Aoufi, H., & Sengupta, A. (2017). *The Digital Culture Challenge: Closing the Employee-Leadership Gap*. Capgemini. Retrieved from: https://www.capgemini.com/wp-content/uploads/2017/12/dti_digitalculture_report.pdf
- Chatterjee, S., Chaudhuri, R. & Vrontis, D. (2021). Does data-driven culture impact innovation and performance of a firm? An empirical examination. *Ann Oper Res* (2021). <https://doi.org/10.1007/s10479-020-03887-z>
- Civil Aviation Authority. (n.d.). Ground handling. Retrieved from <https://www.caa.co.uk/ghost/ground-handling/>

Davenport, T. H. (2020, February 21). Are you using your data, or just collecting it? Harvard Business Review. Retrieved from <https://hbr.org/2020/02/are-you-using-your-data-or-just-collecting-it>

Deal, T., & Kennedy, A. (1982). *Corporate Cultures*. Addison-Wesley Publishing Company.

Esteller-Cucala, M., Fernandez, V., & Villuendas, D. (2020). Towards data-driven culture in a Spanish automobile manufacturer: A case study. *Journal of Industrial Engineering and Management*, 13(2), 228-245.

Flyvbjerg, B. (2011). Case study. *The Sage handbook of qualitative research*, 4, 301-316.

Galbraith, J. R. (2011). The star model. *The STAR Model*.

Griffin, G. W., & Holcomb, D. (2023). Building a Data Culture: The Usage and Flow Data Culture Model. *Springer*.

Herden, T. T. (2020). Explaining the Competitive Advantage Generated from Analytics with the Knowledge-Based View: The Example of Logistics and Supply Chain Management. *Business Research*, 13, 163–214. <https://doi.org/10.1007/s40685-019-00104-x>

McAfee, A., & Brynjolfsson, E. (2012). Big data: The management revolution. *Harvard Business Review*, 90(10), 60–68.

NewVantage Partners AWC. (2022). NewVantage Partners Releases 2022 Data And AI Executive Survey. BusinessWire. Retrieved from <https://www.businesswire.com/news/home/20220103005036/en/NewVantage-Partners-Releases-2022-Data-And-AI-Executive-Survey>

Rogers, K. (2020). Creating a Culture of Data-Driven Decision-Making. Liberty University.

Storm & Borgman (2020). Understanding challenges and success factors in creating a data-driven culture. Proceedings of the 53rd Hawaii International Conference on System Sciences.

Swedavia (2024). Roll och uppdrag. Retrieved from <https://www.swedavia.se/om-swedavia/roll-och-uppdrag/>

Thyer, B. (2009). The handbook of social work research methods. *Sage Publications*.

Wohlin, C. (2014, May). Guidelines for snowballing in systematic literature studies and a replication in software engineering. In *Proceedings of the 18th international conference on evaluation and assessment in software engineering* (pp. 1-10).

Wolff, A., Gooch, D., Cavero Montaner, J. J., Rashid, U., & Kortuem, G. (2016). Creating an understanding of data literacy for a data-driven society. *The Journal of Community Informatics*, 12(3), 9-26.

Windt, B., Borgman, H., & Amrit, C. (2019). Understanding leadership challenges and responses in data-driven transformations. In Proceedings of the 52nd Hawaii International Conference on System Sciences (2019). Retrieved from <https://hdl.handle.net/10125/59936>

