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## The Secret of my Success: An exploratory study of Business Intelligence management in the Norwegian Industry

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### Abstract

The purpose of this paper is the exploration of the management of Business Intelligence (BI) solutions in the Norwegian industry. BI aims to improve data analysis and enhance business performance. Nonetheless, academics and practitioners note that BI is complex and difficult to manage. We interviewed BI managers in 5 companies who had been awarded the Norwegian Computer Society's BI prize, based on the following research question: *What can we learn from the successful BI implementations and management in award-winning Norwegian companies?* We surmise two findings. First, building upon concepts derived from the Digital Infrastructure Theory we find that while the Norwegian industry still has a traditional, complex BI architecture, it is scalable in the sense that they can add or remove elements, or even scrap the whole BI solution. The companies demonstrate innovation and adoption through their use of dashboards and real-time data. In light of these findings we propose a future research agenda for BI. Second, we offer three lessons for managers of BI in organisations.

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### 1. Introduction

Business Intelligence (BI) has been a rising star within the Information Systems field and it is currently enjoying a new boost in the wake of Big Data Analytics. Modern BI solutions are capable of capturing and analysing virtually all types of data. Benefits for companies include reduced cost, increased revenue, enhanced business performance and

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better decision making [1, 2]. However, many companies struggle to manage their BI solution because it is complex and requires ongoing management [3]. The strategy “build it, and the users will come” usually does not work in a BI context [4]. Other researchers predict a *management revolution* [5]: unless your company is *born digital*, like Google and Amazon, you will face managerial challenges in handling the vast amount of data and technologies. Contrary to these concerns, we observed that several Norwegian companies had been sustaining successful BI and they had been awarded a BI prize by the Norwegian Computer Society. In reference to this we believe there is sufficient reason to investigate companies with successful BI management, and our research question reads: *What can we learn from the successful BI implementations and management in award-winning Norwegian companies?*

**2. Literature review**

Business Intelligence is an umbrella term consisting of technologies and processes for gathering, storing and analysing data to improve decision making [6, 7]. The traditional BI architecture is layered and consists of the main components of data sources, the Extract-Transform-Load process, a data warehouse, and the front-end applications like reports and dashboards [8]. Such a solution mainly handles structured data such as numbers and categorised text. A second stage of BI originated in 2000 as the web and the Internet began to offer a collection of unstructured data. Finally, the third stage includes mobile- and sensor-based data [9]. Amongst Ask’s (2013) main findings were that Nordic countries had a fairly traditional design and management of BI solutions. For example, the most common tools included reports, followed by data warehouses. In addition, reports and dashboards were managed top-down. Still, there were some signs of *beyond traditional use* such as interactive dashboards [10].

Critical success factors in BI implementations have been an extensive research area. For example, Hawking identified the following three top factors: *User Participation*, *Team Skills* and *Involvement of Business and Technical Personnel* [11]. However, Hawking argued that the critical success factors had a high level of generalisation, making it difficult for companies to understand how a particular factor would apply to them.

From this brief literature review we identified two main limitations; first, the main focus has been data- and technology-centric, taking for granted that if the technological solution is implemented, the users will embrace the technology and the benefits of BI will follow suit, which may not always be the case. Second, much of the research on implementation and management are of an abstract nature [12].

It was our underlying belief that we needed a different perspective to understand how our case companies were successfully managing their BI solutions. Therefore we leaned on the Digital Infrastructure Theory, which focuses on the continuous interplay between people and technology. Henfridsson and Bygstad (2013) studied the evolution of successful digital infrastructures, and they defined “successful” as a system that has a continuous growth of users and functions. By analysing 41 cases they identified three causal powers (which they refer to as mechanisms) that contributed towards success over time: innovation, adoption, and scaling, as shown in figure 1. The common denominator of these powers is that they are self-reinforcing over time [13].

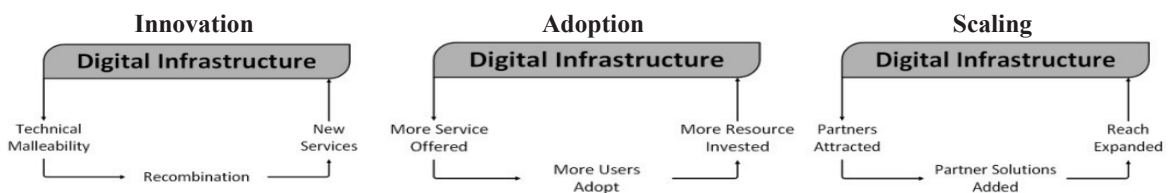


Fig. 1. Three causal powers adapted from Henfridsson and Bygstad (2013, p. 919).

Henfridsson and Bygstad found that the prospect of success correlated with the number of causal powers present in the 41 cases. In 12 of the most successful infrastructures all three causal powers were identified. In other successful cases, at least one of the causal powers was present. When they studied failed infrastructures (11 out of the 41 cases) there was an absence of all three causal powers.

### 3. Method and presentation of case companies

The overall approach was an exploratory case study, which we chose due to its relevance in investigating a contemporary phenomenon in a real-life context [14]. All case companies have won the BI prize from The Norwegian Computer Society (Den Norske Dataforeningen), which is an independent and open forum founded and facilitated by IT professionals. The BI prize was created with the aim to promote companies in Norway that actively work to utilize their data and find new solutions to increase efficiency and stability. Every second year, a company may nominate itself for the BI prize.

Between February and June of 2014, we visited five companies and they are briefly presented below. (We interviewed two more companies, but they did not e-mail us back with the approved transcript and consequently they are not part of this study.)

#### **Diakonhjemmet sykehus (hospital). Winner for *Best Practice* in 2013**

This is a local, non-profit hospital for Oslo, which was established in 1893. The hospital's expertise is spread over approximately 1500 employees and covers the disciplines of pharmaceuticals, surgery, psychiatry, and medicine. They are the largest of their kind after the university hospitals that focus on research [15].

#### **WiMP (music streaming service). Winner for *Innovation* in 2013**

With the vision to offer music via the cloud as a streaming service, the private companies Aspiro and Platekompaniet launched WiMP in 2010. With approximately 90 employees, their goal is to provide Scandinavian countries with new and old music, in full CD-quality [16].

#### **Kommuneforlaget (publishing). Winner for *Innovation* in 2012**

Wholly-owned by the Norwegian Association founded in 1986, they currently count 31 employees. Their focus is to integrate accumulated knowledge into their systems through the municipal organs, while also developing new products to support the municipals in the best way possible. In addition, they publish their own literature in selected sectors such as health and education [17].

#### **Den Norske Bank (DNB) (bank). Winner in 2010**

Established in 1822, DNB is Norway's biggest, and one of Scandinavia's largest financial corporations based on marketing value. They count approximately 14 000 employees. DNB offers a complete package from financial advice to investments for both the private and corporate market [18].

#### **Det Norske Veritas GL (DNV GL) (classification society). Winner in 2009**

This foundation was established in 1864 with the objective to safeguard life, the environment, and property. Their focus lies within the energy- and maritime sector, with regards to oil and gas. DNV GL aims to deliver technical reliability analysis and classification together with independent expert advisory and software. Today they have holdings in over 100 countries and 16 000 employees, enabling us to understand and build a smarter, greener, and more secure world [19].

Our data collection consisted of 11 interviews and 7 internal documents related to the BI strategy and architecture. The semi-structured interview guide was created based on existing literature. The questions covered architecture of the solution, managerial challenges, scaling (if they had tailored any modules with basis in the BI solution), adoption (which functions of the BI solution they used), and innovation (how managers perceived the BI solution to be innovative). Since research of BI in Norway is rather scarce we included background questions such as how each participant defined BI and perceived benefits.

We applied the techniques of Miles and Huberman for data analysis [20]. Our framework for discussion was built upon the concepts of Innovation, Adoption, and Scaling [13].

### 4. Findings and discussion

As presented in the previous section the case companies covered a large spectrum of industries, ranging from a private entertainment (WiMP) to public health care (Diakonhjemmet). They also varied in the size and number of

employees. The respondents were selected due to the fact they were affiliated to BI in different ways, however they were all at management level. Their average experience of BI was 6, 7 years. Our participants were asked to define BI from a personal viewpoint. As expected, their answers were influenced by their positions. For example, the Finance Director at Diakonhjemmet defined it as follows: “For me, BI is management information and leadership” while the Head of BI at WiMP stated: “BI is not an off-the-shelf product that you can purchase. Rather, it is a process which is maintained and integrated in the whole organisation at any time.”

When we asked about what kind of BI tools the companies used, we were surprised to learn about the large presence of different vendors (see table 1). The majority of our case companies had technology from the “Leaders” cell in Gartner’s Magic Quadrant, published by Gartner Group each year. Interestingly, two companies reported that they had built their own solution(s) in addition.

Table 1. Use of BI tools from various vendors (and own development) in each company.

	DNB	DNV GL	Kommuneforlaget	Diakonhjemmet	WiMP
IBM	x	x			
Microsoft	x	x			
Teradata	x				
SAS Institute	x	x	x		
Qlik		x		x	
SAP		x			
Oracle		x			
Pentaho					x
Web Analytics	x				
Easy Research	x				
Own development	x		x		
Sum	7	6	2	1	1

Upon reading table 1 it is noted that DNB used technology from six vendors, *plus* their own, in-house development! DNV GL also juggled six vendors. None of the other companies were close to using this range of tools.

When it comes to the BI architecture we found that all five companies followed the traditional structure described in the BI literature. From the drawings we observed that they had a typical layered architecture consisting of data, business logic and presentation layer. A layered architecture has value because it lets several actors contribute simultaneously; and it facilitates adding and removing applications [21], thus allowing trial-and-error. We believe that the layered architecture can explain how DNB and DNV GL managed to exploit and juggle their many tools from different vendors.

According to Watson (2009) there are seven main benefits to be gained from BI and we asked the managers to tick these off according to their perceptions, as shown in table 2. Each participant could tick off multiple benefits.

Table 2. Perceived benefits from BI in ranked order

Perceived benefit	Frequency
Better decisions	8
Improvements of business processes	7
Support for the accomplishment of strategic business objectives	7
Time savings for users	5
More and better information	4
Cost savings	4
Time savings for data suppliers	2

We observed that benefits related to better decisions and improvements of business processes were ticked off more frequently than saving money and time. Unfortunately we do not have additional information as to why the

respondents chose as they did, however one possible reason may be that *better decisions* ultimately lead to cost- and time savings.

Having analysed our data we wanted to discuss our complex findings of people, BI tools, data, hardware, software, skills, work routines, and vendors through our framework based on the Digital Infrastructure Theory.

#### 4.1. Innovation

According to Henfridsson and Bygstad (2013) an innovation process requires a malleable technology. When the BI architecture from our case companies was studied, it was noted that they all have a layered architecture. Despite the layered architecture, three companies used tools from only one vendor. When WiMP was questioned as to why they only used one tool (Pentaho) the participant explained that the other vendors offered tools that are too complex for their business needs, as well as being too expensive: *“The technologies are becoming more mature, and the open source systems are the best of the bunch”*. Furthermore, the participant explained that the open source community benefited from several actors who contributed.

The fact that all of our companies applied technology from leading vendors (as defined by Gartner) could at first indicate that the companies were innovative. However, when asked, a Gartner senior consultant conceded that it was rather the large companies who tended to choose amongst these vendors, as these vendors offer a large range of functions. One of the largest companies, DNB, also had a history of frequent mergers. We found that this also accounted for the reason that in addition to six different vendors they have created their own solution. When DNB was asked to clarify why it needs an in-house solution in addition to the six other solutions the answer was that they had to build architecture around the existing six solutions at an enterprise level.

All of the managers in the companies regarded themselves as innovative and they clearly stated that this was due to a fast feedback-loop and interplay of end-users, developers, technology, and data. For example, Diakonhjemmet had placed a visual, real time dashboard on the wall of its emergency room. This BI solution was tailored to the users' needs, which typically were: *“Where can I find a vacant room for this patient?”* and mapping the adequate doctor. The dashboard was updated every 10 seconds. The respondent who created the dashboard said: *“The system itself (QlikView – author’s comment) spans innovation, such as the dashboard in the emergency room”*. The companies who used open source tools also perceived themselves as being innovative; *“at least in a national context”* (participant at WiMP). This respondent also shared that *“...if we look at the evolution over the last five years, BI has become more sexy”* – in the sense that both the technology and the people evolve and influence one another: *“The technology is becoming more flexible and can handle more data, and the people are becoming more understanding about data and how to use it to create value for the company.”* The participant at Diakonhjemmet was also aware that BI has been a laggard in health care, and they were quite proud to be pioneers: *“Using BI in hospitals – that is already an innovation!”*.

#### 4.2. Adoption

Adoption requires that users embrace the technology and are able to interact with it in a manner that suits their needs. The more users a technology has, the more resources it will be allocated.

When the characteristics of the technology in the *Leaders* cell were examined, we found that they were dominated by visualisation tools, especially Tableau and Qlik. These tools are also known to be user-friendly, which facilitates adoption. However such tools may result in extra exposure of each co-worker's performance since the manager can easily follow the performance of each individual employee through a real-time dashboard, with the drawback that the dashboard only shows selected information without context. As the senior consultant from Gartner pointed out: *“BI is only about numbers, and it seldom considers the context”*. An example from the participant at Kommuneforlaget illustrated this concern: *“A psychologist was told; ‘You are to have eleven meetings with this troublesome student’. Later the psychologist was called onto the carpet by the municipal; ‘What is going on here, you’ve only had seven meetings?’, upon which the psychologist calmly stated ‘Yes, the student wasn’t as difficult as we initially thought, so he didn’t need more than seven meetings’”*. From this account possible adoption problems can be perceived: the employee may feel monitored. Perhaps the next time the psychologist may refuse to log his/hers meetings in the BI solution. Nonetheless, most of our participants experienced successful adoption. WiMP experienced a chaotic start in their BI implementation; however they managed to turn this around by creating super users. What seemed to be essential here is keeping the expertise close by having multiple resources available throughout the company; in

WiMP's case they aimed to have a super user in each branch nationwide. The respondent at Diakonhjemmet explained that after he created the dashboard in the emergency room, more users became aware of the possibility of real-time information and made requests for more dashboards.

#### 4.3. Scaling

We recall that scaling pertains to attracting partners and new solutions. How easy is it to add new technology to the BI solution? The fact that the majority of our case companies employed BI tools from several vendors indicated that their solutions scaled well. In Ask's (2013) study he asked why companies either chose to use tools from various vendors ("best of breed") or a standardised suite from one vendor only. The ease of working with fewer vendors was one explanation. On the other hand, we believe that using tools from several vendors can reduce the risk of lock-in. Lock-in refers to the idea that the *switching cost* of changing vendor would be too expensive or time-consuming [22]. None of our participants raised concern about lock-in, but we discovered another reason for the many complex BI solution with multiple vendors: heritage.

As mentioned above, DNB had experienced many mergers which resulted in a heritage of many tools. Another example of merging was found at DNVGL, where the participant reported that they are now in the process of consolidating the data from various systems from the acquired companies and mitigate them into Cognos. When asked if this was a cumbersome task the answer was quite opposite: "*it is a fun challenge*". Another interesting finding pertained to Kommuneforlaget. They found that their BI solution, mainly delivered by SAS technology, was about to become too large and complex. Consequently, they decided to replace the whole SAS solution with their own system, which they would build from scratch. This was indeed an interesting finding; no other company mentioned having scrapped their solution. Naturally, a follow-up question was asked to clarify the reason for this decision. Kommuneforlaget responded that they needed a more malleable technology, which could fit their needs. The existing solution was too complex in the sense that on the one hand, they did not need all the standard functions, and on the other hand, it was difficult to tailor functions. They felt comfortable taking the step towards building a full BI solution themselves. One reason for this was that Kommuneforlaget has 25 years of experience in BI. They had adopted an open and impartial approach to what is needed of a full scale solution on a municipal level, as each Norwegian municipal can have up to 300 different professional systems. The focus at Kommuneforlaget had naturally been the quality of data, and not the systems' integration: "*The solution is probably not to get the systems to talk to each other, but rather to get the data out in a standardised format*". They were in the process of creating a whole new solution consisting of their own solution in addition to an open source vendor (but the participant did not specify which one).

In summary, it is noted that there are no clear-cut lines between the three processes of innovation, adoption, and scaling. For example, it is difficult to be innovative if the BI architecture is difficult to scale. This concurs with the study by Henfridsson and Bygstad; the three processes interact and feedback on each other. Consequently, we discuss the issue of evaluation next.

#### 4.4. Business Intelligence as a Digital Infrastructure revisited: the missing link of evaluation

The literature has called for more research on how people use and manage BI tools [12]. Our results suggested that all the target cases had made several loops of the innovation, adoption, and scaling processes of the Digital Infrastructure framework. We were able to link the actions of management to the theory adopted in this research, thus the Digital Infrastructure Theory lens proved useful in this case and we call for more evidence in other contexts, or other parts of the world. However, the need for ongoing evaluation should be added to the model. In the BI context, with many vendors and people involved, the processes of innovation, adoption, and scaling should always be evaluated by managers.

For example, before a company can use BI in an innovative manner, there are preliminary stages. Examples are requirement analysis, a selection of services, implementation, and training. This implies that there have been successful system implementations, however management and implementations are necessary during each loop in figure 1. Based on our data we find that the processes are not quite self-reinforcing in the sense that the managers need to initiate the adoption. On the other hand, if the managers do not supervise the processes, a company runs the risk of lock-in. Lock-in was not identified in our study, on the contrary; we found that the companies rather tended to scale down, change vendors, or even scrap the whole solution.

Nonetheless, as a consequence to our analysis, a new research agenda is strongly recommended: BI as a Digital Infrastructure. This framework has roots from sociology and economics, and as suggested by Grabski et al's (2011) alternative approaches are needed in BI research. Hence, well-known BI case studies such as Netflix; Harrahs; Marriott; and Wal-Mart [23, 24] can be analysed anew through the lens of the Digital Infrastructure Theory and discussed if new insights are made. Also, our study suggests that companies may not necessarily have to face a *management revolution* as stated by [5] but rather a *management evolution*. With the exception of WIMP (founded in 2010), none of our case companies were *born digital*, rather, they date back to 1822, 1864, 1893, and 1986. Yet they are, in reference to the Digital Infrastructure framework, to be classified as successful, and in addition, the managers felt confidence and regarded themselves as successful.

#### 4.5. Lessons learned from studying successful companies

Our data indicated that the companies had a sound foundation for BI allowing them to innovate, adopt and scale (up as well as down). Based on the previous sections we offer three lessons for BI management:

##### **Lesson 1: Consider BI as a continuous and innovative process (innovation)**

BI is a process which must be cultivated. As pointed out by WiMP, BI is not a technology that can be bought-of-the-shelf. BI offers a plethora of tools which can be combined and used in other ways than first intended, such as Diakonhjemmet placing a dashboard on the wall in the emergency room. The participants regarded BI as an ongoing process, and they did not expect it to be perfect at once. Quoting one participant from Diakonhjemmet: "*If you do not have the time or resources to make mistakes, you will spend much time and resources on making mistakes*".

##### **Lesson 2: Attract users by keeping the BI competence close (adoption)**

If the users do not use the BI solution, it does not help if the implementation was completed within timeframe and budget. The users must experience value by employing the tool. And in order to experience value, the solution must be maintained. Management is more willing to invest resources in solutions that are frequently used. WiMP succeeded in getting this process started by having super-users in close proximity to the end-users. Some companies also expressed that self-service BI tools would be the next natural step, allowing the users to create reports and dashboards themselves.

##### **Lesson 3: Balance the number of technologies of your BI solution (scaling up or down)**

It is advised to plan so that one can scale both up – and down. Our findings showed that companies often inherit BI technology through merging. Two of our case companies have scaled up: DNV scaled up by adding visual end-user tools, while DNB created a new platform architecture. Furthermore it is also advised to halt efforts if deemed necessary. Kommuneforlaget decided that scrapping was cheaper than adding even more technology components to their existing BI architecture.

## 5. Conclusion and suggested further research

This paper set out to investigate: *What can we learn from the successful BI implementations and management in award-winning Norwegian companies?* In this exploratory case study we provide a small amount of evidence. From our analysis it was seen that while award-winning Norwegian companies still has a traditional, complex BI architecture, they are able to scale both up and down. Moreover, the companies demonstrate innovation and adoption through their use of dashboards and real-time data. From our study three lessons for BI management are extracted: (i) *Consider BI as a continuous and innovative process*, (ii) *Attract users by keeping the BI competence close*, and (iii) *Balance the number of technologies in your BI solution*.

Moreover, our study supported the Digital Infrastructure Theory by suggesting that it works in a BI context. As future research, we suggest studying BI solutions in other companies and countries through the lens of the Digital Infrastructure Theory. Alternatively, the same companies could be studied through another theoretical lens in order to see if successful management can be explained. Our main focus was from a managerial perspective, but it would be interesting to include the end-users in future studies.

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