Self-Service Business Intelligence at Topicus: An Assessment of Employee-Related Enablers

UNIVERSITY OF TWENTE. | topicus

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Management Summary

Context

Topicus is a Dutch software development company that delivers tailored IT solutions within various domains. This research was executed within ParnasSys, a business line that focuses on delivering software to primary schools in The Netherlands. Within ParnasSys, strong attention is paid to data. A few years ago, a separate business intelligence team was created, the team focuses on providing data-based information that can be used to enhance business performance and gain competitive advantage. However, as the BI team struggles to manage the amount of data generated by the new products, a need for an alternative business intelligence approach arises. One possible solution is self-service business intelligence, an approach that empowers regular employees to perform data analytics independently from the data team. This research aims to provide ParnasSys with an understanding of employees' motivation, as it is a crucial first step for self-service business intelligence adoption. Based on this, the following research question was derived:

"How can ParnasSys employee readiness for self-service BI be evaluated and improved?"

Methods

To achieve the aim of this research, several key steps were taken. Firstly, an analysis of the current business intelligence context was performed. This included a stakeholder analysis, categorising employees into groups and evaluating their influence on the adoption of a new approach, as well as measuring their expected interest. This was done by conducting in-depth interviews with the representatives of the data team. Next, a list of employee-related self-service business intelligence enablers was obtained using a method of literature review. The latter helped derive a theoretical model that was used for further analysis. To measure the indicated constructs and the correlation between them a companywide survey was conducted and amplified by several interviews. The obtained data was analysed using descriptive statistics, Spearman's correlation, and the correlation matrix. Finally, a list of literature-based recommendations on the implementation and the communication processes improvement was provided.

Results

The data obtained from the survey shows that ParnasSys employees have a strong behavioural intention to use the self-service BI approach. However, aspects like user knowledge, data access, and user support are assessed low, see Figure 1. This is explained by the fact that these three variables are less important for a default business intelligence approach but need to be improved to allow self-service. The analysis per team supported the preliminary information obtained with stakeholder analysis interviews, some job families are more interested in the self-service approach, namely Marketing, UX, and Sales. This is explained by the benefit that flexible data analytics can bring to these fields.

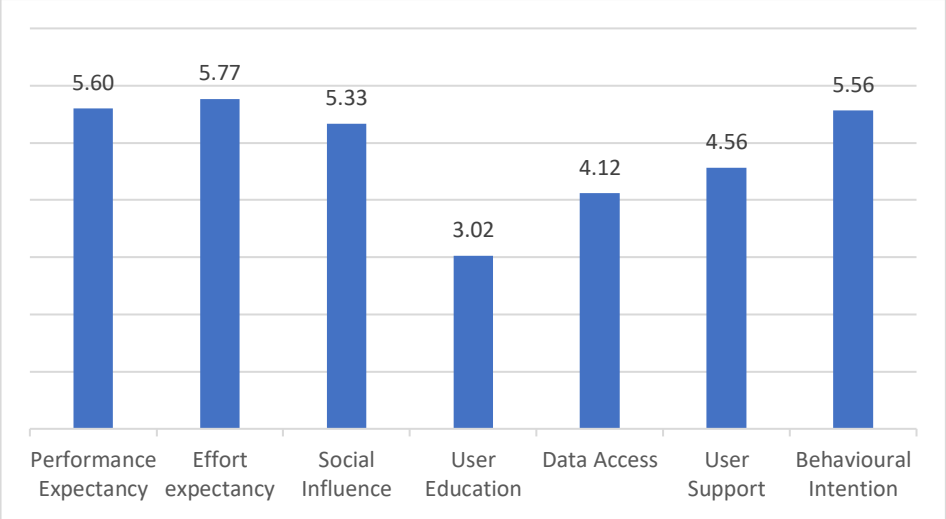

Figure 1. Average result per variable

The correlation analysis suggested only one strong correlation, between Performance expectancy and Behavioural intention, see Figure 2. This can be explained by the result-driven nature of ParnasSys employees, a technology is more likely to be used if a benefit is observed.

	Performance expectancy	Effort Expectancy	Social influence	User Education	Data Access	User support	Behavioural Intention
Performance expectancy	1						
Effort Expectancy	0,230	1					
Social influence	0,164	0,176	1				
User Education	0,255	0,203	-0,188	1			
Data Access	0,217	0,032	0,045	0,209	1		
User support	0,097	-0,065	0,358	0,209	0,147	1	
Behavioural Intention	0,707	0,241	0,118	0,257	-0,041	0,141	1

Figure 2. Spearman's Correlation Matrix

Recommendations and Future Research

Based on the findings and relevant literature, the research derived several recommendations for future communication and implementation of self-service business intelligence. The recommendations are divided into two categories: general technology adoption advice, and improvement of self-service BI-specific aspects.

It is recommended to adopt self-service business intelligence bottom-up within teams that have the highest data knowledge and motivation, which will allow for testing the approach in the early stages. Furthermore, this will serve as a success story, utilising the strong positive correlation between performance and employee motivation. The adoption of self-service BI also has to be made voluntary, as this will improve the well-being of employees and maximize the value that the technology brings, as only the truly knowledgeable or motivated employees will use it. Additionally, knowledge sharing, as well as a standard for data access need to be established for self-service business intelligence to work.

This research had a relatively small sample size, which influenced the significance of its findings. To test the reliability of a model, larger research aimed at understanding which factors affect user behavioural intention can be made. Additionally, the future self-service business intelligence adoption steps for ParnasSys should include more practical aspects, for example, tooling transformation and employee training programs.

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1. Introduction

This section provides a comprehensive overview of the company where the bachelor thesis was executed, explains the encountered problem using a problem cluster, and offers information on the selected research design. It provides a foundation for understanding the research goals, structure, and scope.

1.1 Company Description

Topicus is a software development company based in the city of Deventer. The company has four separate branches that deliver tailored IT solutions to finance, healthcare, government, and education industries. Operating in three tiers of Dutch education (primary, secondary, and vocational), Topicus assists millions of students throughout their academic journey. This assignment was executed within the ParnasSys business line responsible for developing primary school education software. The main ParnasSys product, an administrative system of the same name, is the market leader in the Netherlands with an adoption rate of more than 90% among primary education institutions. The ParnasSys business line has also developed software solutions for parent communication, children's social development, privacy, and education quality, making them add-ons to the main system. Over the last few years, the ParnasSys educational domain has performed several acquisitions, experiencing rapid growth, which led to the problem described in the next paragraph.

1.2 Problem Description

Constantly looking for improvement and valuable information, the ParnasSys business line pays strong attention to its data. A small business intelligence (BI) team is responsible for providing valuable performance insights and assisting the decision-making of other teams. As the company expands, develops new applications, and creates new teams, the amount of generated data grows exponentially. Moreover, increased diversity in data sources requires additional effort to keep data consistent and easily analysed. Such aspects amplify the load on the BI team, decreasing the quality of insights and reducing the number of decisions that are grounded in data. While being simple, an approach of expanding the data team is a postponement of the issue, as future growth will bring the same problem once again.

To address the mentioned issues, ParnasSys is considering introducing self-service BI, which would mean that employees can create dashboards within their departments, only referring to the BI team in case of a problem. This step is expected to enhance agility in data analysis, improving overall business operations. It also enables the use of domain-specific knowledge, allowing for a more accurate interpretation of data. However, self-service BI includes various technical, social, and regulatory challenges which ParnasSys wants to investigate before deciding to go for the change. The specific areas of uncertainty are employee skill and willingness to use self-service BI, as well as the selection of the optimal approach to enable the efficient use of the mentioned technology. The company is looking for an analysis of its weak points and a recommendation on how to approach those problems.

1.3 Action Problem

Based on the given problem description, the action problem can be defined as *"Lack of data-informed decisions"*. The problem refers to an undisclosed analytical potential, which remains such due to the current approach to data practices. The problem is caused by a lack of flexibility, which would allow the BI team to deliver tailored, more insightful, input. The result of not making enough data-informed decisions may lead to substantial financial losses and a decrease in customer satisfaction. Therefore, strong negative outcomes along with the need for a solution at the earliest opportunity made the indicated problem a priority in the research.

1.4 Problem Cluster

The problem cluster gives a detailed overview of the issues leading to the action problem, which is the lack of data-informed decisions, while also identifying the relevant core problem.

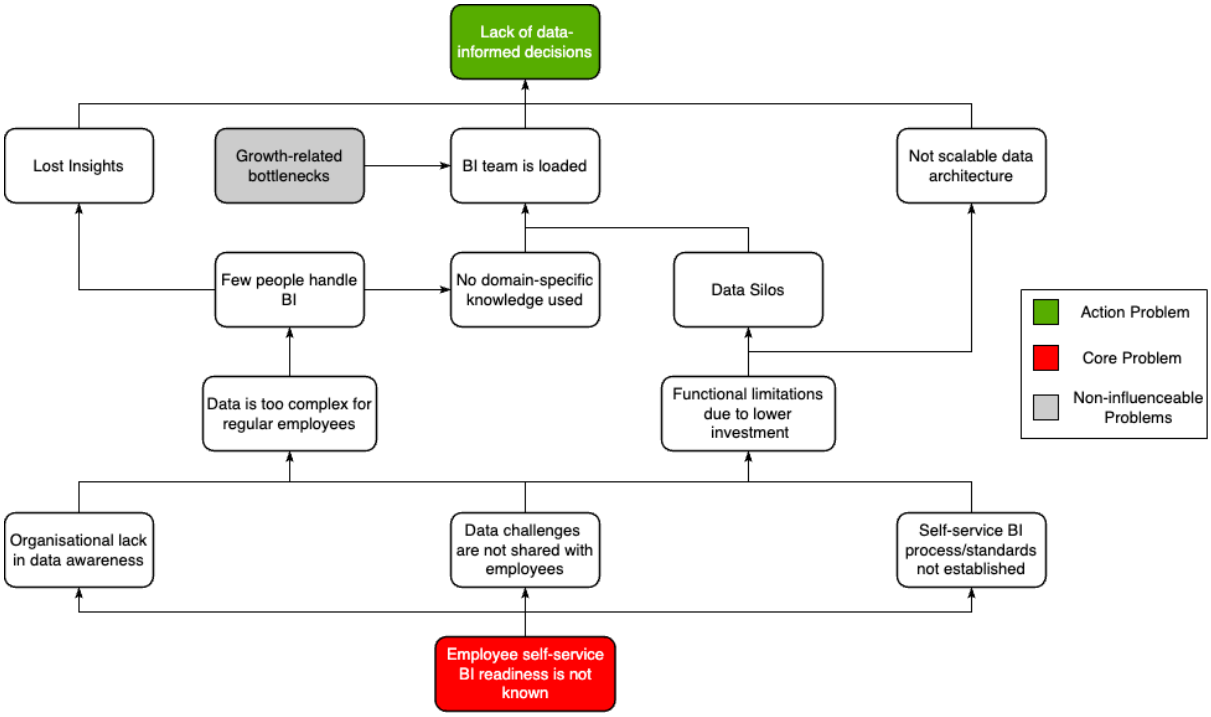

Figure 3. Problem cluster

There are several factors defining the selected action problem. As previously stated, lost data insights, overloaded BI team, and limited architecture directly affect the action problem. However, the situation is more complex. A major cause for the defined problem is that the company barely uses domain knowledge in data interpretation, despite having plenty of expertise in this field, as ParnasSys is a software development company. This results in an overload of the data team, as they are the only people involved in the process. A loss of domain knowledge means a loss of important experience-based information, which data analysts could have overlooked. This problem is not caused by a selected approach alone. Firstly, the current data organisation is complex, which is caused not only by the clustered

nature of the business line but also by the growth of data volume and diversity. This would make self-service BI time-consuming for a regular employee. Secondly, the available architecture brings limitations to data analysis and was initially set up to be used only by the BI team. Lack of standardisation and high number of teams create a problem of data silos, repositories being segregated and controlled by a limited group of employees, which hinders the data interchange (Carruthers, 2022). The architecture also lacks scalability, meaning that processing will get slower with data volume growth, and the system will struggle to adapt to new business needs and innovate.

One cause for these issues, as well as for a delay in deciding on self-service BI implementation, is uncertainty about employee interest and skillset to participate in data analysis. At this moment, the data team actively works with all the available data, providing reports that support decision-making and track the progress of most ParnasSys teams, yet the consideration of the data-based insights varies per department. Some teams pay more attention to data, which leads to data-informed decisions, while others prioritise past experiences or gut feeling over data. The reliance on data and possible resistance to changes in decision-making are the variables that the BI team can hardly measure. A possible indicator is the number of questions that a certain team asks about a report or dashboard, but it can be deceiving due to the lower data literacy of a certain team or function of a report.

Based on the context and identified problems, the core problem is: "*Employee self-service BI readiness is not known*". The core problem is selected for several reasons. First, the company lacks a clear understanding of how to set up self-service BI, which is closely related to employees, as they are the core users of the approach. Having a comprehensive overview of employee readiness will also generate knowledge on which tooling, governance, and communication are suitable in the case of ParnasSys, as well as provide an answer on whether the approach is feasible and more importantly, suitable for the company. Secondly, an improvement in understanding of employee data enthusiasm would elevate the business performance, even if self-service practices are not implemented. Finally, a better understanding of employees would have a cultural impact on ParnasSys, becoming one of the steps in an organisational change towards a data-aware company. All of the mentioned factors contribute to addressing the highlighted action problem, providing a base for short- and long-term increases in data-informed decision-making.

The problem can also be described as a gap between reality and perceived norm. While the current state of events and the desired improvement do not have a quantitative assessment, they can be explained using qualitative terms. At this moment, ParnasSys experiences a bottleneck in BI operations, which cannot be addressed using an alternative, self-service, approach due to a lack of information about employee readiness for this change. The company is looking to achieve a norm of having a clear overview of employee preparedness to use self-service BI. Additionally, the description of weak points and improvement plan are expected.

1.5 Research Question

Based on the selected core and action problems, the following research question has been identified:

"How can ParnasSys employee readiness for self-service BI be evaluated and improved?"

This research question aims to address the issue of employee readiness, which suggests looking at multiple concepts like technical skills, motivation, attitude, and understanding of data. The use of the term "readiness" recognizes a need for a holistic approach, as the overall impact is likely to be achieved only with multiple employee-related components being well-aligned. The research is further advanced by looking into the various improvement approaches, which can include not only employee-related changes, but also revision of current processes, tools, and policies, to benefit from current employee readiness. Summarizing, the research question logically breaks the research into two phases – the development of a procedure to evaluate employee readiness, and the creation of an action plan to improve the readiness. The improvement aspect logically expands the identified core problem, making this research more practical and actionable.

1.6 Knowledge Problems

The execution of this research is accompanied by a number of identified knowledge gaps that have to be addressed to achieve the goal. The sub-research questions aim to address those knowledge gaps and assist with breaking down the research question into steps. Outlining the questions also helps with the literature review, as the key search areas are known. Following, the questions are listed and explained.

1. Which employee groups that will be impacted by self-service BI exist within ParnasSys?

The first knowledge question aims to explore the existent stakeholders that will be affected by an implementation of self-service BI. As this research aims to assess employee readiness for a novel data analytics approach, it becomes vital to highlight the different types of employees available in ParnasSys, explain their perceived motivation and influence on the change, as well as mentioning their priorities and extent to which an addition of self-service BI will impact each group. Answering this knowledge problem involves performing a stakeholder analysis based on the interviews with the BI team, which would allow for a comprehensive overview of the perceived state of events, providing a sufficient context for the next stages of the research.

2. Which employee-related factors are important for self-service BI implementation?

The second knowledge question is intended to highlight the key employee-related enablers for successful self-service BI implementation. The factors will be obtained from the literature

and reviewed with the ParnasSys data team. This allows for a searching approach that makes use of available scientific knowledge, still tailoring it to the case of ParnasSys. Selected sources must focus on software development or similar industries, as this would account for the employee's knowledge of technology, the data analysis method in this case is content (more specifically, text) analysis. Having a sufficient answer for this knowledge problem will lay a foundation for answering the two following questions, as the priority focus points will be known.

3. How can employee readiness be evaluated and interpreted?

The third knowledge question is focused on the development of an approach to measure employee readiness. In this step, an employee survey based on findings in the previous knowledge problem will be conducted. The obtained data will be analysed using not just descriptive, but also more advanced methods to measure the quality of data and possible correlations. Further, putting the results in the ParnasSys context would allow us to perfectly understand the current state of events and pinpoint the most influential variables in terms of self-service technology implementation. This, in turn, will provide input for the indication of solutions that will be provided to the company. Answering this question will potentially generate knowledge useful for the other aspects of the change, namely tooling and governance perspectives.

4. Which self-service BI readiness improvement strategies exist, and which are relevant for the case of ParnasSys?

The fourth knowledge question looks at various improvement strategies that the company will make use of to improve employee readiness. Several improvement strategies will be obtained using a combination of literature and data team interviews, once again allowing for a combination of scientific and contextual knowledge. The solutions must not only include the approaches to improve employee readiness but also more general changes to adjust to the existent state. Each solution will undergo a data team evaluation on multiple factors to assess its feasibility.

A more detailed description of a research design and an approach to answering each knowledge problem can be found in a table provided in Appendix A.

1.7 Deliverables

The execution of this study will result in three key deliverables. These deliverables are achieved in three separate design cycles, whereas the last cycle is based on the findings of the first two deliverables. The deliverables are the following:

- An analysis of self-service BI stakeholders within the company, highlighting the employee groups and understanding their potential benefit.

- A selection of metrics to measure employee readiness based on relevant literature and interviews with ParnasSys BI team.
- Employee readiness assessment. Involving a collection of raw data (employee perception of technology), description of the data analysis, and visualization of findings to effectively communicate them to the company.
- Set of recommendations to address employee readiness. With the description of possible approaches.

1.8 Problem-Solving Approach

A crucial part of any research is the selection of a suitable systematic approach to its execution. This provides a structured roadmap to the research realisation, helps achieve effective findings, and supports validity and reliability. This research will follow a Design Science Research Methodology (DSRM) of Peffers et al. (2007). This section describes the approach itself and motivates its choice over the other methodologies.

According to Peffers et al. (2007), DSRM is a research methodology that focuses on the development of an artefact as a solution to a problem encountered. The six steps that the research method consists of are shown in Figure 4, a special attention here is dedicated to a clear definition of objectives that an artefact must have and the design of an artefact itself. DSRM also incorporates demonstration and evaluation stages, being an iterative approach with multiple design-evaluation-refinement cycles possible. As a final step in the DSRM, the findings are communicated. The research method is flexible and has different entry points, depending on the research motivation. In this case, the research entry point is "Problem-Centred Initiation", because the research is initiated by the ParnasSys BI team who observed a problem.

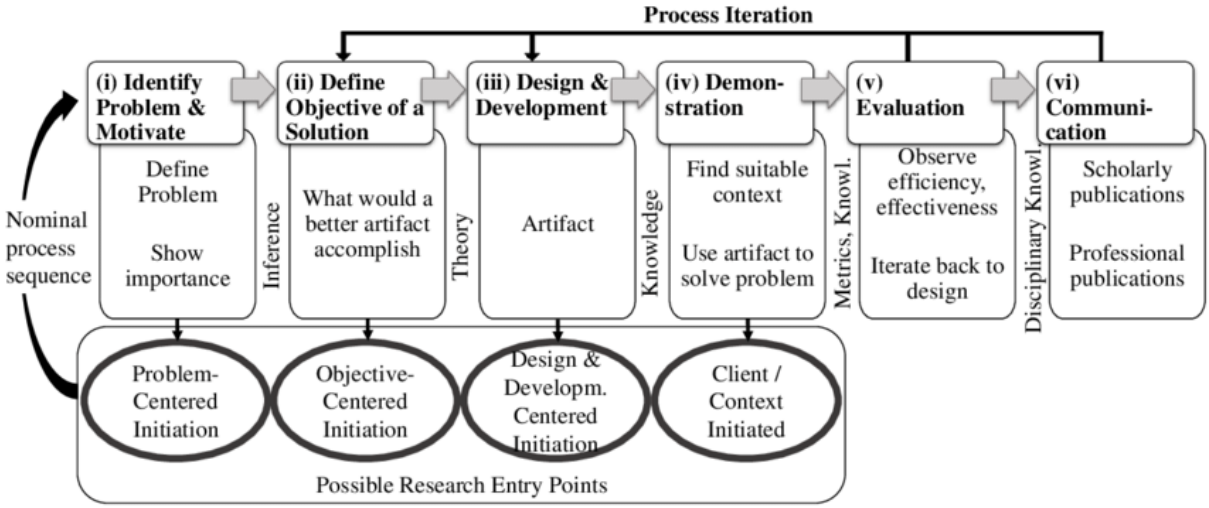

Figure 4. Design Science Research Methodology of Peffers et al. (2007)

The concept of an artefact in DSRM can vary from software to a framework depending on the needs, the main requirement is that it addresses the encountered problem. In their next research, Peffers et al. (2012) elaborated on the concept of an artefact, the literature research described in the article provided an overview of frequently selected artefacts as a part of research. Frequently observed artefacts are methods (non-algorithmic actionable instructions), models (a simplified representation of a company or process), and frameworks. This ensures the suitability of DSRM for this research, as an intended deliverable falls under one of the mentioned artefact types.

The DSRM approach was selected as the main problem-solving method for several reasons. First, it is specifically meant for research where the goal is to create a novel artefact and is widely used in the field of information systems. Secondly, it provides an iterative approach, which supports an adaptation of the design to the given conditions, in this case, to the BI readiness in ParnasSys. The Managerial Problem-Solving Method described by Heerkens and Van Winden (2021) was not selected over DSRM, as it provides a more general approach and is not designed specifically for artefact development. However, it would still fit for the research due to its versatility.

1.9 Validity and Reliability

To sufficiently describe validity and reliability, it is useful to define the perspective and researcher's understanding of these terms. According to Cooper and Schindler (2013), validity is the extent to which the selected methods measure what they were meant to measure, reliability focuses on the accuracy of the method execution.

A big part of the research is executed using qualitative data, more specifically, conducting interviews and a survey, which can often be subjective and affect the reliability of research findings. The two main validity issues that can occur when using these data collection methods are sampling and researcher bias (Brink, 1993). In this case, the sampling bias can occur due to a high number of interviews with data team members, who are more interested and knowledgeable of the data landscape than a regular employee. To reduce sampling bias, a diversity in a research sample with regard to type of job each employee has is ensured. A researcher bias can occur if the author designs the research and observes findings following his own beliefs. To eliminate this possibility, regular reflection and the use of several information sources is ensured. The latter approach is referred to as "triangulation" and can be used anywhere in the research to ensure validity (Brink, 1993). To ensure reliability, the sample per data analysis method will be maximized, this will reduce randomness.

1.10 Summary

Summarizing, the goal of the research is to evaluate and improve employee readiness for self-service business intelligence. The research goal logically leads to the selection of three following deliverables: selection of metrics relevant for measuring employee readiness, employee readiness assessment based on a survey, and a set of literature-based recommendations to improve this readiness. The deliverables will be achieved by conducting two separate DSRMs and creating two artefacts. For each artefact, several DSRM cycles (design, demonstration, evaluation steps) will be performed to ensure the optimality of the design.

2. Contextual Information

This section explains the important contextual information that is needed to expand the problem description and lay a foundation for answering the selected knowledge problems. The provided context focuses on describing the departments present in ParnasSys, summarizing the tasks that the BI team has, and analysing each stakeholder within the company. The stakeholder analysis includes the creation of separate stakeholder groups followed by an explanation of their priorities, specific features, and the role that the problem owners (BI team) give to each group. The outcome of the stakeholder analysis answers the first knowledge problem: "*Which employee groups that will be impacted by self-service BI exist within ParnasSys?*".

2.1 Departments

To provide a better explanation of this case, an outline of the departments must be provided. The graph below describes the actors involved in data analytics and correspondent data sources.

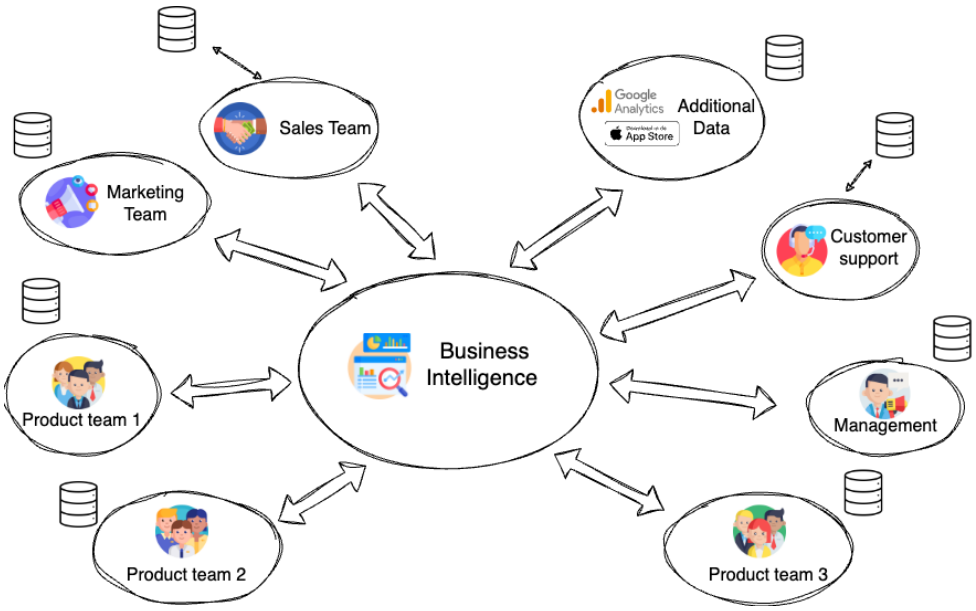

Figure 5. Data sources within ParnasSys

As shown in Figure 3, ParnasSys indeed has a clustered data organisation, which complicates the task for the BI team. Several departments are responsible for general operations within the company, those are marketing, sales, management, customer support, and user experience. Product teams are busy developing and supporting separate applications within the business line. There are six product teams, even though the graph only depicts three, this is done for conciseness. Within this structure, each team has their database, sometimes using alternative data software. For example, Sales and Customer Support use software that offers automatic reporting independent from the BI team. The company also makes use of available analytical data: Google Analytics, App Store, and specifically tracked website interactions.

Each department has a different starting point in data knowledge. An intuitive example is any of the product teams, which mostly consist of software developers. The available technical knowledge base of such a team would allow for a use of a more advanced self-service BI interface, leaving more freedom for the employees, and potentially minimising the amount of questions that may arise. At the same time, a department with less technical knowledge, for example, marketing would probably have a longer adaptation period, using simpler functionalities and needing more support throughout the process. This deviation, as well as difference in impact that data could have on the work of a department, also lead to a companywide difference in data usage motivation and interest.

2.2 BI Team Tasks

Considering that using data to inform decision-making is a relatively new practice within ParnasSys (the BI team was established two years ago), the scope of the BI team functions goes beyond the traditional responsibilities. Following, the list of usual BI team tasks is established and explained. Additionally, the feasibility of the self-service approach introduction for each type of responsibility is provided.

New dashboards

Certainly, the main, yet not the most time-consuming task is the creation of new dashboards for decision-making. This primarily involves a close collaboration with the report recipient, to ensure that the requirements are understood and can be implemented. Another important aspect of the task is the creation of understandable visualisations within the dashboards and a clear communication of what the dashboard measures. The amount of time needed, and the complexity of the task often depends on the department (or an employee) requesting the dashboard. Moreover, the enthusiasm of a recipient may increase the complexity of the tasks, as more advanced insights would be requested.

New dashboards can be divided into two types: management-facing and operational. The first type corresponds to the dashboards having a higher impact on decision-making, requiring higher precision and insightfulness. An example of such a dashboard could be a dashboard to evaluate the current marketing strategy. The second type is the dashboard designed to support everyday operations when a certain value or trend needs to be obtained. For instance, customer service wants to measure the number of calls on a specific issue, as they have a perception that they have increased over the last week.

Both types of dashboards can potentially be created by regular employees. However, the management-facing dashboards require a higher understanding of data and skill to obtain the needed insight. This is simply caused by a higher organisational and financial impact of each dashboard-based decision. On the other hand, operational dashboards occupy a bigger part of the BI team's work, even though the task is simpler. Therefore, the self-service BI approach is expected to be implemented and benefit the second dashboard type.

Maintaining dashboards

Another time-consuming activity for the BI team is dashboard maintenance, this primarily includes updating data, ensuring content relevance, and minor fixes to improve the usability and performance of the dashboard. An example of such activity would be the service desk requesting an update of the value “number of calls”, as they only have the number for the last year and want the most relevant information. This and similar issues could be easily addressed by employees themselves even with the most basic knowledge of BI.

According to the talks with BI team representatives, the maintenance activities are the ones that are expected to be done with a self-service approach. Many of such activities require rewriting a single SQL query or adjusting a filter, in case BI tooling provides such a feature. Even though these requests are simple for a data analyst, having several requests from each department would create an impressive backlog. Therefore, dashboard maintenance is expected to be decentralized.

Annual reporting

This category of dashboards is highlighted separately, as annual (or monthly) reporting includes the BI team looking at a larger picture of the company, providing not only important management-facing reports but also provides the departments with general performance reports. These reports require a high knowledge of data and a skillset to make insightful conclusions. This is primarily because of the higher attention and impact of the report itself.

Therefore, the annual reporting is not expected to be done using a self-service approach. This is also supported by the fact that these reports are needed less frequently. An important addition is that there is close contact with the department representatives during the creation of annual reports, this ensures the use of domain knowledge.

Organising data

Apart from creating reports, the BI team also focuses on the collection and integration of data, ensuring that all the available information is used and structured to allow its smooth usage in reporting. This creates a notable workload for the team, as the current data landscape remains clustered. Introducing a self-service approach would set a new challenge for the company, primarily due to the data landscape being too complex for a regular employee to use. However, this issue lies outside of the research scope and could be addressed after a decision to go for a self-service approach.

Tooling and BI initiatives

Finally, a big part of innovation and development in data lies on the BI team. This includes researching, testing, and pitching new tooling or approaches to the management. An example of this work area is an initiative to start research on self-service BI feasibility.

2.3 Stakeholder Analysis

Having numerous employee groups brings variability in employee readiness throughout the organisation. In this section, a stakeholder analysis is conducted to group stakeholders as the researcher sees fit for the case, analyse their influence and interest regarding self-service BI, and elaborate on the specific features they have.

Stakeholder analysis theory

Groups that can influence the organisation's behaviour, processes and decisions are called stakeholders (Cornelissen, 2020). Analysing them is a crucial step in any research that studies the implementation of new technology, as it is a universal tool that helps to define the needs, obstacles and opportunities of those who will be using the novelty. Gathering and analysing stakeholder data creates an understanding of how particular decisions are made and how one can potentially influence them in the researched context (Brugha, 2000). According to stakeholder theory by Freeman (1984), a company is made up of many groups that have connections with one another meaning the analysis also determines which departments have more relevance to the implementation process. So, to create a proper environment to introduce new systems for process optimisation, the researcher chose to indicate stakeholders by conducting a set of interviews.

Stakeholder Identification

Throughout the research, the method of interviews is one of the main sources of information, which is also the case for stakeholder identification. During the interviews, the BI team of ParnasSys were asked to rank stakeholders supposed by the researcher. The BI team participants identified two ways to categorise the stakeholders: broad and narrow. Broad stakeholders included: BI, Management, Data Enthusiasts and Non-data enthusiasts. The narrow category represents each department existing in ParnasSys. These two will be looked at as the main stakeholders for this research, keeping in mind that the defined categories are internal stakeholders only. The external stakeholders are not studied here, as they are out of the research scope, and it is hard to track their behaviour towards self-service technology implementation.

Power-interest grid

Research by Ackermann and Eden (2011) proposes and describes the power-interest grid as a primary tool to effectively assess and position stakeholders within a company. During the conducted interviews the ParnasSys BI team was asked to plot previously identified stakeholders on the power-interest grid. It was also indicated that the same tool is used by product owners within the company. In this context, the concept of power refers to the positive effect that a certain stakeholder group has on the implementation of self-service BI. The concept of interest is associated with the degree of enthusiasm towards the technology. The latter aligns with the goal of the research and allows for a BI team company assessment as one of the research inputs.

Following, the aggregated stakeholder analysis answers are provided. For simpler representation, the stakeholder groups are assigned to a number (Table 1).

First grid	
1	BI team
2	Management
3	Data Enthusiasts
4	Non-data enthusiasts
Second grid	
1	Software development
2	Service desk
3	Marketing
4	UX
5	Product owners
6	Team leads
7	Sales

Table 1. Stakeholders assigned to numbers

The stakeholder categorisation approaches are shown in two separate grids. The left grid represents the broad, and the right one represents the narrow stakeholder groups. While the precision of each stakeholder coordinates may have less significance for this research, an important factor to consider is the quartile in which each stakeholder lies.

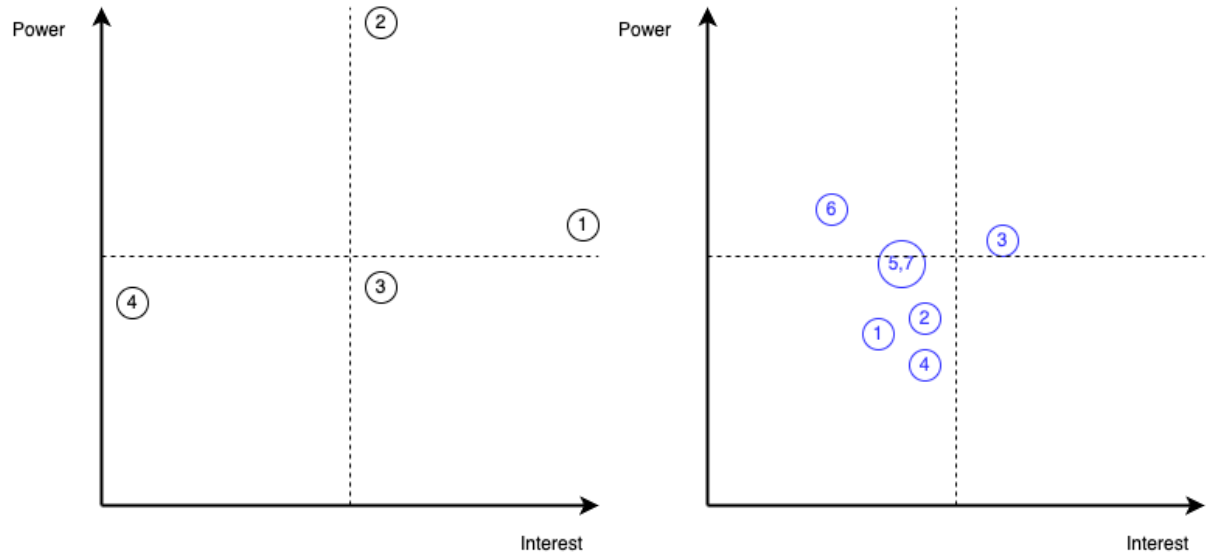

Figure 6. Self-service BI stakeholders on power-interest grid

Stakeholder analysis conclusions

Based on the self-assessment and the talks with the BI team, several conclusions can be made. Firstly, most job families within ParnasSys were placed in the left part of the grid, meaning a low perceived interest. An exception is the marketing team, which is explained by the nature of the field in which the team is operating. In the marketing field, the behavioural intention of the customer can be predicted with more ease, using historical data, which sparks employee enthusiasm. The other job families that frequently require reports are sales employees and product owners, yet the perceived interest in their departments is lower. The indicated potential beneficiaries of the self-service BI are UX designers and product owners, as they frequently need custom reports, which could be created independently.

Secondly, a more general view of the stakeholders shows that the BI team, being the interested stakeholder, does not have a high power in deciding on the self-service approach adoption. The main decision-maker, the management team, has a medium interest, which is mainly driven by the effectiveness that the novelty brings to the table. An important insight is that data-enthusiast employees, whose interest in the new approach is still viewed as a medium, have a higher power and can act as enablers. This is supported by the fact that the self-service approach is not expected to be implemented for every employee within ParnasSys, but only for several users per team.

3. Relevant Literature

In this section, a theoretical basis for the research is described. It highlights the key concepts, methods, and theories that shape the research design. Moreover, this research is put in the context of a larger organizational change, which certainly includes the implementation of self-service BI. This explains the position of employee assessment in new technology implementation, and the benefits and limitations that this step has. Additionally, the second knowledge problem "Which employee-related factors are important for self-service BI implementation?" is answered, providing a literature-based explanation of what self-service BI is, comparing it to the traditional approach, and highlighting the key employee-related challenges that need to be assessed and tackled for successful implementation of the novelty.

3.1 Readiness Assessment Role

The newly adopted technology can often appear to be unreliable and have negative post-adoption effects, resulting in low usage of the recently installed novelties (Dube et al., 2020). Employees are used to their old systems and may be unwilling to use the newly implemented tools, such as self-service, as they are afraid it will interfere with their established processes or they can make a mistake while using it (Kankanhalli, 2016, as cited in Dube et al., 2020). Another important factor specific to employee self-service technology, a reduced motivation due to deviation from their everyday job responsibilities and the need to do extra work (Marler et al., 2009). To avoid this and many other underlying employee-related problems, assessing employee readiness is a crucial step before self-service implementation. Employee readiness as defined in research by Shah et al. (2017) is a construct referring to the extent of employee's beliefs, intentions, and attitudes towards a need for an introduced change.

Assessing the readiness in the BI area includes two key factors: analysing the risk by knowledge gap extraction and the needed steps to fill these gaps for a successful system introduction (Hejazi et al., 2016). Hejazi et al. (2016) also define those gaps as a lack of readiness even with the efforts that were put into the implementation process. An important consideration in that regard is mentioned in research by Nasution et al. (2018). The author argues that measuring employee attitude towards technology is vital, as it shows that a negative attitude will hinder the quick adoption of new technologies. Lai and Ong (2010) and Gärtner (2013) agree that creating an innovative culture within the organisation is another consideration of the readiness assessment, as it allows for better adoption of change and can work as a long-term effect of adding more value to experimentation in the company, as well as it can be a single time case.

Summarising, an assessment of employee readiness allows for quicker adoption by the employees and a smoother implementation of the technology in general. The key steps in assessing readiness would include identifying potential areas of risk and addressing this risk, which supports a selected design for this research.

3.2 Data-Driven Culture

An important construct within this research is data-driven culture. The problem owner does not only see a practical need for business users to independently analyse data. Another driver for the innovation is understanding the company's maturity to use data for decision-making and creating the data culture. To clearly understand this side of research, the aforementioned concept and its success requirements need to be described.

The general definition mentioned by Duan et al. (2020) describes data-driven culture as a collection of behaviours and practices that prioritise understanding and usage of data as one of the key success factors for organisational performance. Another definition states that being data-driven means effectively using data to advance in decision-making (Davenport et al., 2010, as cited in Storm and Borgman, 2020). The importance of data-driven culture is widely accepted, highlighting it as an undeniable success factor in taking data analytics to a level at which a competitive advantage is obtained (Chatterjee et al., 2021; Duan et al., 2020). The development of a data-driven culture within an organization is a complex transformation journey, in their research Storm and Borgman (2020) outlined the four maturity phases of change processes, which were applied to a data-driven culture transformation. Based on a description of each stage, the ParnasSys is currently in the second stage in terms of data-driven culture. This stage is characterised by the change happening within separate projects, with several individuals acknowledging the problem and need for change. This, however, does not suggest a companywide problem acknowledgement. According to authors, an important success factor to allow a transition from single cases to a more comprehensive approach would be a clear strategy and vision from the management. From this perspective, an assessment of employee readiness, which can be used as an input for the data strategy selection, becomes a crucial artefact.

3.3 Self-Service BI

This research is built around the concept of self-service BI. Therefore, it is crucial to provide a literature-based definition and a list of features that are specific to the concept. A common definition for self-service BI is an approach to data analytics which allows less knowledgeable users to perform their own data analytics, less referring to BI analysts (Alpar & Schulz, 2016; Lennerholt et al., 2018; Michalczyk et al., 2020). The cited sources also agree on the nature of a need for this approach, an increased volume and demand for analysis of operational data within enterprises. While being simple to understand, the concept of self-service BI includes several aspects, which need to be well developed and aligned to ensure the sufficient results of the approach. In their research, Michalczyk et al. (2020) highlighted the three key perspectives on the approach: technical solutions, user acceptance, and the need for effective governance. An important consideration is that the concept of self-service BI does not have a general list of requirements that need to be achieved within each perspective, each company decides on the complexity and level of self-service BI implementation. The research by Alpar

and Schulz (2016) described the three different levels of self-service BI implementation, highlighting a dependency between the features that the system has and user self-reliance.

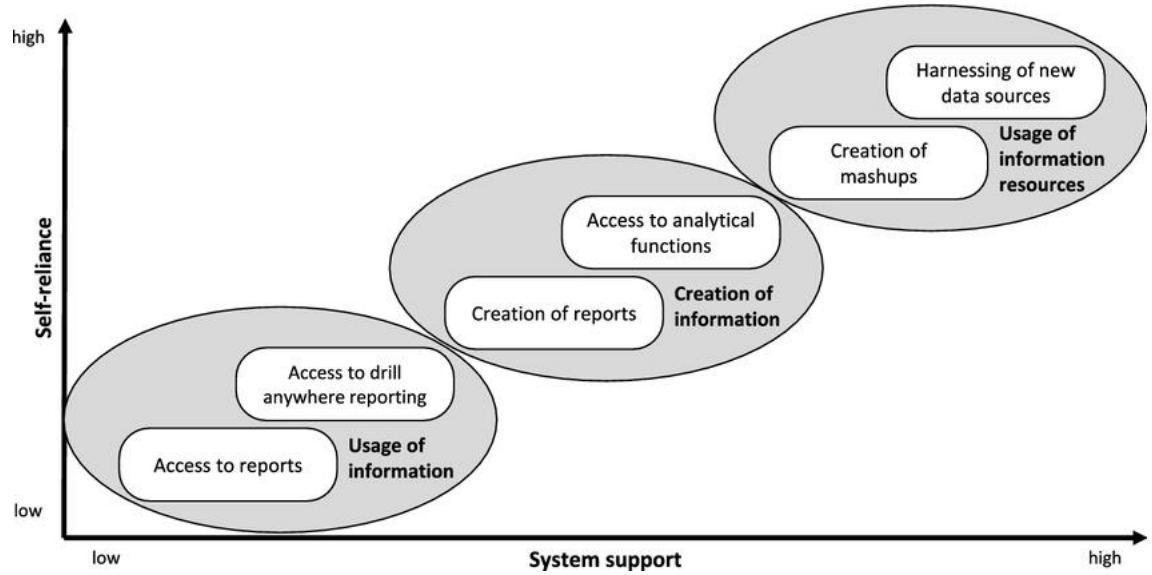

Figure 7. Levels of self-service BI by Alpar and Schulz (2016)

While the various features of the self-service BI tooling are outside of the scope of this research, an important consideration that Alpar and Schulz (2016) bring is that the complexity of self-service can vary from the usage of templates previously created by power users to the creation of reports and even free use of data.

3.4 Self-Service BI Enablers

With self-service BI recently becoming a popular practice within both medium and large size companies it became evident that the implementation of self-service approach does not always bring the expected result. On the contrary, it can become a disruptive technology, wasting the enterprise's and its workers' money and time (Schlesinger & Rahman, 2015). The key reason for this is the variety of factors that must be considered and aligned to enable a smooth transition. As a result, numerous works on self-service BI enablers, critical success factors, and challenges were written. Within this section of the literature review, a general overview of those enablers will be provided, not just focusing on employee-related factors but viewing other factors as possible influencers of employee motivation.

When looking at self-service BI enablers, a different classification of the affecting factors is provided by each study with some of them having overlaps. For example, research by Mauludina et al. (2023) features a division of affecting factors into three perspectives, namely user, technology, and organisational. A study by Lennerholt et al. (2020) split the challenges into user self-reliance, report creation, and education. A similar study by Pałys and Pałys (2023) defined data access and usage as a separate group of factors, highlighting its importance. While the classification of the enablers can only provide a general feeling about

the importance of the enablers and can also be highly dependent on the author's perception, an analysis of the specific factors provides a better overview of their significance. Below, a table with the mentions of the enablers within the analysed sources is provided.

Source\Enabler	User Education	Support	Data Access	Suitable tooling	Organisational strategy	Employee interest
Mauludina et al. (2023)	X	X	X	X	X	
Lennerholt et al. (2020)	X	X	X	X		X
Pałys and Pałys (2023)	X	X	X	X	X	

Table 2. Mentions of self-service BI enablers

As shown in the table, all three sources align in the importance of employee support by the BI team, data being easily accessible, user education, and usable tooling. These factors only summarize a small part of self-service enablers. However, they directly influence the employees and their experience using the new approach. Therefore, these factors need to be taken into consideration when assessing employee readiness and expectations.

3.5 Technology Acceptance Models for BI

Another approach to understanding the employee-related drivers for self-service BI is looking at various technology acceptance models. These models provide a more general overview of how the intention to use certain technology is formed and can be used in various fields, including BI. This section of the literature review looks at the two examples of such models: the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), as well as examines the various cases of their implementation in the field of BI.

The TAM was proposed by Davis (1989) and became the most popular model for investigating variables that affect technology acceptance by users (Marangunić & Granić, 2014). The model introduces the two key factors affecting the intention to use the technology and the actual usage of the system. The mentioned variables are ease of use and usefulness of the technology. Over the decades that the model exists, it has been modified depending on the use case of the model. The final model is displayed in Figure 6 (Venkatesh and Davis, 1996, as cited in Chuttur (2009)). One application of TAM is in the field of BI technology, the works by Bach et al. (2016) and Bach et al. (2017) focused on expanding the classic TAM by adding new external variables, which enable the needed context. While not particularly useful for this research, the works on the extension of TAM show its weak point — a too general nature with a limited number of variables measured. The use of classic TAM would not allow for covering a higher amount of contextual and behaviour-related factors that are needed for this research.

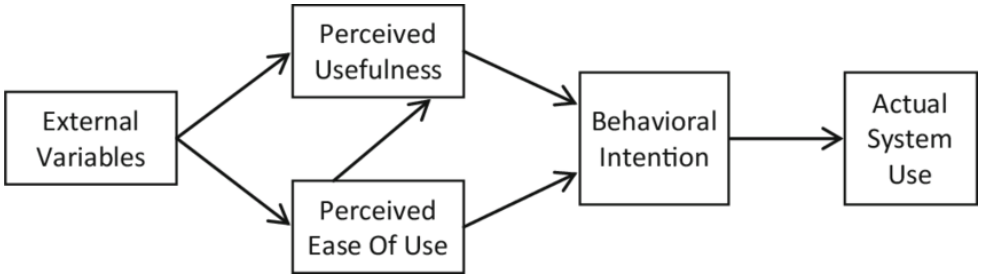

Figure 8. The final version of TAM (Venkatesh and Davis, 1996, as cited in Chuttur (2009))

This leads to the investigation of the more extensive acceptance models. One example is UTAUT, the model developed by Venkatesh et al. (2003) to come up with a single approach to measuring user acceptance. As a result, a combination of eight different models (including TAM) was derived, resulting in a better explanation of use behaviour variance (Venkatesh et al., 2003, as cited in Dwivedi et al., 2017). The integration of different models allowed to take a step back from the psychological perspective that TAM had and incorporate the social context. Apart from expanding the amount of variables, adding social influence and facilitating conditions, UTAUT supplemented the previous models with several moderators, an initial UTAUT can is shown in Figure 7.

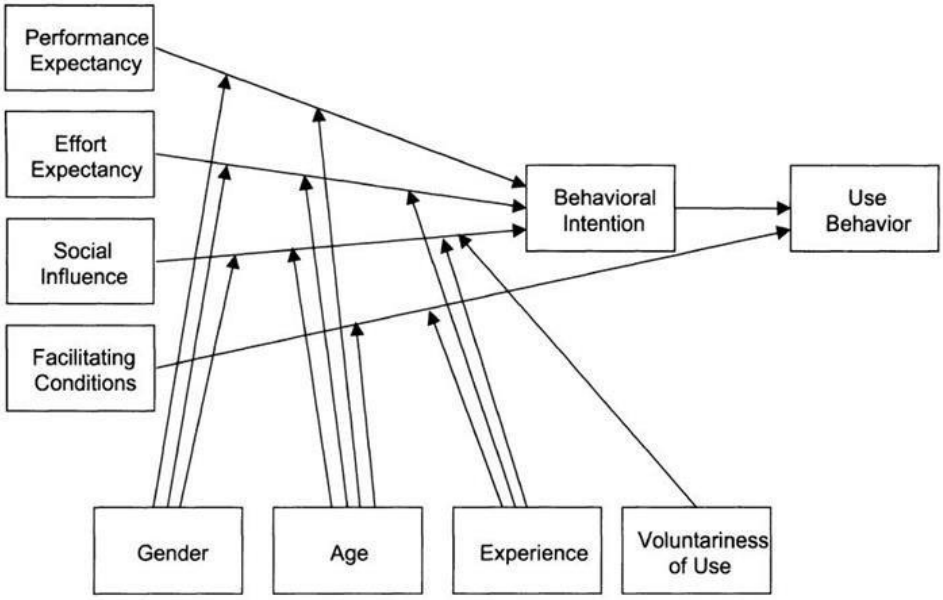

Figure 9. Original UTAUT (Venkatesh et al., 2003, as cited in Dwivedi et al., 2017)

Even though UTAUT is seen as an advancement compared to TAM, the nature of the model brings a few limitations that need to be considered when applying the theory. The moderators and relationships are still highly dependent on the context, which explains the frequent adjustments of the model, reviewing or dropping the variables (Dwivedi et al., 2017). Another consideration that needs to be acknowledged within this research is that the model provides

a static picture of the situation, not considering the future dynamics of technology use. This leads to a need for constant measurement of user acceptance and reconsideration of the model.

3.6 Summary

To conclude, this literature review looked at a variety of concepts relevant to the research topic, ranging from contextual knowledge (readiness assessment role and data-driven culture) to directly addressing one of the knowledge questions based on literature ("Which employee-related factors are important for self-service BI implementation?"). The literature research used two approaches to determine which factors need to be considered: enablers specific for self-service BI and a more general approach, looking at technology acceptance models. The literature review highlighted user education, support, data accessibility, and tooling as the most influential factors. Additionally, the variables of UTAUT are the key metrics that can be used to evaluate the employee perception of the proposed technology.

4. Methodology

This section describes the procedures used to obtain the intended deliverables, providing a selection of metrics that the research will use to measure employee readiness and explaining the selected assessment method. The main objective is to outline the selected data collection method, the design decisions, and the statistical approach to analysing data. Having a clear definition of the steps taken to obtain the results commits to the research's integrity, therefore increasing its reliability.

4.1 Theoretical Model

The first step in assessing the ParnasSys employee readiness would be a definition of the specific aspects that are expected to influence the acceptance of self-service BI. As was described in the literature review, there are two general approaches to understanding these aspects. The first one would be looking at technology-specific aspects, while the second one would be focusing on general technology acceptance factors, based on UTAUT. The combination of aspects highlighted in a literature review is listed in Table 3.

Self-service BI aspects
1. User Education
2. User Support
3. Data Access
General technology acceptance aspects
1. Performance Expectancy
2. Effort Expectancy
3. Social Influence
4. Facilitating conditions

Table 3. Selected factors

An observable change in comparison to the literature review is the exclusion of the tooling as one of the studied metrics within the research. This is influenced by several factors: an obvious positive effect that the interface has on user acceptance, high dependence of the potential self-service tooling on the traditional BI features, and the improbability of changes in tooling at the point of the approach suitability assessment. Therefore, the aspect of tooling was left for the future stages of self-service BI adoption. All the other aspects were kept, perceived as the ones that can directly affect the technology use motivation within the company. An example that may need explanation is data access, having a problem with granting access to certain information (or locating where this information is) consumes employee time, affecting interest (Lennerholt et al., 2020). The UTAUT moderators (Gender, Age, Experience, Voluntariness of Use) are also considered but are only used for the general descriptive statistics and demographics. These values are not used as moderators to simplify the model and prioritise the main aspects, the number of which increased compared to UTAUT.

Having the aspects outlined, a theoretical model can be formulated, see Figure 8. This is done to understand how each of the selected variables affects the intention to use the technology, which in this case corresponds to readiness. The selected model is based on a UTAUT but expands it with the aspects related to the context of self-service BI implementation. One important difference is the removal of the use behaviour variable. This is natural for the research, as the technology was not yet implemented. Additionally, the goal of the research is to understand how employees feel about the possibility of implementing self-service BI, which can be perfectly summarised by a variable behavioural intention.

The model incorporates three self-service BI-related aspects as facilitating conditions, creating additional knowledge on how those aspects may affect the use of the notion. However, it is important to note that this research outcomes are only true for ParnasSys and its context and should not be directly applied to the other cases. Similar research in the case of BI was done by Kašparová (2022), verifying the UTAUT effectiveness with a slightly larger sample than available in ParnasSys and not including technology-specific variables.

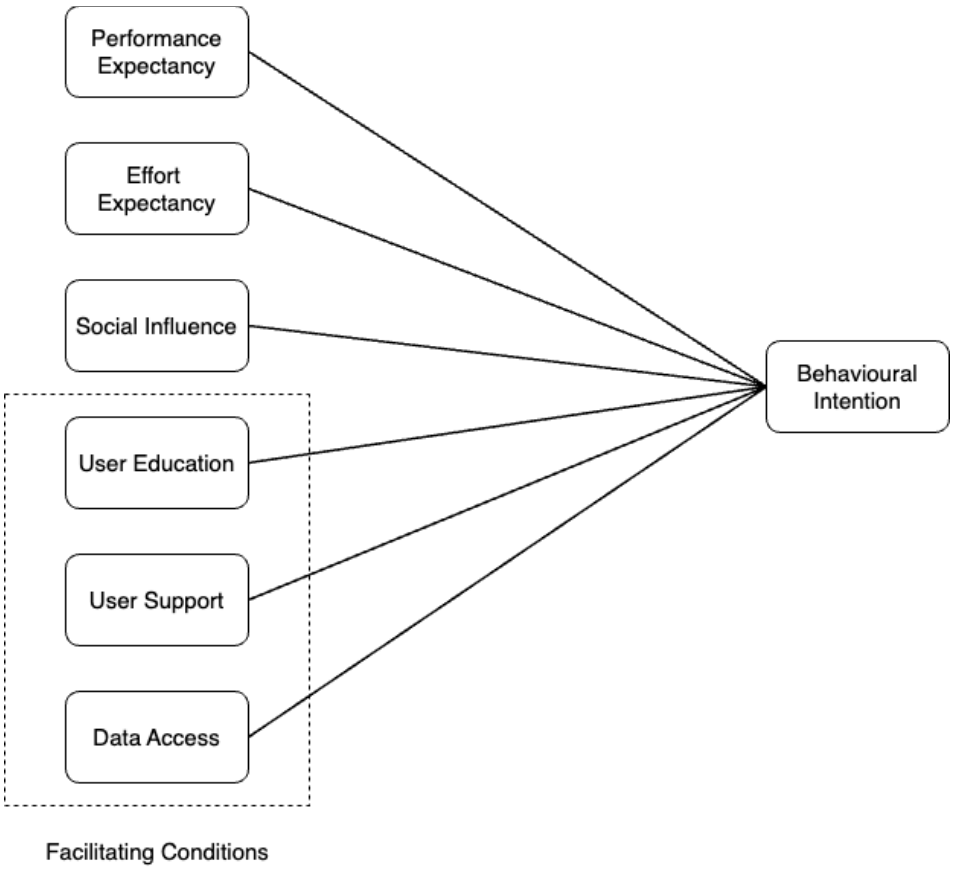

Figure 10. A theoretical model derived for this research

4.2 Data Collection Method

To collect the required employee opinions, a companywide survey was launched. The use of this data collection method is motivated by several factors. First, a self-administered survey allows for an efficient data collection, reaching the participants that would not be able to an interviewed due to time or geographic constraints (Cooper & Schindler, 2013). This aspect is particularly relevant for the case of this research, as it must be executed in a limited period. Secondly, the anonymity and standardisation brought by the method are important factors, mitigating the possible bias. Of course, the method has its downsides, not allowing for an intervention and complexity. This problem was addressed by adding several open questions, ensuring that relevant details could be provided. Cooper and Schindler (2013) also mention the possibility of a low response rate, which is a common problem for this method. This aspect was previously discussed with the BI team, who communicated the expected number of responses during the stage of selecting a data collection method. The method of surveys was also adopted due to being a primary data collection approach in studies adopting UTAUT. Venkatesh et al. (2003) set up a questionnaire in their work where the UTAUT was defined. The later works, which aimed to expand the models, as aforementioned Kašparová (2022) also used the method, leading this research towards developing a survey to assess the influence of the selected factors on the expected behaviour.

4.3 Participants

Even though the self-service BI is not likely to be used by every employee of ParnasSys, a survey aimed to collect all the available opinions. The only employee group that was not included was the BI team, as they are particularly interested in data and will not be the users of self-service BI. Another driver for this was the participation of BI team members in survey design. To ensure the inclusion of all the job-specific aspects, a goal of obtaining a response from each job family was set. This was achieved by separately sharing the survey to internal communication channels and reaching out to specific employees.

A weak point in this research data collection is the sample size, as ParnasSys only has roughly 80 employees. Considering that the response rate will in any case be far from 100%, this poses an issue of statistical significance of the found results. For example, a general rule of thumb suggests having a sample size more than ten times larger than the number of links within the model (Barclay et al., 1995, as cited in Kašparová, 2022). This would mean that a minimal number of responses to obtain a statistically significant result within this research would be 60, which is realistically impossible. This brings several important considerations for the research. The findings within the research may not have a high statistical power, resulting in a lower generalisability, especially for the scenarios where a larger sample is studied. While some of the advanced statistical tests may not be available, a wide range of approaches do not require a high sample size, including descriptive statistics. Finally, as the sample size problem is acknowledged and effectively addressed, for example by consulting with other sources, the research remains valid and reliable.

4.4 Survey Design

When selecting an optimal design for a survey, the following three key aspects were highlighted: survey length, coverage of the selected variables, and availability of the open questions. The latter allows for a deeper insight, reducing the gap with the interview method and allowing the production of qualitative data, which also plays an important role in understanding employee readiness. Moreover, having open questions may help detect other aspects affecting the employees specifically in the case of ParnasSys and generate potential solutions. The survey design was done using DSRM methodology, executing two design, demonstration, and evaluation cycles with BI team members and one employee volunteer reviewing the preliminary versions of a survey.

Within the first design cycle, the first decision was to include two questions for each variable, this would enable a holistic view of each variable, discussing more than one of its aspects and removing bias, while keeping a survey concise. To measure the variables, a ten-point Likert scale was selected, as it allowed for easier data analytics. Additionally, several demographic and open questions were added. The first version of the survey can be seen in Appendix B.

After reviewing the first version of the survey, a few fixes were offered. Firstly, it was suggested to reconsider using the ten-point Likert scale, and approach this aspect not from a data analysis, but from a respondent quality perspective. Secondly, the survey needed to consider the unfamiliarity of the concept, both adjusting some of the questions and providing a general explanation of the self-service BI concept and research purpose. Finally, a few questions had to be reviewed, as the UTAUT variables were incorrectly interpreted. While the last two aspects could be immediately changed, the Likert scale needed to be reviewed based on relevant academic literature. Research by Taherdoost (2022) discussed the Likert scale in the context of surveys, looking for an optimal response range. According to a range of studies that the author mentions, the length of a rating scale affects the response preference, as well as the research validity and reliability. In his research, Taherdoost (2022) found the seven-point Likert scale to be optimal. This fact is also supported by the ParnasSys BI team, as previous surveys launched within a company included a similar scale.

The second design cycle focused on creating a clear survey description, which was shortened and placed at each new page of the survey after an additional feedback round. This was done to ensure that the respondents can refer to the description before answering each new question. The final version of a survey, as well as a brief self-service BI description, are provided in Appendix C. The survey included an opening with three questions focused on understanding its demographics, and two questions for each of the variables mentioned in the theoretical model, namely Performance expectancy, Effort expectancy, Social influence, User education (knowledge about self-service BI in this case), Data access, User support, and Intention to use self-service BI.

4.5 Data Analysis Method

Being the first stage of BI implementation, readiness assessment is very dependent on qualitative data, as it requires analysing the future user's opinions and intentions. A survey was conducted to collect a sensible dataset that would allow for analysis, so a mix of methods that include quantitative means was applied (Kalpokaite & Radivojevic, 2019). The quantitative part of the analysis, however, is descriptive and does not look at calculating the statistical significance of the findings. This study aims to explore the factors that affect employee readiness, so it is centred on finding relationships between the studied factors, their strengths and vectors. Data is also analysed by interpreting the interview findings by highlighting specific mentions and looking for similar patterns within the employee feedback on the topic.

To see how each derived factor influences behaviour intention, descriptive statistics and the Speramans correlation coefficient are used. The chosen methods organise survey data in a useful way and allow for a description of the findings without any testing (Kalpokaite & Radivojevic, 2019).

Descriptive statistics were used to summarise the data and make data visualisation possible. The latter is particularly important, as the final step of this research is providing future recommendations for the company. Measures such as average, average use behaviour per department, and demographic statistics were calculated using the data collected from the survey. These statistics visualise central tendencies of self-service employee perception within the company.

According to Hauke and Kossowski (2011), the Spearman coefficient is a good fit, since it allows for the analysis of ordinal data (Likert scales were the main source of numerical data in this study) and the strength of association between the studied factors. According to the same author, Spearmen's correlation is used to describe relationships between the factors and is not focused on the frequency or linearity of the relationship. The small sample size of 40 participants also advocates for the lack of statistical testing. In order to understand the whole picture of the associated strength of the found correlations between one another, a correlations matrix is created. That approach amplifies the ranking of Spearmen's correlation.

In addition to the mentioned computations, the researcher understands the need for reliability even in a study with a small sample. Therefore, the Cronbach's alpha was calculated as a measure of reliability of the used survey as a research tool, so that it allows for replication in future studies.

Synthesised integration of those data analysis methods allowed for a detailed description and interpretation of the findings, resulting in thorough implementation recommendations and valuable insights on the topic.

5. Results

Within this research stage, the outcomes of the selected data analysis approach are provided. This includes calculations, numerical results, and their interpretation. More specifically, assessing the selected scale reliability using Cronbach's Alpha, explaining employee feelings towards self-service BI, describing the respondent population, and finding correlations between the highlighted variables using Spearman's rank correlation coefficient. Additionally, frequent and insightful open-question responses will be provided, ensuring that employee's extra input is reviewed, as qualitative information has the potential to bring insights into this research.

5.1 Cronbach's Alpha

The calculated Cronbach's Alpha allows an understanding of a scale's internal consistency, which explains if the same construct is measured in this survey questions (Tavakol & Dennick, 2011). Finding Cronbach's Alpha involved using a sum of variances per question, a variance of total scores per respondent, as well as the number of questions. The formula for calculating Cronbach's alpha is provided below.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k}\sigma_y^2}{\sigma_x^2}\right)$$

The calculation resulted in Cronbach's alpha being 0.704, meaning that the selected scale is reliable. According to Tavakol and Dennick (2011), Cronbach's alpha value should be between 0.7 and 0.95, ensuring the interrelatedness of the questions. The designed survey meets the requirements but is extremely close to the lower border of acceptable values. This can be described by two aspects, which are both relevant to this research, a low number of questions and the fact that a survey is newly created and might need several revisions.

5.2 Descriptive Statistics

Having a small sample size, which does not allow for a precise advanced statistical analysis, descriptive statistics become a usable tool. Within this part of the results section the findings on survey demography, average values per variable, and average interest per job family. The latter is especially relevant for self-service BI, as its implementation may not take place companywide, with only several departments needing the approach.

The first finding would be the number of respondents to a survey, 43 employees filled in the survey, with only 41 answers being selected as complete. The main criteria for removing an answer were a provision of the same answer for each question and ignorance of open questions, which indicated that the respondent did not fill out a survey. The response rate for the survey was roughly 50%, indicating a moderately high interest in the topic of data or to the research itself. As remarked by the BI team, most respondents were likely to be a more

data-oriented part of the company, with less data-interested people not responding. This, however, does not create a bias for the research, as the majority of non-respondents is unlikely to use self-service BI in the future. Most of the respondents were aged between 25 and 44, having a completely different experience in Topicus, from being a first-year employee to being at the company for more than a decade.

An important requirement for a survey was to include each job family present in ParnasSys. A result is provided in Figure 9, the distribution of responses does not explain the difference in interest that each job has. Product developers are the largest employee group, as ParnasSys is a software development company, while marketing, management, and sales departments only have five employees each, which means that two answers obtained for each of these departments already make up almost half of the opinions involved. A certain conclusion can only be made about UX and service desk employees, who showed an especially high interest in the topic of research.

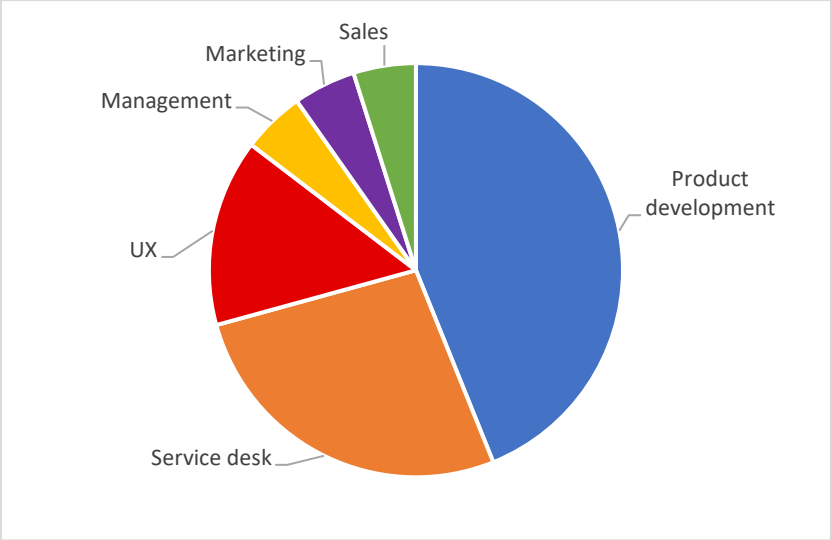

Figure 11. Respondents by job family

Moving to the general results, the average opinion on the six independent and one dependent variable was measured. Within a survey, the UTAUT-related questions were formulated to understand how the behavioural intention is affected, BI technology-specific questions also aimed to measure the employee perception of the current state within ParnasSys. The results per variable are provided in Figure 10. As described in the chart, the employees acknowledge a potential performance improvement that the novel approach brings, while expecting a low effort investment. Social influence is also described as an important consideration for employees. The three self-service BI factors were rated lower, with user knowledge being expectedly the lowest scoring variable. An important notice here is that the survey measured the self-service BI user knowledge, which turned out to be low as the concept is novel and very specific. Therefore, the outcome does not imply the low average technical knowledge

within the company, which is expected to be significantly higher. Finally, the average behavioural intention ended up with an average value of 5.56 out of 7, indicating a high enthusiasm for self-service BI and a high perceived feasibility of its adoption. For each variable, the value range was 6, this means that the opinions on this variable are quite widespread.

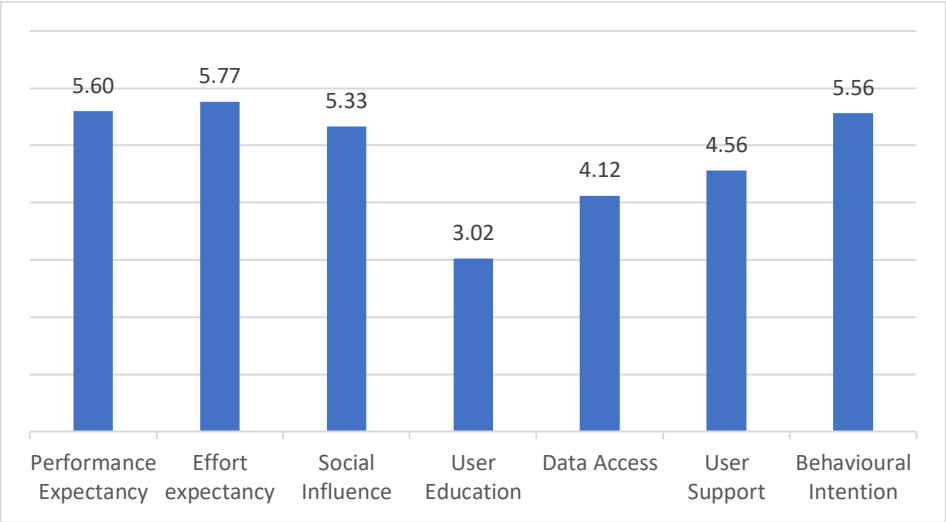

Figure 12. Average result per variable

The Behavioural Intention variable needs to be closely investigated. In Figure 11 a declared Behavioural Intention per job family is provided. Coming back to the stakeholder analysis, the findings mostly support the opinions provided by the BI team members before the survey execution. Management, marketing, and UX employees indeed declared a higher interest in the self-service approach, while software developers score lower on average. Additionally, the deviation in opinions per department is small, with the highest Behavioural Intention difference in non-management jobs being 0.69, which is less than ten per cent of the scale. This also aligns with the stakeholder analysis provided.

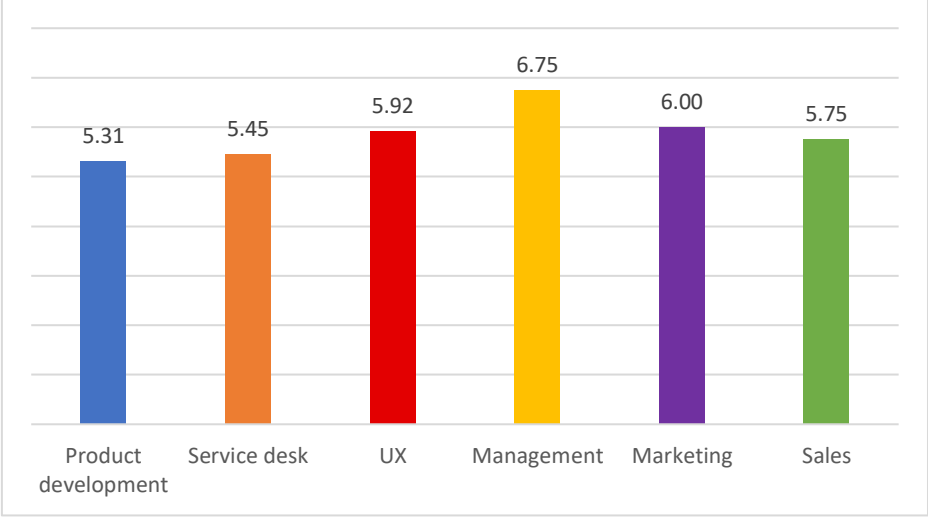

Figure 13. Behavioural Intention per job family

5.3 Correlation Matrix

The next step of the research involved measuring the correlation between variables. As mentioned before, the tests for statistical significance were not included in the results, as sufficient test values are not feasible with the sample size of 41 respondents. Therefore, only the strengths and directions of the correlations are measured. To ensure a holistic view of the variables, a general correlation matrix is created.

The measurement of Spearman's coefficient involves ranking each response within a question (Khawla, 2022). This was done using =RANK.AVG() Excel function. After, a correlation matrix was automatically created based on the output of applying the =CORREL() function to the obtained ranks. As a result, a correlation matrix provided in Figure 12 was obtained. The correlations are colour-coded with red and blue depending on their distance to -1 and 1 respectively. The correlations between the same variables are equal to 1.

	Performance expectancy	Effort Expectancy	Social influence	User Education	Data Access	User support	Behavioural Intention
Performance expectancy	1						
Effort Expectancy	0,230	1					
Social influence	0,164	0,176	1				
User Education	0,255	0,203	-0,188	1			
Data Access	0,217	0,032	0,045	0,209	1		
User support	0,097	-0,065	0,358	0,209	0,147	1	
Behavioural Intention	0,707	0,241	0,118	0,257	-0,041	0,141	1

Figure 14. Spearman's Correlation Matrix

Based on the findings of the analysis, a strong correlation is only observed between variables Behavioural Intention and Performance Expectancy, while a weak correlation can also be seen between Behavioural Intentions and Effort Expectancy or User Education. Additionally, a moderate correlation between Social Influence and User Support is observed. In the rest of the cases, little to no correlation is observed.

Even though the research does not focus on performing statistical tests, a p-value test for the main finding of the matrix, the correlation between Performance Expectancy and Behavioural Intention supported the finding. The obtained p-value was lower than 1%, verifying a strong statistically significant relation between the two variables.

5.4 Open Questions

A final part of the survey included several open questions that ought to capture the qualitative knowledge important for this research. The findings within this part of data collection can be divided into two parts: barriers that employees foresee, and previous positive or negative experiences with the implementation of new tooling or approaches to everyday work processes.

The frequently mentioned concerns regarding self-service BI included the degree of technical knowledge available in the company, as well as an understanding of data and its location within the ParnasSys database. Another mentioned concern included the time and headspace that a certain employee or team would need to dedicate, not being confident if it brings the expected value. Finally, several employees mentioned a problem of not having enough knowledge about the problem, not knowing where to start the implementation, and having an implementation that would fail to incorporate the obtained theory in practice, leading to a lowered usage of the self-service approach.

A valuable input on the experience with new tooling was provided. The closest concept to self-service BI included the implementation of HubSpot software in the Sales and Marketing departments, allowing data-informed workflows and automation, yet it was mentioned that there is room for improvement in this direction. Most of UX employees mentioned using AI to ask questions as an important recent addition to their workflow. Finally, several product developers mention occasionally using BI tooling to analyse and communicate results for a certain work task.

It is also important to mention that a noticeable number of employees asked for a piece of additional information on the topic of self-service data analysis either in a dedicated feedback field after a survey or in person. This highlights both the enthusiasm of some employees and a low overall awareness of the concept, which could have possibly affected the survey results.

6. Discussion

This part of the research aims to interpret the obtained results, prioritising the findings and putting them in the context of ParnasSys. This section ensures that first of the two final knowledge questions is answered, namely the question *"How can employee readiness be evaluated and interpreted?".*

Even though the majority of findings were mentioned in the results section, it is important to structure them and provide an interpretation as a base for a solution. The key findings are split into two parts, including descriptive statistic observations and correlation analysis. Below, a list of findings is provided.

1. The employees of ParnasSys expressed a high interest in data-related research, which can be tracked by a high response rate and willingness to provide detailed answers to the open questions both via the survey and personally. The practical implication of this finding is the suitability of survey and interview methods for employee opinion collection, as a sufficient response is expected. Additionally, at least an initial interest in change and data was observed.

2. The majority of employees have declared an enthusiasm towards self-service BI. However, an important condition is the unwillingness to dedicate the extra time and effort to both learning and using a self-service approach. This is supported by the low expectancy of effort scoring the highest in the survey. A practical meaning of this finding will be a need for simplifying the tooling or using the self-service approach for very basic tasks.

3. The current state of self-service BI enablers was assessed as low. This is natural, as the current data access and user support are tailored to a traditional BI process, not enabling a focus on the regular employee. A possible switch to a self-service approach would bring changes to the mentioned aspects, as well as to user education on a highlighted matter, leading to an increased average self-assessment score. However, the current assessment is a good input to understand the starting point.

4. A Social influence variable was awarded a high average score, meaning that employees expect to be more willing to use the self-service in case their colleagues or even teammates use it. A practical implication for this finding is the potential benefit that a department-by-department self-service BI implementation may bring, as well as word-of-mouth popularisation.

5. Measurement of behavioural intention per department highlighted Marketing and UX as the most interested teams, which aligns with the information provided during the BI team interviews and can lead to the first self-service BI attempts taking place within the mentioned department.

6. Apart from the measurement of employee responses, a correlation analysis was performed. A key and the most significant finding within this part of the research is a strong correlation between Performance Expectancy and Behavioural Intention variables, meaning that the higher the performance benefits are, the more enthusiastic the employee is about the use of self-service BI technology. This characterizes the respondents, as the employees driven by personal or organizational performance. An obvious practical implication is the better self-service works, the faster it is expected to spread within the company.

7. User Knowledge about self-service BI also had a small correlation to Behavioural Intention, making a possible factor for improvement. This take is supported by practice, as broader knowledge about the technology will make employees closer towards its usage.

7. Solution Proposal

In this section a list of solutions to improve employee readiness and interest is provided, as well as an assessment of these solutions. This section ensures that the final knowledge question is answered, namely the question *"Which improvement strategies are relevant for the case of ParnasSys?"*

An important part of this research is the recommendation on which solution approaches can be used to optimise the self-service BI implementation, maximising its value. This also formulates the last deliverable of the research, a list of self-service BI readiness improvement strategies. The strategies are divided into two categories: general technology adoption approaches and self-service BI-specific enablers improvement. The solutions are selected based on the relevance to the findings of data analysis, this ensures the suitability of a certain solution to the studied case.

Based on the first two findings, the employees declared a rather strong interest in self-service BI, which gives the concept the potential for successful adoption within the company. However, the limited effort that employees are willing to dedicate brings the research to the first recommendation. Self-service BI must be implemented as an additional possibility, but not an obligatory part of each employee's workflow. This still implies communicating the possibility and providing the needed information for each job that allows the use of data, but with self-service BI being a completely voluntary option. The benefit of this approach is twofold, the well-being of employees is supported, while the value obtained from the self-service approach is maximised, as only the enthusiastic employees are involved. Additionally, the self-service data analysis has to be simplified to attract employees, ensuring both a simple process for data retrieval and analysis. This may also not always involve regular employees doing a full BI process for a certain problem. As mentioned by Alpar and Schulz (2016), the self-service approach may include the creation of a template or knowledge repository created by BI team members, which can simplify the regular employee experience.

The fourth and fifth findings highlight a high perceived importance of colleague advice for a ParnasSys employee and a varying self-service BI interest per department respectively. This leads to a logical conclusion about the suitability of pilot testing within one or several departments, validating the approach with a certain employee group. A supporting factor for this is the small size of the relevant teams: UX, sales, and marketing. The latter two already have some experience with data-informed working. A successful case within a single domain would allow for a faster potential companywide implementation, helping to eliminate the potential mistakes. Furthermore, having a group of employees with a positive experience would assist the popularisation of the technology, either with employee informal talks or companywide communication campaigns. When referring to the classic diffusion of innovations theory developed by Rogers (1962), see Figure 13, the mentioned employee group is expected to act as innovators, or technology enthusiasts if put in the context of this

research. An alternative approach may include the selection of highly interested employees regardless of their job family to form a group of innovators.

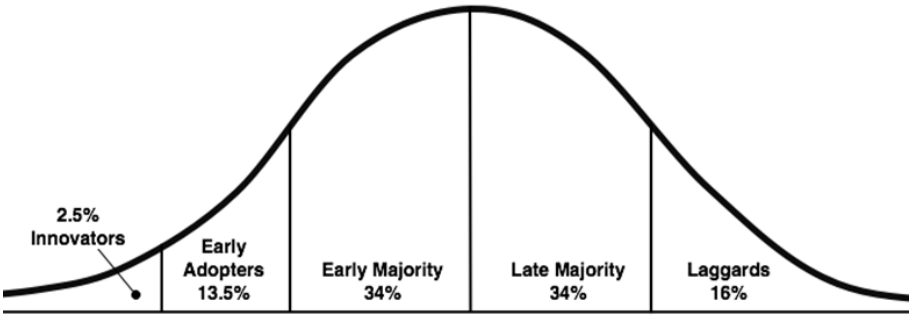

Figure 15. Technology Adoption Curve

The sixth finding, an outcome of correlation analysis shows the importance of the technology performance. This highlights the practical nature of employee intentions, meaning that the change will only be made in case of an observed or expected benefit to individual or organisational performance. This leads to a need to highlight the success stories and effectively communicate the value brought by technology. Rogers (1962) also highlights the importance of this aspect for successful technology diffusion, naming it observability. The development of observability is also supported by the second proposed strategy, where a pilot group, if successful, will motivate the rest to engage in a novel approach. The joint outcome of the first three strategies is the need for a bottom-up, often voluntary approach. This would allow for a closer understanding of needs and overall alignment with employee empowerment, which self-service BI also suggests.

To address the challenges specific to self-service BI, a study by Lennerholt et al. (2022) will be used. While user knowledge about technology is not as critical at the initial stages, an improvement in this aspect can still be made, ranging from general awareness campaigns to personal training. Lennerholt et al. (2022) also suggest the use of pilot groups and champions as a means to improve companywide education, emphasising the need for implementation of the approach before the global self-service BI implementation. The problem of data access is, perhaps, one of the most complex in the context of ParnasSys. In most cases, simply providing a free opportunity to work with data will bring complications to the company's operations. An offered solution, includes a selection of different user groups, identifying their specific data needs and granting them with different access options (Lennerholt et al., 2022). An example would be providing UX employees with access to job-specific data. Addressing the issue of data access with this approach would need a significant time investment in the beginning, but it is also a continuous approach that would need regular communication and access updates in the future.

8. Conclusion

This chapter will summarize the key research findings, answering the knowledge problems and the main research question. Furthermore, the limitations of this research will be listed, which will provide a better understanding of the findings. Finally, the possible areas of future self-service BI research within ParnasSys will be explained.

8.1 Conclusion

This research was built around the adoption of self-service BI, which ParnasSys data team members view as an opportunity to address several data-related business problems and needs. Considering the numerous aspects that the adoption of a self-service approach to data analytics has, it was decided to focus on an assessment of employee readiness and interest in the novelty. For this, the following research question was derived: "How can ParnasSys employee readiness for self-service BI be evaluated and improved?". To answer this question, a number of sub-questions was derived, which helped to systematically obtain the information needed to achieve research objectives. Following, each sub-research question is answered.

1. Which employee groups that will be impacted by self-service BI exist within ParnasSys?

To address this knowledge problem an analysis of stakeholders affected by self-service BI was created. This was done by firstly categorising the employees into groups, based either on the type of job the employee does or on data enthusiasm. After, a power-interest grid analysis was performed, providing information on how strong the influence of a certain employee group on the decision about self-service BI adoption is, and how interested the group is. The information was obtained from several interviews with the ParnasSys data team, who were the problem owners of the research. As a result, several key conclusions can be made. First of all, each job family (except of management and team leads) has roughly equal influence on the self-service BI decision. Secondly, most of the teams have a low expected interest, the exclusions are marketing, sales, and product owner job families, as more flexible data analytics is expected to bring a stronger benefit to their fields. Performing a thorough stakeholder analysis helped to map the company, highlighting the key groups and their expected influence.

2. Which employee-related factors are important for self-service BI implementation?

Answering this question suggested performing literature research. After an initial search it was decided to divide the factors into two categories: general technology acceptance influencing factors, for this a range of older sources was used, and factors specific to self-service BI that were derived from more recent works. As a result, the following metrics were selected: Performance expectancy, Effort expectancy, Social influence, User education, Data access, and User support. This information helped the researcher with understanding the relevant areas that need to be further assessed and improved.

3. How can employee readiness be evaluated and interpreted?

To evaluate employee readiness, a variation of a technology acceptance and use model was developed, specifically tailored to the case of self-service BI technology. Further, a survey was designed to collect the opinions of employees on the previously highlighted factors, as well as on intention to use the self-service technology. The survey answers were analysed using descriptive and correlation statistics, leading to several important findings. The employees declared a strong enthusiasm towards the technology, this is also supported by a high response rate of the survey. The variables connected to self-service BI were rated low, highlighting a need for better communication of the available capabilities, or their improvement. Some of the teams had a higher declared interest, supporting the information provided in the stakeholder analysis. Finally, a correlation analysis shows a strong influence that the performance of the technology has on the opinions of the employees, providing an important input on what to prioritise in future communication.

4. Which self-service BI readiness improvement strategies exist, and which are relevant for the case of ParnasSys?

Having the findings of the previous questions, a number of employee motivation and readiness improvement strategies can be used. As suggested by the literature, an important aspect is the communication of the BI process transformation, not making it obligatory companywide, creating a bottom-up adoption process with the use of pilot groups and success stories. Further, job-specific data access needs to be ensured, as well as employee training and user support channels.

The abovementioned knowledge problems sufficiently addressed the selected knowledge question, providing ParnasSys with a list of employee-related self-service BI enablers and an assessment of the current state based on a companywide survey. Additionally, several action strategies for sufficient implementation of the approach into employees' everyday routines were given.

8.2 Limitations and Future Research

A number of considerations regarding both business and scientific outcomes of this research must be discussed to ensure that its scope and reliability level are acknowledged.

The scope of the research included looking at employee perceptions and the influenced factors, providing several solutions based on the findings. While user-related knowledge is certainly important for the implementation strategy within the initial stages, the self-service BI approach includes numerous aspects that are interrelated and all need to be aligned for a successful process. As this is a bachelor thesis that was executed in approximately three

months, focusing on all of the key aspects while providing insightful research was not feasible. Therefore, it was decided to prioritise employee research while briefly touching upon other factors. With this research looking at the preliminary stages of technology implementation, further research should include the more practical aspects, like tooling selection, development of data governance rules and employee training campaigns, as well as revising the employee opinions, expanding the author's approach.

Another limitation of this research included a low availability of operational data, with the number of requests to the BI team not being systematically tracked, frequently changing tooling, small number of employees being frequently engaged with data. This led to a selection of the social aspect of the technology, studying opinions rather than quantitative operational data. This brings a possible bias in the interpretation of qualitative data, which the researcher attempted to omit to his best. For this, a survey with a Likert scale was adopted to allow quantitative data.

The survey, however, does not act as an ultimate solution, as the survey with a small sample size cannot provide a strong quantitative result. The objective in this case was to understand the general trends and try to connect them to the context of the problem owner. This brings a business value to the study. At the same moment, a scientific value can be improved by increasing the sample size both for enablers' literature search and the survey. For example, conducting the study within a larger company or a certain sample of companies within an industry.

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Appendix A. Research Design

Knowledge question	DSRM Phase	Research question type	Research population	Data collection method	Research strategy	Activity plan
Which employee groups that will be impacted by self-service BI exist within ParnasSys?	II	Descriptive	Literature, ParnasSys data team	Literature review, Interviews	Qualitative	Conduct a stakeholder analysis based on interviews with ParnasSys supervisors. Link a selected stakeholder analysis approach to literature.
Which employee-related factors are important for self-service BI implementation?	III	Descriptive	Literature	Literature review	Mixed methods	Conduct a literature review to find the factors enabling self-service BI implementation, preferably focus on employee-related factors.
How can employee readiness be evaluated and interpreted?	III, IV, V	Evaluative	Literature, ParnasSys employees	Literature review, Survey	Quantitative	Create a survey based on selected factors/framework for self-service BI implementation. Statistically verify the validity of a survey. Perform descriptive analysis, also looking for relations between factors and willingness to use the technology.
Which self-service BI readiness improvement strategies exist, and which are relevant for the case of ParnasSys?	III, IV, V	Descriptive	Literature, ParnasSys data team	Literature review, Interviews	Mixed methods	Conduct a literature review looking for suitable employee readiness improvement strategies. Verify the strategies using interviews.

Appendix B. First Survey Version

Question	Type
How old are you?	Multiple choice
Which department are you working in?	Multiple choice
How many years have you been working in Topicus?	Multiple choice
How familiar are you with the concept of self-service business intelligence?	Likert (1 - 10)
Using Self-Service Business Intelligence will improve the results of my work.	Likert (1 - 10)
Using Self-Service Business Intelligence will make my work process more effective.	Likert (1 - 10)
I expect to find a Self-Service Business Intelligence software easy to learn an use.	Likert (1 - 10)
I expect that using Self-Service Business Intelligence interface would be intuitive and not require advanced technical skills.	Likert (1 - 10)
Recommendations from my colleagues would increase my will to use Self-Service Business Intelligence technology.	Likert (1 - 10)
If most members of my team will use Self-Service Business Intelligence, I will also use it.	Likert (1 - 10)
I believe that data within ParnasSys is easily accessible if there is a valid reason for this.	Likert (1 - 10)
Getting help from Business Intelligence team is a time-efficient and straightforward process.	Likert (1 - 10)
I believe that using Self-Service Business Intelligence technology will become a part of my working routine.	Likert (1 - 10)
I am enthusiastic about using Self-Service Business Intelligence in my work.	Likert (1 - 10)
Which barriers for using Self-Service BI do you foresee?	Open
Do you have previous experience with the addition of new technology to your regular workflow? If yes, which technology and what helped you sufficiently incorporate them in your everyday work?	Open

Appendix C. Final Survey Version

Question	Type
How old are you?	Multiple choice
Which department are you working in?	Multiple choice
How many years have you been working in Topicus?	Multiple choice
Using Self-Service Business Intelligence will improve the results of my work.	Likert (1 - 7)
Using Self-Service Business Intelligence will make my work process more effective.	Likert (1 - 7)
I expect to find the Self-Service Business Intelligence software easy to learn and use.	Likert (1 - 7)
I expect that using Self-Service Business Intelligence interface to be intuitive and not require advanced technical skills.	Likert (1 - 7)
I will be more willing to use Self-Service Business Intelligence technology if my colleagues recommend it.	Likert (1 - 7)
If most members of my team will use Self-Service Business Intelligence, I will also use it.	Likert (1 - 7)
How familiar are you with the concept of self-service business intelligence?	Likert (1 - 7)
I believe that currently data within ParnasSys is easily accessible if there is a valid reason for this.	Likert (1 - 7)
Currently, getting help from Business Intelligence team is a time-efficient and straightforward process.	Likert (1 - 7)
I believe that using Self-Service Business Intelligence technology will become a part of my working routine.	Likert (1 - 7)
I am enthusiastic about using Self-Service Business Intelligence in my work.	Likert (1 - 7)
Which barriers for using Self-Service BI do you foresee?	Open
Do you have previous experience with the addition of new technology that changed your regular workflow? If yes, which technology and what helped you sufficiently incorporate them in your everyday work?	Open
If you have any questions regarding the research, feel free to leave them here.	Open

Description
Self-service BI is a data analysis approach that allows business users to analyse and use their data in everyday decision-making without relying on the BI team. This is enabled by introducing intuitive data analysis interface, which helps users create data-based reports without much technical knowledge. Self-service BI is associated with increased process efficiency and scalability of data analytics, as the data team can now reduce a backlog and focus on more complex business problems. Most importantly, it facilitates the use of domain-specific knowledge, which supports the creation of reports that are better tailored for decision-making.