To Save, Spend or Invest?

Working towards a more balanced view of a municipality's performance

By

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Preface

Dear Reader,

I present to you my bachelor thesis revolving around measuring the performance of Dutch municipalities executed at the municipality of Twente.

I would like to thank Ralph Meijers, the supervisor from the municipality, for giving me this opportunity and supporting me while conducting the research. I am grateful for all the work that he put into me and my research, especially in these odd times due to Covid. Furthermore, I would like to thank all employees that helped me out over the past few months. Everyone that I spoke to was very enthusiastic, showed interest and was willing to help me. I have learned a lot about municipalities and gained many new experiences by being part of such a large organisation.

Finally, I would like to thank Wouter van Heeswijk, my first UT-supervisor, for steering this research in a good direction by having helpful meetings and by providing valuable feedback. I would also like to thank Joerg Osterrieder as my second UT-supervisor.

Enjoy reading this thesis!

Siem Peters

Summary

Problem context

The municipality of Enschede would like to increase its investments by applying more maintenance to neglected assets and improve the quality of the city to increase its population. Enschede has cut its costs drastically over the past decade. As a result, many investments were neglected. Maintenance on roads, school buildings, streetlighting, etc. is urgently needed. In addition, Enschede wants to increase its population size by making Enschede a more attractive city. The municipality must make large investments to improve the city. Before they can decide how much money to invest and which funds to use, they need to know how good their current performance is. The core problem is that Enschede does not have a clear overview of its performance.

Research goal

The goal of this research is to develop a model which can assess the performance of a Dutch municipality. We do not only assess the financial state but also analyse the investment volume and level of facilities in order to determine the actual performance of a municipality. This will help to determine whether Enschede can increase their investments and determine the impact these investments will have on the financial state, investment volume and level of facilities. The model will be analysed with the help of a dataset and dashboard. The main research question that we try to answer is: *'Can it be justified, by analysing its performance, that Enschede increases its investments?'*

Recommendations for Enschede

Since 2012, Enschede has improved its financial state a lot such that its financial state is currently sufficient. This means that they have a relatively low debt compared to their equity, they have decent reserves and the amount they tax their citizens is acceptable. On top of that, they decreased risks by lowering their ground positions and by having more money available to pay for potential financial setbacks. However, their investments have been neglected and thus they should increase their investments. Their level of facilities has been kept quite high, especially after the extra facilities they offered since the decentralization of youth care in 2015. By using the model to analyse Enschede's current scenario and by using their budgets to estimate the future performance we concluded that Enschede can invest €47.5 million in qualitative and quantitative growth. These investments could be made in its urban development and new residential areas. The extra funds necessary to increase their investments can be gathered by acquiring €33 million worth of loans and by taking €14.5 million out of their reserves. This keeps their financial state sufficient with a score above 0.5, it will increase the investment volume from 0.16 (2020) to 0.36 (2024) and the level of facilities will remain at a similar level.

Recommendations for municipalities and government

We recommend municipalities and the government to not only calculate indicators related to their financial state but to also analyse what happens to their investment volume and level of facilities as a result of an

increasing/decreasing performance of their financial state. So we recommend municipalities to analyse the following 3 subjects: financial state, investment volume and level of facilities. The financial state can be assessed with 3 of the 5 indicators defined from the law 'Besluit Begroting en Verantwoording provincies en gemeenten', namely the solvency ratio, the net investing quote and the tax producing capacity. The investment volume can be assessed by using the fixed tangible assets and the net investing quote. For the fixed tangible assets we recommend looking at the increase/decrease in comparison with the average of all Dutch municipalities. This ratio is useful to determine how much of an increase in assets is expected from a municipality. The level of facilities can be assessed by comparing the increase/decrease of the total net expenditure without governance and support costs in comparison with the Dutch average. In order to give an overall assessment of each of these 3 subjects, we would recommend scoring the individual indicators by setting an appropriate norm with an upper and lower bound (poor and good score). This makes the results of the model easy to interpret because a score of 0.5 would be sufficient. The different indicators can then be combined, by optionally using weights, into 1 variable for each subject. By scoring all indicators individually and combining them into the 3 corresponding subjects, the performance of a municipality can be determined. Additional indicators are used to assess the performance in more detail.

Contents

1. Introduction

This first chapter of the thesis gives an introduction to the municipality and the problems solved during this research. The introduction consists of the company introduction (Section 1.1), identifying its problems (Section 1.2 and 1.3) and the main research question (Section 1.4). The company introduction includes the tasks of a municipality, the current scenario and Enschede's goals. In the problem identification, the problems that must be solved during this research are discussed. From the different problems, the core problem is found, with the help of a problem cluster. Lastly, the main research question, which will be answered during this research, is discussed.

1.1 Municipality introduction

Municipality tasks

The Netherlands consists of a central government with provinces. Each province has multiple municipalities consisting of some towns and cities. The municipality is the closest relation between the government and the citizens. A municipality carries out national laws and policies, called government capacity.

Municipalities have many different other tasks. It registers who live in the municipality. It hands out official documents to all citizens, like passports and driver's licenses. They also give payments to those who are unable to financially care for themselves. They provide buildings for schools and help special-need students. They make destination plans, supervise the housing market, build new roads and make sure that the garbage is collected. Municipalities also support local organizations like pools, libraries and cultural institutions.

Many decisions must be made for all these affairs. The municipal council consists of different layers. There is the local council (parliament, set boundaries, controlment), college of mayor and councillors (decision making, informing, accountability) and civil service (prepare plans, execute plans, operations).

Municipality of Enschede goals

Enschede has many goals they want to achieve in the future (Gemeente Enschede, 2020). One of their first major goals is to expand the number of inhabitants, in specific young talented adults. The vision of Enschede is that these young adults can increase the prosperity of all citizens. Enschede has always been a city with many poor citizens and many citizens with government aid. The current population growth in Enschede is slowing down and the population is even expected to decrease in the future (See Figure 1). This results in a smaller workforce. A benefit of these young and well-educated people is that they can spend more money in the city, which will boost the incomes of Enschede through taxes and improve the business climate. A large population also helps to increase the municipal fund. The municipal fund is the money a municipality receives from the government to provide facilities. The municipal fund is the largest income source of a municipality and is mainly influenced by the population size, Appendix A.1. lists the most important indicators. These indicators determine the proportion of the municipal fund a municipality

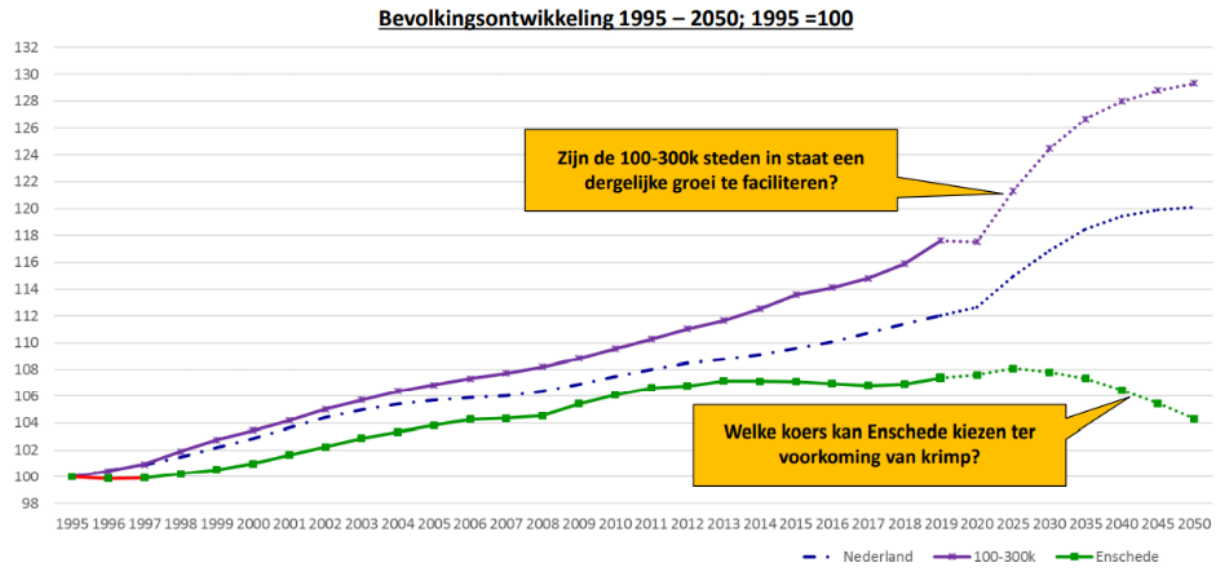


Figure 1: Predicted population growth 1995 -2050 in Dutch (CBS, 2019)

receives. If the number of citizens in a municipality decreases then a municipality must cut costs. As a result, they need to offer fewer facilities, which could decrease the population even further. Enschede does not want to end up in this vicious circle. Enschede uses the following three methods to increase its population:

- The first method to increase the population of Enschede is by attracting more youth to the educational institutes in Enschede so that these people already have had a lot of experience with Enschede. The municipality would like to keep these students once they graduate. Therefore the housing options for graduates and young families must improve. The main focus will be on creating an appealing appearance of the city and innovative working locations focused on meeting new people.
- The second method to attract more people towards Enschede is to improve the accessibility of jobs. The council wants to achieve this by reducing travel times between Enschede and other areas with jobs, improving the bond with Germany and by creating more jobs in Enschede itself. They will also focus on the digital accessibility of Enschede by experimenting with new technological fields (Smart City/Big Data) and investing in the improvement of the digital infrastructure.
- The last method that Enschede will use to attract more citizens, is to make the city more appealing. They organise many events and support many cultural organisations in the centre of Enschede. This results in a wide variety of entertainment options for all citizens. Another focus is that climate change will be taken care of appropriately. The goal of Enschede is to increase the amount of renewable energy by focusing on energy efficiency and clean methods to generate power. The extreme weather which will be a result of climate change, like large periods of rain and extreme temperatures, must be taken care of. This will be achieved by adapting houses, the infrastructure and sewage systems towards the changing climate.

1.2 Problem identification

Enschede's large financial problems

As discussed in Section 1.1. Enschede currently has many challenges that need to be dealt with. After the global recession in 2008, a lot of issues arose and Enschede almost became an article 12 municipality. This is a municipality that has so many financial issues that it needs extra government support (Rijksoverheid, 2021). In such case, it will also become supervised by the government to make sure that the financial issues are fixed. Due to the decreasing ground prices in 2008, Enschede had to write off on their ground positions. This meant their solvency worsened and their general reserves decreased. Therefore the council decided in 2012 to use a different ground policy to solve Enschede's financial issues (Gemeente Enschede Gemeenteraad, 2012).

Improve finances by applying a new policy

The policy since 2014 is to lower the risks and improve the financial position (Gemeente Enschede, 2014). The goal of this policy was to increase their reserves, reduce debt and minimize future risks. They decided to sell part of their ground (see Figure 2) and give fewer loans to third parties. They decided to only apply maintenance on streets, street lighting, sewers, etc. when it was an absolute necessity. Additionally, many other investments, which would attract more people, more businesses and increase urban development, were postponed. In order to decrease risks, they would outsource larger projects, like building new

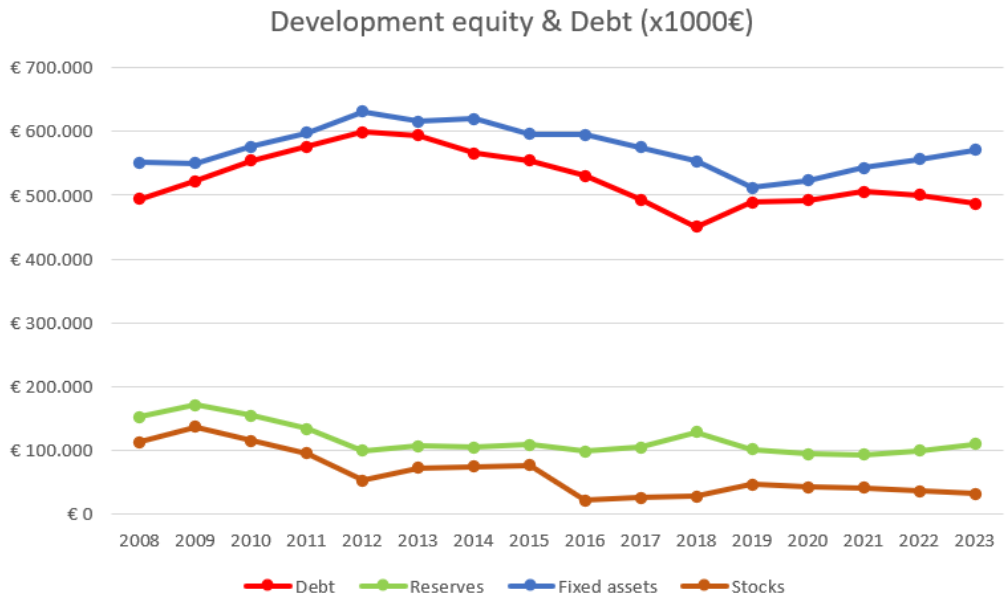


Figure 2: Equity & Debt Development 2008-2023 (Gemeente Enschede, 2019)

neighbourhoods, to other entrepreneurs. This meant that Enschede did not have to take additional loans to make these large projects possible, which resulted in less debt. They would collaborate with other private investors and organizations to realize these new investments. The municipality would only give investors

the possibility to build these new investments and facilitate the necessities, like permits and ground. Because Enschede outsourced large investments, risks were and their financial position improved, but this strategy also had its downside. The decision to outsource larger projects was made to anticipate potential future risks and to reduce their yearly interest payments because no additional loans had to be taken. However, many investors did not want to take investments if the risk was too high and the reward was too low. Moreover, there are many essential investments, like maintenance on government buildings, which had to be executed by Enschede themselves.

All the yearly expenses that a municipality makes, determine the level of facilities (Voorzieningenniveau) in a city. This includes all the facilities that it offers to all citizens and companies. Examples are the design of public space, civil affairs, authorization and youth/elderly care. Level means both the quantity and quality of the facilities. The level of facilities is split up into 4 categories; social, physical, recreational and governance & organization domain.

Enschede cannot longer postpone investments

Because investments have been postponed for so long, many investments must be made now, in order to offer all the necessary facilities in Enschede. The financial state must be good enough to be able to invest more. Therefore Enschede must know how good its current financial state is to see if it can make more investments.

1.3 Core problem

In order to find the core problem, a problem cluster (Figure 3) is made (Heerkens, 2015, p42). The problem cluster consists of action problems, where there can be one or multiple core problems. An action problem is the difference between reality and the desired situation.

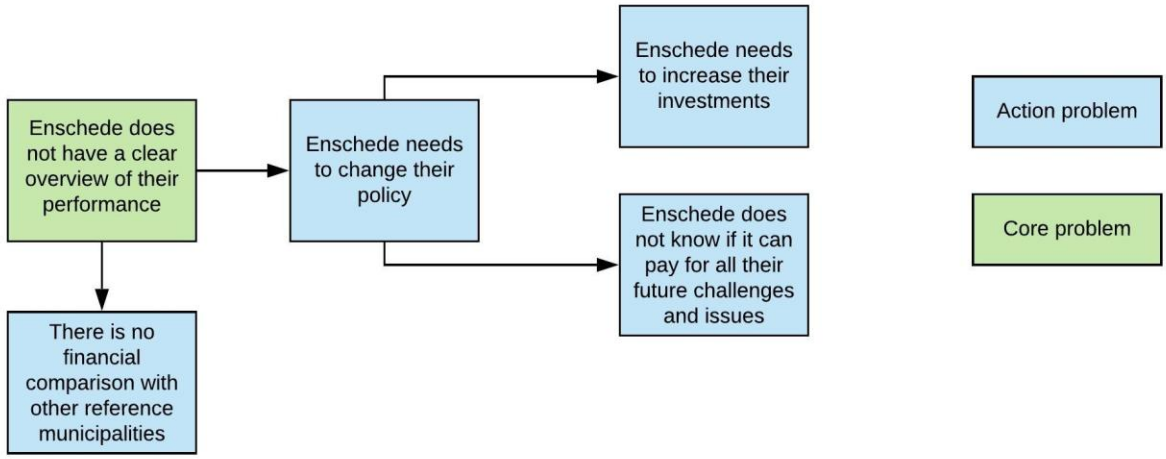


Figure 3: Problem cluster with core problem

There are multiple criteria for a good core problem (Heerkens, 2015, p44). It must be an actual problem occurring in the organization, so when dealt with, it will solve the issues of the organization. The core problem should not have a direct cause itself, but it should be able to influence other problems. Enschede wants to change its policy to a more investment-focused policy. However, currently they do not know if their financial state allows them to make this change. They also do not exactly know how well they are doing compared to other municipalities. Thus the core problem is: *'Enschede does not have a clear overview of their performance'.*

1.4 Research question

After having established the core problems and their sub-problems, the main research question must be found. The research question must state the objective of the research study (S. Schindler, 2019, p50). In other words, a research question defines what will be done and discovered during the research to answer the core problem. It must be effective and feasible with the time and resources available. As mentioned in Section 1.3, we must find out whether Enschede has enough financing available to increase its investments. The current performance of Enschede must be assessed and monitored. The main research question is: *'Can it be justified, by analysing its performance, that Enschede increases its investments?'.* An explanation of how this research question will be answered can be found in Section 2.5. the demonstration phase.

2. Research design

In order to answer the main research question, we must first have a clear overview of the performance of Enschede. See Section 2.1. for the method that we will develop to assess the performance of a municipality. The research questions and methodology framework, necessary to solve the core problem, are discussed in Section 2.2. and Section 2.3. respectively. Section 2.4. includes the objectives that the solution of this research must bring. In Section 2.5. we will discuss which operations are executed this research. Section 2.6. is a small recap of this chapter.

2.1 Performance measurement

In this section, the method to determine the performance of a municipality is explained. We will develop a model called the municipality's performance model, which must be able to assess the performance of a Dutch municipality. The goals of a municipality differ from a company's goals. The goal of a municipality is not to maximize profit or to attract more investors. The main goal of a municipality is to provide services and facilities to its citizens like roads, schools and cultural institutions. In order to provide all these services and facilities, a municipality must make investments. A municipality can only make these investments if its financial state is good enough. Therefore we will look at the financial state of a municipality in order to determine whether it can increase its investment volume so that the level of facilities it provides to its citizens can be increased.

This model will show the relationship between the financial state, investment volume and level of facilities. Assessing the municipality's performance by comparing these three subjects has not been done yet by municipalities or researchers. The current focus of most municipalities is on calculating some indicators to determine the financial state. However, there is barely any focus on the investments and level of facilities. During this research, we try to assess their actual performance by also implementing these additional subjects and thus develop a new method that gives municipalities a better indication of their performance.

Dashboard

All 3 subjects will be assessed by using relevant financial indicators, chosen in Chapter 3. The financial indicators of the model are calculated and displayed on a dashboard. A dashboard is chosen because it gives a clear and simple overview of the performance in a specific time period. The dashboard can be updated yearly so that the municipality of Enschede can also monitor its performance in the future. With a dashboard, historic data can be used to see trends so that future decisions can be made based on the data. The dashboard will show the development of these indicators over the past years. The dashboard will also show Enschede's performance compared to other municipalities. The goal of the dashboard is to predict the future based on historical data. So the dashboard will contain the indicators of the model. Because the model consists of three subjects, we decided to use a radar chart to plot the performance. For each subject, a score is calculated by combining the individual scores of the underlying indicators. This process is explained in Chapter 3. See Figure 4 for an example of a radar chart with a comparison between multiple municipalities' performances. Decisions can be made, by using the dashboard with the model, to make sure that Enschede's

performance goes into the desired direction. This means that the municipality can be pro-active rather than reactive.

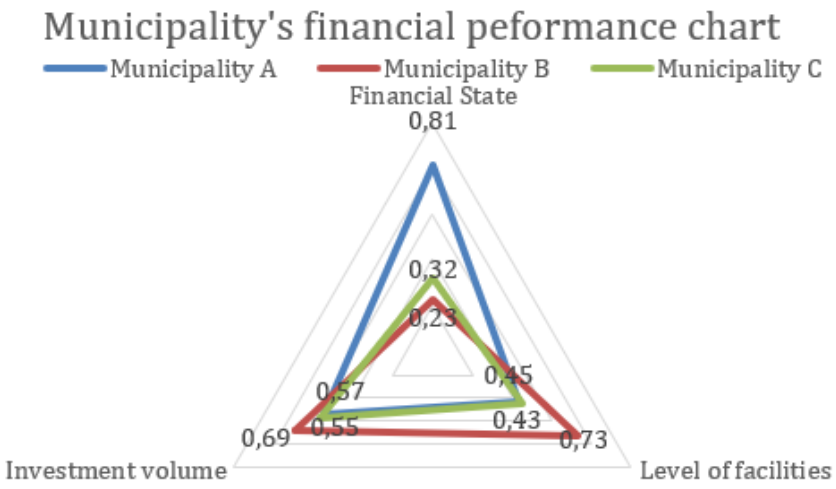


Figure 4: 3-way Radar chart with the performance of 3 different municipalities

2.2 Research questions

We will split the main research question up into multiple problem statements. These problem statements must be answered in order to answer the main research question. A problem statement consists of multiple sub-problems. Answering these sub-problems must give an answer to the problem statement. A problem statement should be formulated as a question because this makes it distinguishable from action problems (Heerkens, 2015). The following three problem statements must be answered:

Problem statement 1: *'How to assess the performance of a municipality?'*

All research questions of problem statement 1 are answered in Chapter 3. The following research questions need to be answered for problem statement 1:

1. 'How to determine the financial state of a Dutch municipality?'
2. 'How to determine the investment volume of a Dutch municipality?'
3. 'How to determine the level of facilities of a Dutch municipality?'
4. 'What are commonly used norms by other municipalities for each of the financial indicators?'

Problem statement 2: *'How to build a dataset and dashboard, for Enschede and reference municipalities, to assess their performance?'*

The research questions from problem statement 2 are answered in Chapter 4. The following research questions need to be answered for problem statement 2:

5. ‘When using the dashboard, which decisions must the user be able to make?’
6. ‘Which comparisons, between different municipalities, years and financial indicators, must be shown on the dashboard to determine the performance of a municipality?’
7. ‘How to structure a dashboard and determine which information to show?’
8. ‘What are municipalities with a similar nature compared to Enschede?’

Problem statement 3: *‘Can Enschede change their financial policy, in order to leave more room for investments?’*

The research questions of problem statement 3 are answered in Chapter 5. The following research questions need to be answered for problem statement 3:

9. ‘How has the performance of Enschede developed over the years and what is the reason for this development?’
10. ‘How did the reference municipalities perform over the past decade?’
11. ‘What is the expected performance of Enschede in the future based on their budgets?’

Problem statement 1 is used to assess the performance of a municipality. We need to find out which indicators can assess the financial state, investment volume and level of facilities. Norms are necessary to score the individual indicators.

Once problem statement 1 is answered, a dashboard must be built, to analyse Enschede’s performance. For this, a dataset is necessary for both Enschede and the reference municipalities, see problem statement 2. We need to find out how to make a dataset and dashboard which can assess the performance of a municipality. We will conduct interviews to find out which decisions the user needs to make and which indicators he/she wants to analyse. Reference municipalities to Enschede must be found based on relevant literature.

Problem statement 3 is necessary to find out whether the current policy can be changed by analysing the current and future financial state of Enschede. Then we can also answer the main research question. The research design can be found in Appendix B.1.

2.3 Research methodology

A clear financial overview of Enschede must be developed. This will be achieved by the municipality’s performance model and the dashboard. By analysing the dashboard, we can find out whether Enschede can change its policy towards a more investment-focused strategy. So first we must build a model and dashboard, then we can evaluate Enschede’s situation and draw conclusions. Therefore an appropriate framework is necessary, which focuses on building the model and dashboard and then using these to analyse the performance of Enschede.

This research uses the Design Science Research Methodology (DSRM) (Peffers et al., 2007). The goal of design science is to create an object which can help to solve a problem. Therefore this framework fits well with the goal of this research, where we will create a model and dashboard to solve Enschede's problem. The DSRM framework consists of 6 phases which are explained in this section. The actions that we will execute during phases 3, 4, 5 and 6 are explained in Section 2.5. DSRM consists of the following 6 phases (see Figure 5):

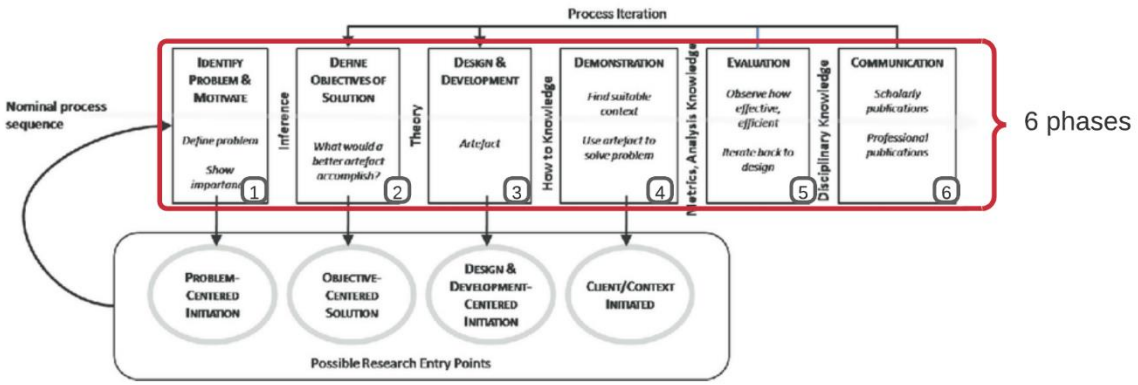


Figure 5: Design Science Research Methodology adapted from Peffers et al. (2007)

Phase 1: Identify the problem & motivate

In phase 1 the problem or issue of the organization is defined. The value of a potential solution must already be justified in the first phase. On one hand to show the usefulness of the solution to the problem towards the researcher and the stakeholders, so that the solution is pursued. On the other hand to understand the researcher's understanding and interpretation of the problem. Phase 1 can be found in Section 1.2. and 1.3.

Phase 2: Define objectives of the solution

The goal of phase 2 is to define the objectives that the solution must bring. Both quantitative or qualitative objectives are fine. Phase 2 can be found in Section 2.4.

Phase 3: Design & development

Phase 3 is the design and development phase. Here the researcher must create the artifact(s). Examples of artifacts are models or methods. It must be a designed object, where research must be embedded in the design. The functionality and the architecture of the artifact must be determined, then the artifact itself can be developed.

Phase 4: Demonstration

In phase 4 the demonstration will start. Here, the artifact must be used to solve an instance of the problem, for example an experimentation or a case study.

Phase 5: Evaluation

Phase 5 is the evaluation phase. Here, measurements and observations will be done with the artifact(s) to figure out to what extent the artifact(s) is/are a useful solution to the problem. The objectives can be compared to the real-world experience of the appliance of the artifact, done in phase 4. Another alternative is to evaluate the artifact by looking at its performance. Any type of empirical evidence or logical proof that can justify the artifact is a solid evaluation.

Phase 6: Communication

This is the final step of the DSRM approach. Here the goal is to communicate the problem and its solution (the created artifact(s)) to stakeholders and researchers. The design and its effectiveness must be discussed.

2.4 Objectives of solution

Phase 1 of the DSRM framework, identifying the problem, has been discussed in Section 1.2. and 1.3. The goal of phase 2 is to define the objectives that the solution to the core problem must deliver. The main objective is to find out the current performance of Enschede and the future expected development. In order to assess the current and future performance, we will develop a model. The model will consist of a method to assess the financial state, the investment volume and the level of facilities as discussed in Section 2.1.

To make sure that Enschede can also monitor its performance over the upcoming years, we will build a dashboard. This dashboard must be able to calculate all the financial indicators of the model and it must be expandable. It will also show the results of the model, which is a radar graph of all three subjects, the financial state, investment volume and level of facilities. The research questions from problem statement 2 about the dataset and dashboard development must be answered

Once both the model and dashboard have been developed, an assessment of their current and future expected performance can be made. Both the model and dashboard combined must be able to indicate whether Enschede has enough financial room to increase its investments in the upcoming years. The research questions from problem statement 3 must be answered. In addition, a group of employers from the municipality of Enschede will be interviewed to determine the usefulness of this research for their situation.

2.5 Research operations

In this section, the DSRM approach will be explained for phases 3, 4, 5 and 6. Phases 1 and 2 have been elaborated in Chapter 1 and Section 2.4 respectively. The goal here is to explain which actions will be taken for each of these 4 phases.

Phase 3: Design & Development

The goal of the design and development phase is to build the municipality's performance model and the dashboard, which will be used to solve the main research question. The model must be built before the dashboard because the model contains important financial indicators which will be presented on the

dashboard. Literature is used to find relevant financial indicators. We evaluate the indicators to decide whether they apply to our model. For each financial indicator, we will set a norm, to score an indicator. After defining and scoring all indicators for each subject, we will develop a method that combines the indicators into one variable per subject to determine the performance of a municipality. See Chapter 3 for the model.

Once the model is developed, we will build the dataset and dashboard, see Chapter 4. The dashboard and dataset will be made in Excel. Excel is chosen because the users of the dashboard, employees of the municipality of Enschede's concern staff, know how to use Excel. This makes it easier for employees to expand the dataset and thus update the dashboard over the upcoming years. The dataset must contain all data necessary to calculate the indicators of the model. The dataset will mainly consist of balance sheets and income statements found on the internet. However, additional data needs to be collected like data before 2010 and future budgets, which might need to be requested for each municipality or be found in the private database of Enschede. Once all raw data has been collected, the specific data necessary to calculate each indicator will be extracted from the dataset. We will develop an Excel VBA program that will first extract this data and then calculate all financial indicators for each municipality. Once the financial indicators are calculated, the radar graph can be constructed based on the performance model.

The dashboard will consist of the indicators defined in Chapter 3 and the requirements of the municipality of Enschede. We will conduct interviews to get the requirements from the municipality of Enschede, see Chapter 4. On the dashboard itself, graphs of all the financial indicators from the model since 2010 will be made. The radar graph, which combines all three subjects of the model, will also be present on the dashboard. There are 2 reasons why 2010 is a good starting year. First of all, because the effects of the crisis in 2008 are not noticeable yet on its performance (Cebeon, 2021). Secondly, because 2010 was the last time the municipal fund distribution, the model that determines how much each municipality receives from the government, was changed. See Chapter 4 for the dashboard. The dashboard will be tested on expandability by inserting budgets into the dataset and making sure the dashboard and indicators properly update, see Chapter 5.

Phase 4: Demonstration

The goal of the demonstration phase is to solve an instance of the problem, to prove that the model and dashboard developed can indeed determine the performance of a municipality. This is achieved by answering the main research question. We must find out whether Enschede's financial state allows them to invest more money into their investment volume and whether they can increase their level of facilities. We will use the municipality's performance model and dashboard to solve the main research question. We will analyse the development of the performance over the past decade. Based on this we give recommendations regarding their investments and level of facilities. Additionally, we will insert their budgets into the dataset. Then we can predict their future performance and thus how their financial state, investment volume and level of facilities will develop as a result of their decisions. See Chapter 5 for this analysis.

Phase 5: Evaluation

The goal of the evaluation phase is to determine how effective the dashboard and model are. This means that the objective of the solution, Section 2.4, must be met. The main objective is to create a clear financial overview for Enschede. This must be achieved with the municipality's performance model which can be analysed on the dashboard. This must show the performance of Enschede and from there it should be able to give an estimation of the future expected performance. The model and dashboard are evaluated by applying them to Enschede and its reference municipalities to see whether we can properly determine their performances. See Chapter 5 for the evaluation phase. In Chapter 6 potential improvements of different aspects of the model and dashboard are discussed. In addition, some users of the dashboard are interviewed to evaluate the model and dashboard.

Phase 6: Communication

The last phase is the communication phase. This includes all deliverables of this research. The solution to the core problem and the answer to the main research question must be communicated with the stakeholders. In the end, the municipality of Enschede will receive the previously discussed dashboard. Additionally, they will receive this report where the past, current and future performance of Enschede is analysed. It will focus on whether Enschede has room to invest more money in the future, or if they might need to budget even more. This will help them to find out if they can finance all their future goals and ambitions.

2.6 Recap

This research follows the DSRM framework. We will start by developing a model to assess the performance of a municipality. This model will consist of 3 parts, namely the financial state, the investment volume and the level of facilities. We will develop a dataset that contains financial data, necessary to calculate the indicators, for Enschede and its reference municipalities. We will calculate scores of the model for each part and calculate some additional indicators with data from the dataset and display these on a dashboard. Based on the model displayed on the dashboard we will give Enschede future financial recommendations.

3. Municipality's performance model

In this chapter, we will develop the model which can assess the performance of Enschede. The model is the first creation of phase 3 (Design & Development) of the DSRM. The other creations that are made in phase 3, the dataset and dashboard, can be found in Chapter 4. We will start by shortly repeating why a model is necessary and explain the advantages of this model compared to standard municipality performance measurements methods, see Section 3.1. In Section 3.2, 3.3 and 3.4. the different parts of the model are explained. In Section 3.5 we explain the method to assess the performance of each indicator. Then the methods to determine the individual scores per indicator are discussed in Section 3.6. In Section 3.7 the statistical techniques to validate the model are discussed. In Section 3.8 two methods to determine the weights of the indicators are discussed. An overview of the entire model is found in Section 3.9.

3.1 Model reasoning

The goal of this research is to find out whether Enschede can invest more money, in order to increase its investments. To make these investment decisions, the current performance of Enschede must be found first. Therefore we decided to develop a model which can assess the performance of a Dutch municipality. Councillors, who together form the local council, need to decide which investments to make in a municipality every year. This model can help municipalities in decision-making by assessing the past and current performance and to determine the influence future decisions will have on their performance.

There are currently 5 mandatory financial indicators used by the government to determine the financial state of a municipality. These are embedded in the law 'Besluit Begroting en Verantwoording' (BBV) article 11 (Overheid, 2019). Because municipalities are obliged to calculate these indicators, we will discuss each in Section 3.2. and determine whether they are useful in the model. For the investment volume and level of facilities, we will find and discuss other relevant indicators in order to assess these two subjects. Indicators for the model must be comparable over multiple years and between multiple municipalities. Therefore it must be possible to determine a general norm for each indicator based on literature.

Subject 1 of the model is used to assess the financial state of a municipality, see Section 3.2. Subject 2 is used to determine the total investment volume within the municipality, see Section 3.3. Subject 3 determines the level of facilities of a municipality, see Section 3.4. These 3 parts combined determine the performance of a municipality. Even though an indicator might not be used directly in the calculation of the performance, if it is useful for the analysis (phase 4 of the DSRM) it will still be part of the dataset and dashboard. The goal of these three sections is to use literature and our reasoning to decide which indicators are useful for the model and on the dashboard. Each indicator will be explained by using literature. We will discuss the advantages and disadvantages of the indicator to determine its performance. Based on this we will explain why an indicator will be part (or not) of the model or dashboard. If helpful, examples are used.

3.2 Financial state

In this section, the financial indicators necessary to assess the financial state of a municipality are discussed. The following indicators will be discussed:

- Solvency ratio
- Net debt quote
- Lendquote
- Ground exploitation space
- Tax producing capacity
- Structural exploitation space
- Total reserves
- Debt per citizen
- Income per citizen (Service solvency)

Solvency ratio

Definition: The **solvency ratio** measures an organization's ability to meet its long-term debt obligations (Hayes, 2021). It gives the ratio between their equity and their total assets. See the following formula for the solvency ratio:

$$Solvency\ ratio = \frac{Equity}{Total\ assets}$$

Evaluation: If a municipality has to use its reserves to pay for its yearly expenses then their equity decreases and thus the solvency decreases. A municipality cannot do this for many years in a row, because eventually their reserves will be (near) empty and then they cannot pay for all their necessary investments. So the solvency gives an indication to what extent a municipality can handle financial setbacks. As mentioned in Section 1.2, a municipality cannot go bankrupt but it can become an article 12 municipality. This happens, just as going bankrupt, if their finances become so bad for an extended period that they cannot manage themselves without extra government aid. The solvency ratio is a useful indicator to predict bankruptcy (Brîndescu-Olariu, 2016).

Conclusion: The solvency ratio will help to assess financial state of a municipality. Therefore this indicator will be used in the model and dashboard.

Net debt quote

Definition: The next financial indicator from BBV is the **net debt quote**. This shows the ratio between all the debt of an organization and the total income. It indicates how much of the total income must be spent on interests and repayments, which are a result of all the debt that an organisation has. It is used to find out whether they can pay for all their debt obligations, like interests and repayments, with their current income (VNG, 2020). See the following formula to calculate the net debt quote:

FixD = Fixed debts
NetCurDebts = Net current debts
AccL = Accrued liabilities
FinA = Financial assets
Exp = Exposures
LiqA = Liquid assets
AccA = Accrued assets
TotInc = Total income

$$Net\ debt\ quote = \frac{(FixD + NetCurDebts + AccL - FinA - Exp - LiqA - AccA)}{TotInc}$$

Evaluation: As shown in the formula, the net debt quote indicates the interest burden of the loans a municipality has taken, by comparing the debt and income. However, a high net debt quote is not always an issue. A municipality can take loans for other external organisations. In that case, the external organisation pays for the interest costs of the loan that the municipality has taken. So the costs of the loans are not paid by the municipality and thus the increase in the net debt quote is not directly an issue. For the model, it is important to distinguish between their own actual debt and total debt. To get a better insight into this, we will use the **net debt quote corrected** for provided loans (BBV, 2020). The net debt quote corrected is calculated by subtracting all loans given to other organisations. This gives a better indication of how much debt a municipality has already taken to use for itself.

Conclusion: Therefore the net debt quote corrected for provided loans will be part of the model and dashboard. Additionally, we will monitor the **lendquote** on the dashboard. These are all loans given to other organisations expressed in the total net income (van der Lei, 2019). See the following formula to calculate the lendquote:

$$Lendquote = \frac{Total\ lent\ supplies}{Total\ income}$$

Monitoring this indicator in combination with the net debt quote gives an indication of the actual risks and debt burden that a municipality has for all its debts.

Ground exploitation space

Definition: The **ground exploitation space** is a ratio between the total value of ground of a municipality and their total yearly income (Eshuis, 2019). See the following formula to calculate the ground exploitation space:

$$Ground\ exploitation\ space = \frac{Total\ ground\ value}{Total\ income}$$

Evaluation: The reserves and ground that a municipality has are the only 2 assets that can be used to cover risks (VNG, 2020), therefore it is important to monitor both. If a municipality has a lot of ground and it depreciates during a recession, then their total assets will decrease. This is an issue because then they might

need to sell their ground for a lower price to pay for necessary expenses. So investing too much in ground increases risks if the ground price decreases. However, a low ground position makes it difficult to expand the city by building new neighbourhoods. If ground is bought to build new neighbourhoods, the risk is lower than constantly having large ground positions because the municipality will eventually sell the houses, with the ground, to the citizens.

Conclusion: The ground exploitation space will not be part of the model because the desired value depends on the goals of the municipality and thus it is difficult to set norms for the indicator or compare it with other municipalities. However, because it is a useful indicator to analyse the risks of Enschede, it will be included on the dashboard.

Tax producing capacity

Definition: The fourth indicator of the BBV is the **tax-producing capacity**. As mentioned in Chapter 1, a municipality taxes the citizens who own a house, which is called 'Onroerende zaakbelasting' (OZB). The tax producing capacity is a ratio between the addition of the OZB, sewer fee and waste fee of a municipality divided by these average costs in the Netherlands (BDO, 2021b). See the following formula to calculate the tax producing capacity:

OZB = OZB costs for family with average WOZ-value[1]
Sew = Sewage charges for family with average WOZ-value
Waste = Waste charges for family
TaxC = Potential tax credit
AvgLiv = Average national (Dutch) living costs in current year - 1

$$Tax\ producing\ capacity = \frac{OZB + Sew + Waste - TaxC}{AvgLiv}$$

Evaluation: At a tax producing capacity of 105%, a municipality charges 5% more OZB, sewer fees and waste fees to their citizens than the national average. The OZB is for many municipalities the only large tax source that can create structural extra income (van der Lei, 2019). So the indicator tax producing capacity, which includes the OZB, is a useful indicator to express the flexibility in the total net income of a municipality according to Van der Lei. The downside of this indicator is that it is compared to the national average.

Conclusion: The trend of the total net **OZB** for an individual municipality must also be analysed separately on the dashboard to determine how much extra OZB income a municipality generated yearly. The model

[1] WOZ also known as 'Waardering Onroerende Zaken' determines the value of houses and other real estate, based on the estimated market value (De Hypotheker, 2021)

and dashboard will use the tax-producing capacity to determine how much extra income a municipality can generate.

Structural exploitation space

Definition: The last financial indicator of the BBV is the **structural exploitation space**. This indicates the differences between structural incomes and structural expenditures (BZK, 2014). A structural income source must be a constant income source over multiple years, like the municipal fund or the OZB income. The exact amount is allowed to differentiate per year. This indicator shows whether a municipality can also pay for all its expenses over a longer period because it does not take into account incidental income sources.

Evaluation: However, municipalities count certain posts, like youth care support, to their structural income even though they are not actual structural posts. This makes their structural exploitation space seem better than it is in reality. Due to this issue, it is difficult to compare the structural exploitation space to a norm or with other municipalities.

Conclusion: Therefore we will not include this ratio in the model and dashboard.

Reserves

Definition: The reserves are the sums of profits and losses of all past years and are part of the equity of a municipality.

Evaluation: Now additional indicators not part of the 5 indicators defined in the BBV are discussed. One of these indicators that is useful is the total **reserves**. If financial setbacks occur and the income of a municipality would decrease then a municipality needs to take action. They can lower expenditure, by postponing investments or pay partly for their expenses by using their reserves. Thus the reserves can be used to handle financial setbacks. If the reserves have decreased over the past years, it implies that a municipality was not able to pay for their yearly expenditures with their current income. This can only be done for a limited time because eventually, the reserves are too low. The difference in reserves between the years indicates how much the net savings of a municipality were. So following the trend of this indicator also tells us how much a municipality was able to save over the years.

Policies that determine to hold large reserves, support investments without hindering performance (Mikkelson et al., 2000). This comes because stockpiling cash avoids the use of debt financing (Berger et al., 1997). Lower debt increases the total income after the subtraction of interest payments and thus leaves more money to spend on investments. So by increasing reserves, a municipality can indirectly also support investing in the city.

Conclusion: For the reasons mentioned above we decided to also add the reserves to the dashboard.

Debt per citizen

Definition: An additional debt indicator that could be used is the **debt per citizen**. This indicator shows how much debt the municipality has per citizen.

Evaluation: However this indicator on its own is not recommended to use as an indicator (Kloha et al., 2005) because higher debt per citizen often also means higher income per citizen. So in order to properly use this indicator the total revenue per citizen must also be monitored. The total revenue per citizen (service solvency) is discussed at the end of this section.

Conclusion: The debt per citizen and revenue per citizen will both be shown on the dashboard to indicate how much debt the municipality has per citizen and how much revenue a citizen yields. This combination of indicators is useful to determine how much an investment is going to cost per citizen and how much extra money it is expected to return per citizen. Because both are relative to the number of citizens, the indicators can be compared over many years and in between municipalities.

Service solvency

Definition: Now we will look at the income of a municipality by analysing the **service solvency**. This indicator indicates the relation between the total revenue in comparison with the total population (Wojtasiak-Terech, 2019). It will be analysed in combination with the debt per citizen. See the following formula for the service solvency:

$$Service\ solvency = \frac{Total\ reveneus}{Population}$$

Evaluation: This indicator can help to identify whether additional citizens can improve the financial state of a municipality. It can help to figure out whether the extra citizens increase the income enough (depending on the type of citizens) to pay for the extra investments that are necessary to attract and sustain this population growth.

Conclusion: This indicator will be part of the dashboard to later use during the analysis in phase 4 (Chapter 5).

Recap

The indicators to determine the financial state of a municipality are the solvency ratio, net debt quote (corrected) and tax producing capacity. The additional indicators that can be found on the dashboard are the lendquote, debt per citizen, service solvency (revenue per citizen), ground exploitation space, OZB and total reserves per citizen.

3.3 Investment volume

The second subject of the model is the investment volume. The investment volume is the total value of all assets that a municipality owns. Examples of this are government buildings and roads. The average national

investment volume has decreased significantly since 2009 (CPB, 2018). The main driver for this decrease has been the recession of 2008. The investment volume shows on one hand the degree to which a municipality can develop itself, by for example acquiring more ground to build houses on. On the other hand, it shows the depreciation of the value of already existing assets. For example, roads or government buildings that have not received maintenance in years have depreciated, so the value of these assets on the income statement has decreased. Therefore it is important to monitor the investment volume and make sure that it increases or at least remains at the same level. This way a municipality maintains its current level of assets (e.g. quality of roads) and can invest more into assets that can develop the municipality (e.g. Urban development and building new neighbourhoods). The following indicators will be discussed:

- Fixed tangible assets
- Net investing quote

Fixed tangible assets

Definition: The first indicator that can determine the investment volume, is the total amount of **fixed tangible assets** a municipality has. Fixed tangible assets are physical items with a clear purchase value. Fixed means that they cannot easily be sold, for example, they are used daily or they are long-term investments. The goal of these assets is to produce goods or provide services with them and they are intended to be used longer than a year (Tamualevielene et al., 2019).

Evaluation: The trend of this indicator tells us how much their assets have depreciated/appreciated and if many new investments have been made. So this indicator can be used to determine the trend of the investment volume of the years. From this we can analyse how the investment volume has performed compared to other Dutch municipalities.

Conclusion: The fixed tangible assets are useful to determine the investment volume and thus it will be part of the model.

Net investing quote

Definition: An additional indicator to assess whether a municipality invests enough to keep its investments at an acceptable level is to look at the **net investing quote** (VNG, 2019). Here the total intangible and tangible assets are compared to the total expenditures. See the following formula for the calculation of the net investing quote:

Tan_assets_t = Tangible assets in year t
Intan_assets_t = Intangible assets in year t
Tan_assets_t4 = Tangible assets in year t – 4
Intan_assets_t4 = Intangible assets in year t – 4
Tne = Total net expenditures year t

$$Net\ investing\ quote = \frac{(Tan\_assets\_t + Intan\_assets\_t) - (Tan\_assets\_t4 + Intan\_assets\_t4)}{Tne}$$

Evaluation: This indicator is more appropriate to determine the investment volume than the level of facilities because the goal of this indicator is to determine how much a municipality invests to remain at the current total value of its own assets. This indicator compares the current level of assets versus 4 years ago. It can be used to assess how much more/less a municipality has invested in the 4 year period.

Conclusion: The net investing quote indicates the amount a municipality invests into its tangible and intangible assets and is therefore useful to determine the investment volume. This indicator will be part of the model and dashboard.

Recap

The indicators that will determine the investment volume for the model are the fixed tangible assets and net investing quote. Both can also be found on the dashboard.

3.4 Level of facilities

The goal of the last part of the model is to determine the level of facilities in a municipality. The level of facilities concerns the amount of money that is spent yearly on all 4 domains. The level of facilities is difficult to measure because it contains both quantity and quality (Cebeon, 2021). For example, the number of swimming pools in a municipality and the quality it offers are difficult to measure. There must be an objective method to determine the level of facilities in a municipality. Wauters (2005) defined, apart from comparing cost levels, different elements which are useful to benchmark the facilities. Some relevant examples of these elements for a municipality are:

- Space use which covers all premises costs (ex. cost of maintenance, cleaning)
- How effective and cost-efficient is the facility management (FM) operations on a strategic level
- How effective and cost-efficient are the computer-aided facilities management systems like the help desk

These elements are useful within a firm where all data of these different aspects is available. This makes it possible to benchmark the facilities and see how cost-efficient and effective all the facilities are. Defining indicators like this for a municipality would be possible. For example, computer-aided facilities management systems could measure the cost and effectiveness of the help desks of a municipality. However, data for these types of indicators are not available and would be very time-consuming to obtain. For pragmatic reasons we decide to use indicators for which data is publicly available. The following indicators will be discussed:

- Total net expenditure
- Social domain
- Municipal fund

Total net expenditure

Definition: The first indicator that we will use to determine the level of facilities is by looking at the **total net expenditure**. The total net expenditure are the total costs a municipality makes on a yearly basis.

Evaluation: We assume that if a municipality increases its expenses then the facilities that it offers will also increase. However, the efficiency at which municipalities execute tasks might differ. Low efficiency means that a large proportion of the total net expenditure is spent on governance and support costs. To monitor the actual level of facilities, the governance and support costs must be subtracted from the total net expenditure.

Conclusion: We will add the total net expenditure (subtracted with governance and support costs) to the model. The total net expenditures will also be compared to the municipal fund and OZB, the largest income sources. This comparison gives an indication of the increase in expenses versus the increase in income.

Social domain and municipal fund

Definition: The **social domain** is all money a municipality spends on social facilities and services for its citizens like youth care and income support. The **municipal fund** is the money a municipality receives from the government. The amount of money a municipality receives is based on a distribution model.

Evaluation: For most municipalities, the largest expenditure of a municipality is the social domain and the largest income source is the municipal fund and thus it is important to monitor both to see if they increase/decrease at a similar rate. Some issues seem to have occurred by the added tasks to the social domain and lacking increase of the municipal fund. In 2015 municipalities needed to execute the tasks of youth care, which was previously done by the government (Rijksoverheid, 2015). Since youth care needs to be executed by municipalities, the cost of the social domain increased and at the same time, the municipal fund increased as well (Divosa, 2018). If the extra costs in the social domain exceed the increase in the municipal funds then the level of facilities must have decreased in a different domain (physical/recreational/governance & organization).

Conclusion: With this indicator, we can analyse the effects of the added youth care on the duties of a municipality. In addition, both indicators can be monitored to make sure that the cost of the social domain will not increase much faster than the municipal fund. This ratio will be part of the dashboard.

Recap

The total net expenditure will be used for the model to determine the level of facilities in a municipality. The cost in the social domain and income of the municipal fund can be found on the dashboard.

3.5 Performance measurements

Now the indicators have been defined, we need to develop a method that can assess the overall level of performance of a municipality. When assessing the performance, the three subjects (financial state/investment volume/level of facilities) need to be differentiated. Therefore the model must have a method that can express all three subjects in such a way that it is comparable between municipalities and

over multiple years. The method must show which subjects are the municipality's weak/strong points. To achieve this a 3-way radar chart will be used. A radar chart is a method to visualize multivariate data (Nowicki, 2016). In addition to the radar chart, the dashboard will also include 2 graphs with the historic trend of the model. One graph includes the score of the model per year and the other will have a cumulative score for the investment volume and level of facilities.

Each subject will have its own composite variable consisting of all indicators previously selected per subject, this will be explained at the end of this section. The financial state, investment volume and level of facilities can be plotted for each municipality (example in Figure 6). Alternatively, the financial state, level of facilities and investment volume can be plotted for Enschede in 2010 and 2019 (example in Figure 7). So the radar charts are used to visualize the performance of a municipality. Thus this model presents the performance of a municipality by visualizing the performance of each of the three subjects individually. For each subject, a weighted average of all financial indicators of the model must be made. Therefore we developed a method to determine the individual score per subject based on the results of the indicators. This method consists of 2 parts. First, scores will be determined for each indicator. Secondly, the indicators will be combined into 1 variable per subject.

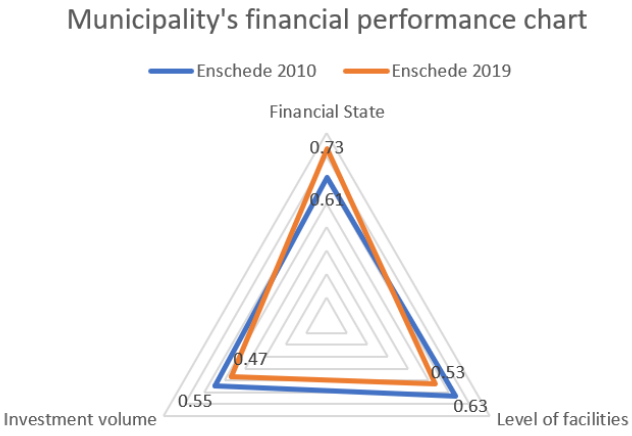


Figure 7: Enschede's performance 2010 vs 2019

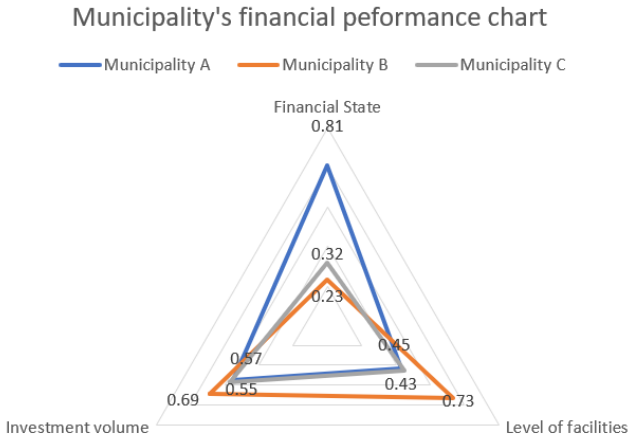


Figure 6: Performance between 3 municipalities

Starting with scoring the individual indicators, the values of each indicator will be normalized. The goal of normalization is to bring the unit or range of multiple indicators to a common basis (European commission, 2016). We will shift all indicators to fit in the range from 0 to 1. The normalization process where the values are shifted between the range of 0 to 1 is called the min-max scaling (Bhandari, 2020). The minimum/maximum value is the lowest/highest value an indicator can realistically take. For some variables, this method does not work. Different methods for these indicators are discussed in Section 3.7. The formula for the min-max scaling for an indicator score where a higher score is better is calculated in the following way:

$$Upper\ indicator\ score = \frac{Actual\ value - minimum\ value}{Maximum\ value - minimum\ value}$$

The indicator score where a lower score is better is calculated in the following way:

$$Lower\ indicator\ score = 1 - \frac{Actual\ value - minimum\ value}{Maximum\ value - minimum\ value}$$

Once the individual indicators have been scored, a composite variable will be constructed for the financial state, level of facilities and investment volume. According to Nardo (2005), a composite variable is an aggregate index consisting of individual indicators and weights that represent the relative importance of each indicator. Even though a single indicator cannot always appropriately explain an observed phenomenon (Song et al., 2013), it can summarize complex issues which are desired by many stakeholders (Saisana et al., 2016). So the composite indicators by themselves might not give the best-detailed explanations of the performance in comparison with observing each indicator separately. It does however give a quick overview and summary of their performance to the employers of the municipality of Enschede, which is necessary for decision making. Therefore we decide to use composite variables to model the performance. On the dashboard, both the individual indicators and model can be found. Therefore it is up to the user of the dashboard how he/she would like to view the performance of Enschede. So the composite variables will be built out of the indicators of Section 3.1/3.2/3.3. For example, the composite variable 'financial state' will consist of the solvency ratio, net debt quote and tax producing capacity which together determine the financial state of a municipality. The weights of each composite variable are discussed in 3.8.

3.6 Scores

First, the different indicators need to be normalized to give scores to each subject. In this section, the normalization of all indicators is discussed. To achieve this, we first must determine a norm for each indicator. An indicator should receive a score of 0.5 (after normalization) if it has a sufficient value. To achieve this, the minimum/maximum value must be set appropriately such that it receives a score of 0.5 when the indicator is sufficient.

3.6.1 Scores of the financial state

First, the score of the financial state is determined. The indicators that are going to be used for this are the solvency ratio, net debt quote and tax producing capacity. For each indicator, we must choose the highest and lowest value. Here the absolute minimum and maximum value of a ratio can be used. However, doing this has 2 downsides. First of all, not all ratios have an actual maximum value. Second of all, by using the absolute minimum and maximum the range becomes larger which means that a change in the ratio only has a very small impact on the score. Therefore we will set the minimum and maximum value in such a way that the created range ranges from a bad to a good score, where a middle score (0.5) implies that the indicator is sufficient. The minimum/maximum will be set in such a way that the range is not too large (most of the range not used in reality).

The minimum value of the **solvency ratio** is 0%. This happens when the total assets completely consist of debt. The actual maximum is 100%. This can only happen when the total assets consist solely out of equity. A higher score means less risk for a municipality and that more loans can be taken to invest in the city. However, a very high score is not necessary because a municipality uses debt to make investments.

Therefore a maximum value will be used for which the solvency ratio is good. According to some literature, a solvency ratio of 40% to 50% is seen as low risk and a score of around 25% is sufficient (BDO, 2021a) (Gezonde solvabiliteit, 2016) (Graydon, 2021). Therefore 50% will be used as the maximum value. A value higher than that does not increase the score of this indicator. The following formula must be applied to get the score of the solvency ratio:

$$Solvency\ ratio\ score = Max(1, \frac{Solvency\ ratio}{50})$$

The **net debt quote** has a minimum value of 0%. This occurs if a municipality does not have any debt. The maximum value could be very high if a municipality does not have any income or extremely large debts. A lower value is better because it indicates less debt in comparison with their total income and thus less yearly interest costs relative to their total income. A value lower than 90% indicates low risks and higher than 130% indicates high risks (BDOa, 2021). So a net debt quote under 90% is sufficient and over 130% is bad. A sufficient value must give a score of 0.5. Considering that 90% is the middle value, 50% will be set as the minimum value (90% - (130% - 90%)). A value under 50% must give a score of 1 and over 130% a score of 0. The following formula is used to calculate the score of the net debt quote:

$$Net\ debt\ quote\ score = 1 - \frac{Net\ debt\ quote - 50}{130 - 50}$$

$$If\ Net\ debt\ quote > 130\ then\ set\ Net\ debt\ quote = 130$$

$$If\ Net\ debt\ quote < 90\ then\ set\ Net\ debt\ quote = 90$$

The **tax producing capacity** is the difference between the amount a municipality taxes its citizens compared to the national average taxes. A lower value indicates that a municipality has relatively low taxes and thus can increase its income in the future when necessary. So a lower tax producing capacity is better (assuming the investment volume and level of facilities are the same) because it gives a municipality more options to increase their income during financially difficult times or to make extra investments. The average tax producing capacity is 100%, this value should result in a score of 0.5. Values have been defined to score the tax-producing capacity. For example the values between 95% and 105% (BDO, 2021a). However, only 39% of the Dutch municipalities have a score between these values. So 61% of the municipalities will receive a perfect or worst score due to this small range. In the case that the range of 95% to 105% is used then the score of the model will not give an accurate representation of the actual tax producing capacity for many municipalities. This can be fixed by enlarging the range. The majority of the municipalities must fall into the range and the average value of 100% must still yield a score of 0.5. In 2019 roughly 89% of the municipalities had a value between 80% and 120% (Appendix A.3.). This gives a more accurate score to the actual value of the tax-producing capacity of a municipality. The following formula must be used:

$$Tax\ producing\ capacity\ score = 1 - \frac{Actual\ value - 80}{120 - 80}$$

$$If\ Tax\ producing\ capacity > 120\ then\ set\ Tax\ producing\ capacity = 120$$

$$If\ Tax\ producing\ capacity < 80\ then\ set\ Tax\ producing\ capacity = 80$$

3.6.2 Scores of the investment volume

The fixed tangible assets and net investing quote determine the investment volume of the model. Starting with the **fixed tangible assets**, a method must be made to score this indicator. The previous method will not work, because the fixed tangible assets are not a ratio but an absolute value. This makes it more difficult to compare between years and with other municipalities. Therefore a different scoring system is used for the fixed tangible assets. Rather than using the absolute value of the fixed tangible assets, we will calculate the increase/decrease, which we call delta. Based on this delta the fixed tangible assets will be scored. The delta can be determined in multiple ways. The delta can be determined in comparison with other municipalities or to its own municipality. Both methods are briefly discussed.

Calculating the delta by only using its own municipality could for example be done by dividing the previous year's fixed tangible assets to its current level. Based on this delta a score could be given. The main downside to calculating the delta by only using its own municipality is that many assets (e.g. buildings) increase/decrease in value over the years which is called appreciation/depreciation. In that case, by just applying maintenance to its assets the investment volume can increase/decrease and they seemingly perform better/worse. However, this is not the effect that we want, because in reality the investment volume remained at the same level. We want to score the fixed tangible assets in such a way that the investment volume only increases/decreases if they are genuinely increasing/decreasing their total investments (not only apply maintenance) and thus perform better.

It makes more sense to compare the delta of an individual municipality to the national average delta. For both the municipality and the national average the individual delta must be calculated. Then we can assess the performance of a municipality by comparing the 2 deltas with each other. The issue that some assets increase/decrease in value over the years due to appreciation/depreciation is not an issue anymore, because all other municipalities will also see an increase/decrease (with different degrees) in some assets. If a municipality has the same increase/decrease in assets as the national average they will receive a score of 0,5. A downside of this method is that the maintainability of the dataset becomes worse because more data needs to be collected. However, we think that the benefits outweigh the costs. Therefore the fixed tangible assets of a municipality are scored by comparing them to the national average. The formula of the delta is as follows:

Fix_tan_assets_t = Fixed tangible assets in year t
Fix_tan_assets_t1 = Fixed tangible assets in year t - 1

$$Delta = \frac{Fix\_\text{tan}\ \_assets\_t}{Fix\_\text{tan}\ \_assets\_t1}$$

Based on this delta the fixed tangible assets can be scored as follows:

$$Fixed\ tangible\ assets\ score\ of\ municipality\ i = Min\left(1, Max\left(0, \frac{Delta\ i}{Delta\ Dutch\ average} - 0.5\right)\right)$$

This formula results in a score of 0.5 with equal delta's. This means that increasing/decreasing the fixed tangible assets at the same rate as the Dutch national average gives an average score of 0.5. After analysing historic data we noticed that roughly 98% of all yearly increases/decreases in fixed tangible assets are within the range of +/-50%. A decrease/increase of 10% in fixed tangible assets will lead to a decrease/increase in score of 0.1 with the current scoring method. The effect of a changing level of fixed tangible assets has in our opinion enough of a significant effect on the end score. Therefore the maximum and minimum values are set in such a way that an increase/decrease (relative to the Dutch national average) of 50% will result in a score of 0 or 1 respectively. This scoring formula will give a score between 0 and 1 for roughly 98% of all municipalities per year.

We will now score the **net investing quote.** A low net investing quote indicates that many investments must be made in the future to compensate for the currently low investments made. If investments now are too low, they will struggle in the future because they must compensate by investing even more money in order to maintain or replace the old assets. These types of investments are called replacement investments. The signal value defined by VNG (2019) which indicates a very poor net investing quote is 1%. We would still like to notice a difference in score between 0% and 1% and thus the minimum value is set to 0%. A net investing quote of 4% is sufficient and will therefore receive a score of 0.5. Based on this we will set the maximum value to 8%.

$$Net\ investing\ quote\ score = Min(1, Max\left(0, \frac{(Net\ investing\ quote)}{8}\right))$$

$$If\ net\ investing\ quote > 1, set\ net\ investing\ quote\ to\ 1$$

3.6.3 Scores of the level of facilities

In this section, the method to score the **total net expenditure** of a municipality is discussed. The total net expenditure is, just like the fixed tangible assets, an absolute value. Therefore a different scoring method must be applied. The total net expenditure for a municipality cannot be scored directly by comparing it to the previous year. The municipality's tasks can change per year and thus the total net expenditure will also change as a result. For example, the added social tasks in 2015 significantly increased the total net expenditure. This increase in total net expenditure did not automatically increase the quality or quantity of the already existing level of facilities.

We decided that the increase/decrease of the total net expenditure will be compared to the Dutch national average increase/decrease. We assume that a higher total net expenditure results in an increased level of facilities. After all, if a municipality increases its yearly expenditures towards the services it provides, either the quality or quantity must increase as well. However, there are 2 drawbacks to this assumption. First of all, the efficiency at which the tasks are executed influences the level of facilities. For example, the improvement of quality and quantity of pools in a municipality if €1 million extra is invested depends on how efficiently the municipality executed these corresponding tasks. This issue will be handled by subtracting the costs of execution from the total net expenditure. Second of all, in order to remain at the same level of facilities with a growing population, the total net expenditure must also be increased. To

address this issue we will use the total net expenditure per citizen to calculate the score. Now the assumption that spending more money per citizen increases the level of facilities is reasonable. The following formula is used to calculate the increases/decreases (delta) in total net expenditure:

Exp_t = Total net expenditure per citizen in year t
Exp_t1 = Total net expenditure per citizen in year t - 1

$$Delta = \frac{A}{B}$$

Based on this delta the total net expenditure can be scored as follows:

$$Total\ net\ expenditure\ score\ of\ municipality\ i = Min(1, Max\left(0, \frac{Delta\ i}{Delta\ Dutch\ average} - 0.5\right))$$

3.7 Validating the model

To validate the choices of indicators for each subject from a statistical point of view, we will apply Factor Analysis. Factor Analysis is used to model the interrelationships between indicators with fewer variables (Institute for Digital Research & Education, 2021). Therefore we can use Factor Analysis to determine whether it is allowed, from a statistical point of view, to construct three composite variables consisting of the underlying financial indicators of the model chosen in Section 3.2, 3.3. and 3.4. All statistical calculations are executed in SPSS, see Chapter 4. Appendix B.2. includes a detailed definition of Factor Analysis and a step-by-step approach to the entire test. We want to execute the following 3 steps:

- Check whether the individual correlation between each of the financial indicators is acceptable. There must be enough correlation to construct composite variables out of them. The correlation cannot be too high either because this implies that 2 variables explain the same behaviour, which is undesired.
- Determine how many composite variables are necessary to properly explain the data. We already decided to use 3 composite variables. This test must determine whether choosing these 3 composite variables is statistically acceptable.
- Determine the correlation of an individual indicator on its corresponding composite variable. We must determine whether this correlation is statistically acceptable and thus find out whether we were statistically allowed to combine the indicators with its corresponding composite variable.

3.8 Weights of indicators

In this section, the weights of the different indicators are discussed. The composite variables can either be constructed with equal or varying weights for each financial indicator. So either each indicator is of equal importance or a method must be used to determine the importance of a financial indicator.

The first option is to give equal weights to each indicator of the composite variable. In this case, each indicator has an equal influence on the outcome of the composite variable. The following formula can be used to calculate the weights of an indicator for its corresponding composite variable:

$$Equal\ weight = \frac{1}{z}, where\ z\ is\ the\ number\ of\ indicators\ for\ its\ corresponding\ composite\ variable$$

However, the indicators might not be equally important to determine the three composite variables. In that case, varying weights are necessary. A method to determine varying weights is by using the opinion of experts in the field of municipality finance. The downside to integrating the experts' opinions into the model's weights is that other users might not agree with the vision of these experts. Therefore we decide to include fields on the dashboard where the user itself can insert the weights. This means that each user can apply their own knowledge. However, if a user is not an expert on the field, but still wants to use the dashboard for decision making, a different method must be used to determine the varying weights.

A different method to determine the varying weights is to apply Factor Analysis. The downside to Factor Analysis is that it could give results that do not apply to our model, which we will discuss later in this section. The steps to calculate weights with the help of Factor Analysis can be found in Appendix B.3. The results of this test are discussed in Chapter 4.

If the Factor Analysis does not give applicable results, equal weights will be used for each indicator by standard. The user of the dashboard can still insert weights according to his/her liking. It is important to note that all indicators have been selected based on relevance and importance to determine the performance of each of the subjects. So all indicators are important to score the performance otherwise they would not have been included. Even if an indicator might statistically receive a lower weight, then the user of the dashboard can still decide to give equal weights to each indicator if that would be more appropriate according to his/her knowledge.

3.9 Summary of the municipality's performance model

The model can assess the performance of a municipality by quantifying the financial state, investment volume and level of facilities of a municipality. For each of these subjects, relevant indicators have been selected based on literature. All the indicators are normalized in order to score and then compare them. Weights for each indicator will be calculated by applying Factor Analysis. So every subject of the model will consist of some indicators with weights. The three subjects combined determine the performance of a municipality. See Figure 8 for an overview of the model.

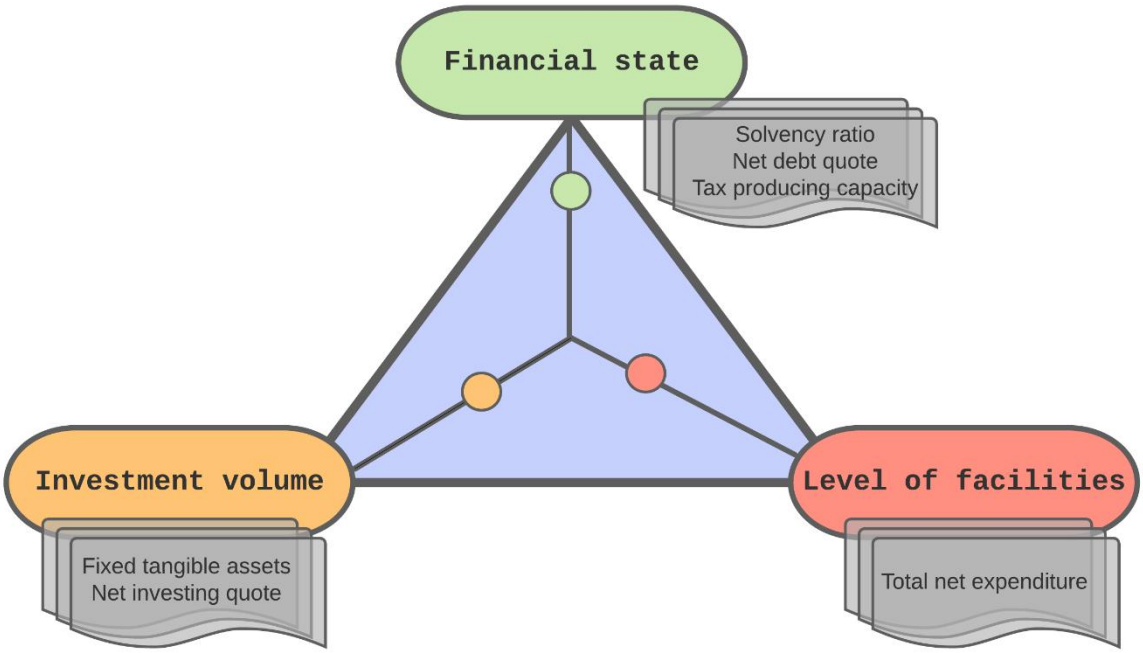


Figure 8: Municipality's performance model

The model will be present on the dashboard in a 3-way radar graph and 2 historic line graphs. In addition, the following indicators are present on the dashboard to get more insights into the performance of a municipality:

- Lendquote
- Debt per citizen
- Total revenue per citizen (Service solvency)
- Ground exploitation space
- OZB
- Total reserves per citizen
- Cost social domain
- Municipal fund
- Net debt quote (Uncorrected)

4. Dataset and dashboard development

In this part, the dataset and the theoretical side of the dashboard development are discussed. The dataset and dashboard are the second creations of phase 3 (Design & Development) of the DSRM. We built the dataset and dashboard by using some methods of the Effective Dashboard Design by Janes A. et al. (2013). This method consists of 2 main parts. The first part is choosing the 'right' data, related to the dataset that we need to develop, see Section 4.1. This part is already largely defined by the indicators selected in Chapter 3. However, there are still some decisions that need to be made and requirements that must be set before the dataset can be made. This first part will give more structure for building the dataset. Part 2 is choosing the 'right' visualization. Here the design of the dashboard is discussed. Part 2 will explain how the data is visualized on the dashboard, see Section 4.2. The Effective Dashboard Design will be used as a guideline to develop our dataset and dashboard. Additional literature to help make decisions or substantiate either the data gathering or dashboard development will also be used.

4.1 Choosing the data

In this section, the data will be collected in order to show useful information on the dashboard. We will discuss which data will be present in the dataset. This decision is based on the GQM approach, which is explained in the next paragraph, in combination with requirements set by the municipality of Enschede. In Section 4.1.2. all collected data is discussed and explained in detail.

Goal-Question-Measurement

We start by finding out which data to collect. In essence, the minimum data that needs to be collected is all data necessary to calculate the indicators of Section 3.9. However, to give some structure to the data gathering process we will follow the same approach used in the Effective Dashboard Design. The Effective Dashboard Design adopts the Goal-Question-Measurement(GQM)+Strategies Approach (Basili et al., 2010). This approach consists of three levels:

1. Goal: This is the conceptual level. What to study and why. What is studied is the "object of study" and the why is what the reason behind this is.
2. Questions: This is the operational level. Determine the focus of the study.
3. Measurements: This is the quantitative level. Define which data to collect to answer the questions objectively.

Appendix A.4. includes an overview of the different levels for the GQM Model. Levels 1 and 2 have already been defined in the previous chapters and thus will not be discussed in more detail in this section. Level 3 is briefly discussed in this paragraph.

For measurements we need data for Enschede and its reference municipalities. We chose the following municipalities as a reference to Enschede:

- Arnhem
- Emmen
- Leeuwarden
- Nijmegen
- Zaanstad
- Average of the Dutch municipalities with 150.000-250.000 citizens

In order to decide which reference municipalities to choose, the Financial Scan of Enschede by the province of Overijssel (2019) has been used. This financial scan chose the municipalities based on important characteristics of municipalities and with consultation with the municipality of Enschede. The characteristics that are used to select the reference municipalities are the social structure, centrum function and the amount of citizens. The reference municipalities are very similar in these characteristics with Enschede. They all have a strong centrum function, which means that many surrounding villages use the facilities of a city. They also have similar social issues with many citizens using financial government aid. The number of citizens between the reference municipalities is also roughly the same.

In addition, the municipality of Enschede wanted to know how well Enschede compared to other municipalities with 150.000+ citizens. Therefore we chose to also add municipalities with citizens between 150.000-250.000 to the list of reference municipalities. This range was set because there are only 14 municipalities in this range (total in the Netherlands is 355) which makes it doable to collect all data of these municipalities and thus makes it decently expendable in the future. For both the income statements and balance sheets averages of this range are publicly available so it saves time collecting this data. However for some data, like living costs, the averages must be collected and calculated manually. We must gather the correct data to calculate all indicators for each municipality. But before we start collecting the data necessary to calculate all indicators, we must first set requirements. In Section 4.1.2 a more detailed overview of the data that must be collected is discussed.

4.1.1 Requirements

To build the dataset, requirements have been set together with the municipality of Enschede. The employers want to use the dashboard over the upcoming years, thus it must be easily updatable which is the first requirement. The following 2 methods to automatically update the dashboard are applied:

- The first automation method is to use a consistent data format. All indicators can be calculated from a combination of balance sheets, income statements and housing costs. To have a consistent format between municipalities for the balance sheets and income statements the ‘Informatie voor Derden’ (Iv3) is used. Iv3 is an information system that states which financial information and in what format must be provided by municipalities (Rijksoverheid, 2009). This information can then be used by for example the European Union and CBS. The exact regulations can be found in the Iv3 ‘Informatievoorschrift’ (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2020). Considering that all new data for all municipalities is provided in this format, the dataset can be updated by copying the new Iv3 data into the dataset. So there is not a lot of manual work to be done to update the data.

- The second automation method is by using VBA to collect all data, necessary to calculate the indicators, from the dataset. The user can just copy the new rows into the dataset and all relevant data will automatically be collected and stored. So the user does not need to find the data from the balance sheets and income statements manually. In addition, the calculation of all indicators will also automatically be updated by VBA. This will save the user a lot of time by not having to find all data and calculate the indicators themselves.

The second requirement is that the user must be able to insert future expenses, expected income, assets and liabilities, based on the investment decisions they make, into the dataset. After the addition of the data, the future expected performance of a municipality must be calculated. VBA will automatically gather all relevant data to calculate the indicators from the dataset. Then the model and indicators on the dashboard will all automatically be updated. This makes it possible to determine the impact that investments or other management decisions will have on the future performance. The user can iterate through many different investment decisions and immediately see the result on the performance.

Another obvious requirement of the dataset is that it must contain at least all data necessary to calculate the indicators from Section 3.8. This in combination with the other requirements determines how we need to build the dataset.

4.1.2 Building the dataset

Now we know which data to collect (and why) and the requirements have been set, we can start to collect the data. See the following list for a brief overview of all data to collect (for Enschede + the reference municipalities):

- Balance sheets for all municipalities in Iv3 (year 2010-2019)
- Income statements for all municipalities in Iv3 (year 2010-2019)
- Population for all municipalities (year 2010-2019)
- Average housing costs multi-person household for all municipalities (year 2010-2019)
- Average Dutch housing costs multi-person household (year 2009-2018)
- Fixed tangible assets and fixed intangible assets for all municipalities (year 2006-2009).
- Detailed budget for both balance sheets and income statements of Enschede (year 2021-2024)

We will now elaborate on the list. Considering that all balance sheets and income statements need to be provided in Iv3 form by all Dutch municipalities to the government (see Section 4.1.1), we decide to use these for the dataset. The user can update the dataset by copying the balance sheets and income statements into the dataset. For the municipalities with 150.000-250.000 citizens the balance sheets and income statements can be found online as well. However, in order to compare the results with other municipalities, the data must be divided by the total number of municipalities in this range, which is 14. The balance sheets and income statements contain most of the information to calculate the financial indicators. We used the https://findo.nl database to gather this data.

The population size for all municipalities must be known. This data is necessary to calculate for example the debt per citizen. For the 150.000-250.000 municipalities the average population is used.

In order to calculate the tax producing capacity, housing costs are necessary. The housing costs consist of the OZB, sewer fees and garbage fees minus potential tax credit. The tax-producing capacity uses the housing cost of a multi-person household (Commissie BBV, 2020). This data has been collected by 'Centrum voor Onderzoek van de Economie van de Lagere Overheden' (Coelo). For the 150.000-250.000 municipalities the data of all municipalities need to be collected to calculate the average. In addition, the Dutch average housing costs for a multi-person household must be gathered. The tax producing capacity uses the Dutch costs of year t – 1, so this data must be collected from 2009.

The net investing quote looks 4 years back. Therefore we must gather the fixed tangible and fixed intangible assets from the balance sheets of 2006 to 2009 in addition to the balance sheets from 2010-2019. However, municipalities don't need to publish their balance sheets from before 2010. The CBS also only publishes the data since 2010 (CBS, 2021). If data before 2010 is publicly available then it is implemented in the dataset. The missing data was estimated by calculating the average slope per year. It does mean that the score of the net investing quote of some municipalities up to 2014 is not very accurate. However, Enschede's data is complete and thus the users of the dashboard can still properly analyse Enschede's performance from 2010 and onwards.

We also want to analyse the future performance of Enschede. For this, we will use the budget made by Enschede of their income statement and balance sheets. This budget is based on the goals Enschede wants to achieve over the upcoming 4 years. The income statement is published online. However, a detailed expected balance sheet which is a result of the income and expenditures of the income statement is missing. For this, we will use the internally proposed balance sheets made by employers of the municipality of Enschede. This is an estimation of the changes in the balance sheet as a result of the future investment decisions that have been made by the local council. Unfortunately, this is not in Iv3 form, thus we must try to convert the posts that Enschede uses into the Iv3 format so that it fits our dataset.

4.1.3 Calculating the indicators

We inserted all data discussed in the previous section into the dataset. All the data, necessary to calculate the indicators, is extracted from the collected data by VBA. VBA helps to automate the process. First VBA loops through all input data to extract the necessary data to calculate the indicators. This data is inserted into a table. A different VBA script is used to calculate the financial indicators based on the previous table. Then a script calculates the scores of each indicator of the model with the formulas discussed in Section 3.6. Finally, the composite variables are calculated.

When the user has added extra data, he/she must press a button. The user only needs to copy the new data into the already existing dataset and everything will automatically be updated. Thus the dashboard can be used to insert many different budgets quickly and analyse the results it has on the performance. The button will first clear all tables, such that all old data is removed. It does not remove any of the data inserted by the user or ourselves. Once the tables are empty, all scripts are automatically run again. All calculations are

executed and the tables are filled up. This automatic process of filling the tables is also necessary to automatically update the dashboard. See Figure 9 for an overview of the steps that are executed.

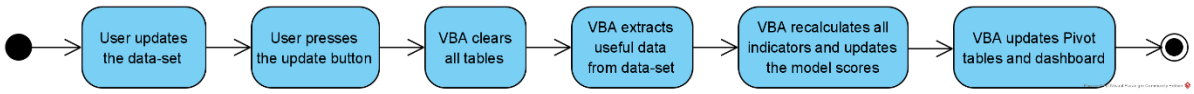


Figure 9: Updating the dashboard process

4.1.4 Statistical validation

Since the dataset is complete and all scores of the model are calculated, the statistical validation can begin. The steps made in Section 3.8. are executed with SPSS. Appendix B.4. includes a detailed step-by-step explanation of the Factor Analysis. In this section, the results are briefly discussed.

The KMO and Bartlett's result is acceptable with a value of 0,512 and thus the data is suited for Factor Analysis (test 1). The test shows that data must be represented with 3 composite variables (test 2), this is the case in the municipality's performance model. The individual indicators have a solid correlation with each other and thus we can make composite variables out of them (test 3). The solvency ratio, net debt quote and tax producing capacity load well on the same composite variable (test 4). The net investing quote and fixed tangible assets also load well on the same composite variable (test 4). The total net expenditures belong to the third composite variable. The conclusion is that the theoretical choices of the model are also statistically acceptable.

4.1.5 Weights with Factor Analysis

In this section, we will discuss the results of the Factor Analysis to determine the weights of the indicators. Appendix B.5. has a more detailed explanation of the results of the Factor Analysis. We concluded that the weights are acceptable and theoretically logical and will thus be used in Chapter 5 for the analysis. The weights are shown in table 1.

	Weights financial state	Weights investment volume	Weights level of facilities
Solvency ratio	**9.5%**	-	-
Net debt quote corrected	**39.8%**	-	-
Tax producing capacity	**50.7%**	-	-
Fixed tangible assets	-	**51.6%**	-
Net investing quote	-	**48.4%**	-
Total net expenditure	-	-	**1**

Table 1: Weights for the model as a result of Factor Analysis

4.2 Visualization

In this section, the dashboard development process is discussed. We will start by explaining the visual choices in Section 4.2.1. In Section 4.2.2. the interview, used to gather requirements and information of the users, is discussed. In Section 4.2.3. the structure of the dashboard, with all the different graphs choices, is briefly explained.

4.2.1 Explanations visual choices

Push & Pull dashboard

The Effective Dashboard Design defined 2 scenarios for a dashboard namely pull or push. In short, a pull scenario is when a user uses a dashboard to obtain a specific piece of information. A dashboard with a pull

scenario should have many options to explore, filter and search the data and should be able to investigate reasons for the occurrences of the data.

A push scenario pushes important information to the user, it tries to capture the attention of the user and inform him. The push scenario tries to inform the user of unexpected and unforeseen situations about problems. A push scenario is mainly useful to grab the attention of a potential user and show information without much effort.

Our target group is people who are already interested in using the dashboard, it is specifically made for them by keeping in mind their requirements. The goal of our dashboard is to create many different insights into the performance of Enschede over the years and compare it with reference municipalities. This will be achieved by using filters to select relevant data and create new insights. Therefore a dashboard that supports a pull scenario seems more fitting. However, considering that there is a significant overlap between both scenarios, we will also implement many aspects often found in a push scenario.

Data context

When building the dashboard from a pull scenario it is important to make the context of the data clear to the user. Some examples are how to interpret the data and how it can be applied in practice. This will be achieved in the following ways:

- **Manual**: The dashboard will contain a manual. This manual will give a short explanation of how to insert new data into the dataset. It will explain how the user can update the model and graphs once he/she updated the dataset. It will explain how to receive more info on the model and graphs (Tip box). It will contain some tips on how the dashboard can help in decision-making by inserting budgets.
- **Short explanation model**: The model will have a tip box. This tip box will briefly explain how the model is constructed and how to interpret the results. It will also explain how to use the model in combination with the other graphs on the dashboard.
- **Explanation of graphs**: There will be some tip boxes with a short explanation of the meaning of the graphs. Additionally, some tips on how they can be applied in decision-making are added.

Dashboard useful in practice

We try to display many different insights into the data, while at the same time keeping the dashboard structured. The dashboard must display information that can help the user in executing their tasks. This aspect is in line with the Technology Acceptance Model (TAM). The TAM tries to define the user's motivation to use the system (Chuttur, 2009). The end goal is a system that is built in such a way that the user actually uses the system in practice. To achieve this the dashboard must properly display the performance of Enschede. The indicators defined in Section 3.9. are effective to determine the performance of Enschede and will thus be displayed on the dashboard. Additionally, the employees of Enschede might have other requirements or insights that he/she wants to extract from a dashboard. To find out the desired structure and extra content (additional indicators) of the dashboard to make sure that the user will actually

use the dashboard in practice, we will conduct some interviews. The interviews can be found in Section 4.2.2.

The user can select which years and which municipalities must be displayed in order to make useful comparisons for all different indicators discussed in Section 3.9. The user can select the years and municipalities with slicers. Slicers are visual filters in Excel which allow for many different data selection options. Slicers do not only give the option to create many different insights on the same dashboard, but it also keeps the dashboard structured and organized. The user can select multiple municipalities over the years in the same graph to see useful comparisons. This must help to make sure that the employees of the municipality of Enschede will use the dashboard in practice by making the dashboard easier and faster to use.

Dashboard structure

An aspect of the push scenario that we deem important is that the user should be able to extract useful information without too much effort. Especially considering that the user of the dashboard might need to make changes in the dataset many times by inserting different potential budgets, to see the effects of different policies on their performance. This is done by making the dashboard more self-explanatory.

The user should be drawn to the most important data first. Therefore the municipality's performance model, with a 3-way radar chart and 2 historic line graphs, will be the main attributes of the dashboard and thus can be found at the top of the dashboard. The rest of the dashboard is split up into the same three parts as the model which are the financial state, investment volume and level of facilities. Each of these parts includes some graphs with relevant in-depth insights into the corresponding subject. With this layout, the user can easily extract information about the topic he/she needs. The layout of the dashboard is discussed in Section 4.2.3.

We deem it important that the user must not have to put in effort to find information about Enschede specifically. This is achieved by setting the slicers to Enschede for 2010 to 2019 at default. This way the user does not need to change any settings if their only goal is a quick overview of Enschede's performance. If more insights and comparisons with other reference municipalities and years are necessary then the user can decide to use the slicers.

4.2.2 Dashboard interview

In this section, we will discuss the interview. For the interview, we followed the focus-group-interview from Assema et al. (1992) where applicable. This method helped us to gather information from a focus group to support decision-making. This method consists of many steps. Appendix B.6. includes an explanation for each step. The question route, which includes all questions asked during the interview, is in Appendix B.7. The following list of requirements is established from the interview:

- Deposits and withdrawals of the reserves.
- Results of the annual report, with and without reserves.

- All 5 indicators of the BBV.
- Trend of the municipal fund as a percentage of the total income.
- Trend OZB, tourist tax, leasehold, advertisement income, dog tax.
- Trend overhead costs compared to total expenditure.
- Costs of governance and support vs total expenditure (inefficiency).
- Amount of free spending money.
- Ratio to determine the ability to handle financial setbacks (‘Weerstandsratio’).
- Values of indicators of the model for the average of the municipalities with 150.000-250.000 citizens in the graphs. Useful for reference.

4.2.3 Dashboard elements

In Section 4.2.1 we made decisions based on the principles of push/pull. In Section 4.2.2. we conducted interviews to incorporate the requirements of the users of the dashboard. A combination of the push/pull principles, the interviews and the financial indicators selected in Section 3.9. make up the dashboard. As mentioned in the previous section the dashboard covers the same parts as the model (financial state/investment volume/level of facilities). The selected financial indicators must cover each part in more detail, for the structure see Figure 10. We will briefly discuss the graph types that are used.

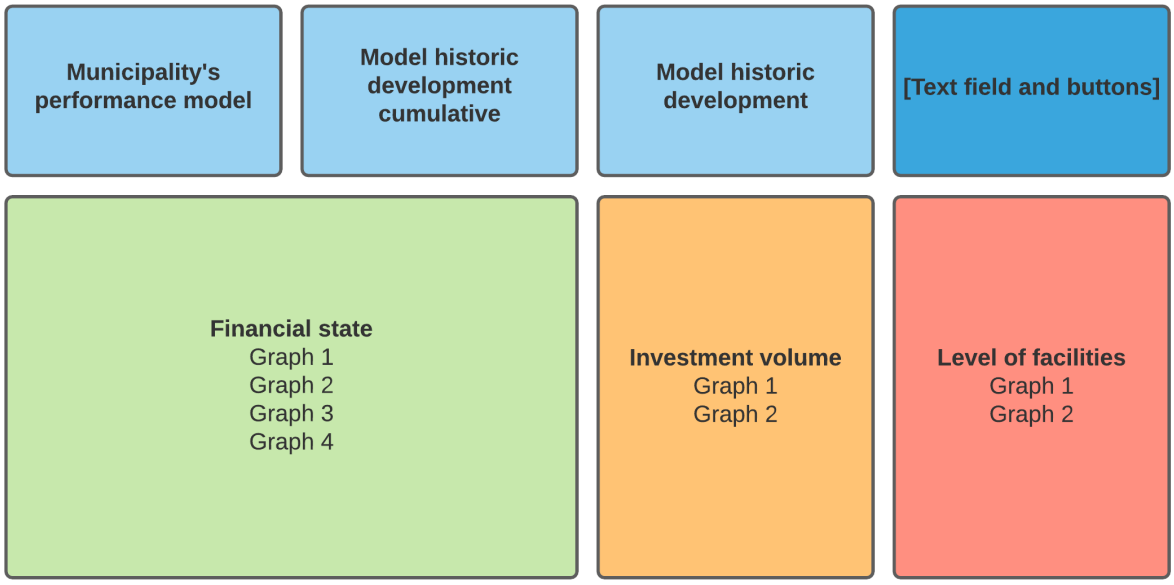


Figure 10: Dashboard structure

For the indicators of the model, we decided to use a combo chart. This combo chart will consist of the actual indicator in a line chart (percentage) and the underlying values in a bar chart (euros). This keeps the dashboard compact and simple while at the same time giving useful explanations of the ratios. For example, the solvency ratio is displayed in combination with the assets and debt, see Figure 11.

Indicators that do not have any useful underlying indicators, like the debt per citizen, will all be plotted in a bar chart. A bar chart is easy to read. A bar chart can also consist of multiple indicators in the same chart

so that comparisons are easily made, like the debt per citizen and income per citizen. The dashboard is shown in Figure 12 and Figure 13.

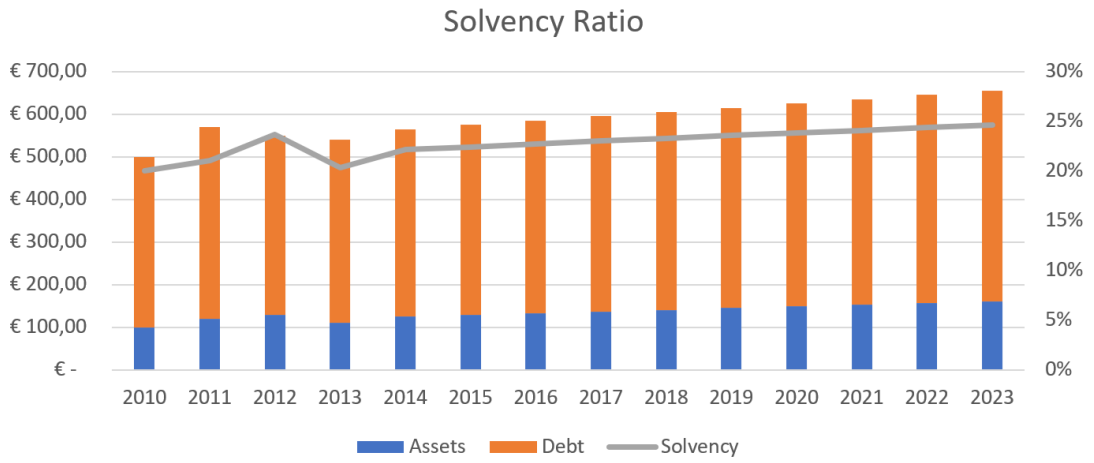


Figure 11: Solvency ratio combo chart

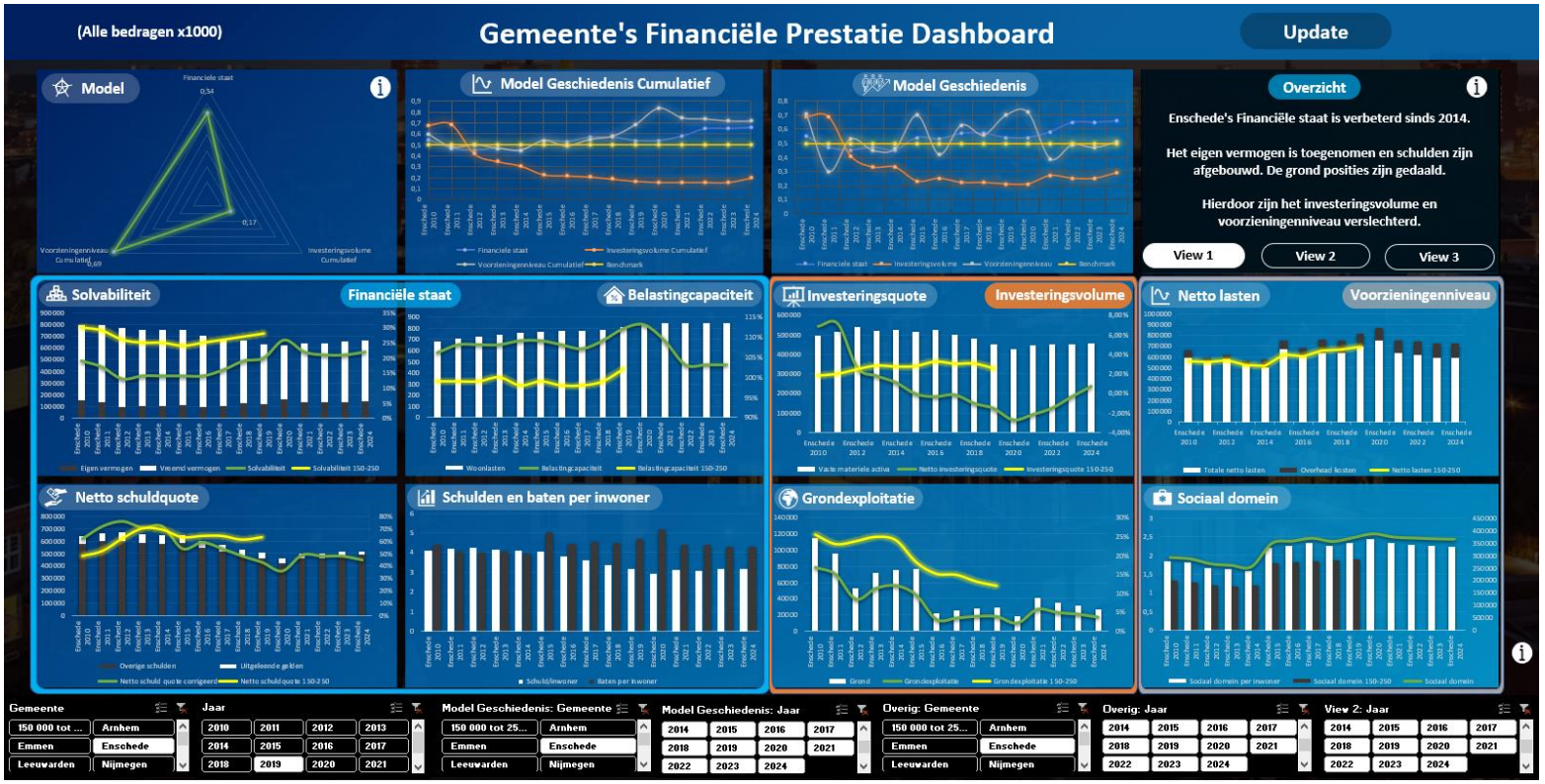


Figure 12: Dashboard view 1 with model, financial state, investment volume and level of facilities

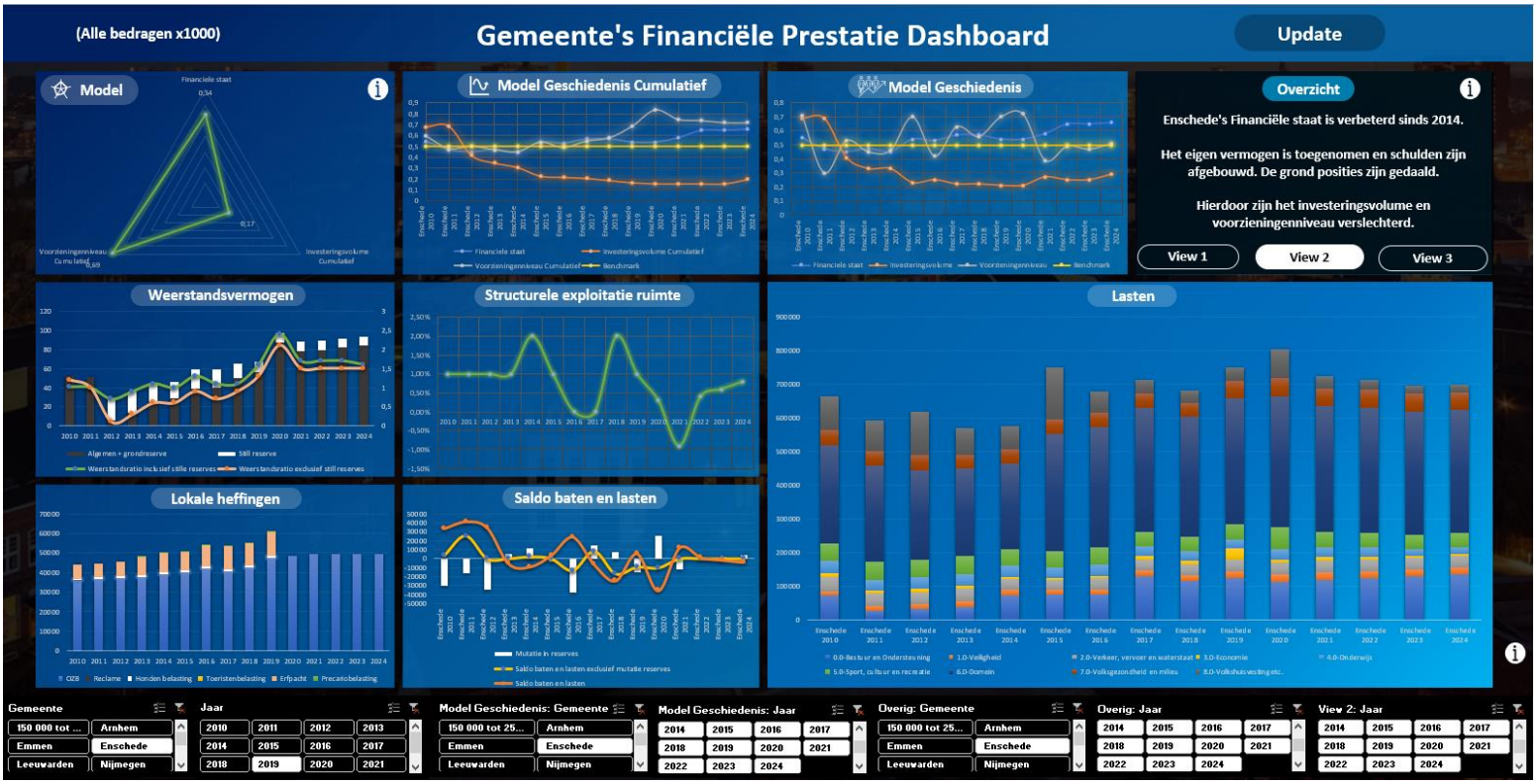


Figure 13: Dashboard view 2 with model and additional indicators required by the municipality of Enschede

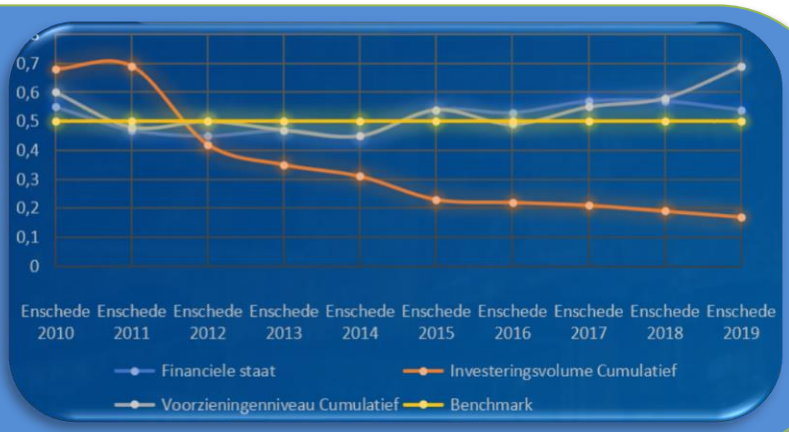
5. Enschede's Performance

Now the model and dashboard are finished, we can determine the performance of Enschede and give recommendations for the future. In Section 5.1. a small recap of the most important trends of all the reference municipalities is discussed. In Section 5.2. we will analyse Enschede's performance in more detail. Here we will also analyse the additional indicators selected in Chapter 3. In Section 5.3. we will find explanations for the occurrence of the trends of Enschede. Finally, we will give our recommendations for Enschede based on the results of the model and the goals of Enschede in section 5.4.

5.1 Recap trends of all reference municipalities

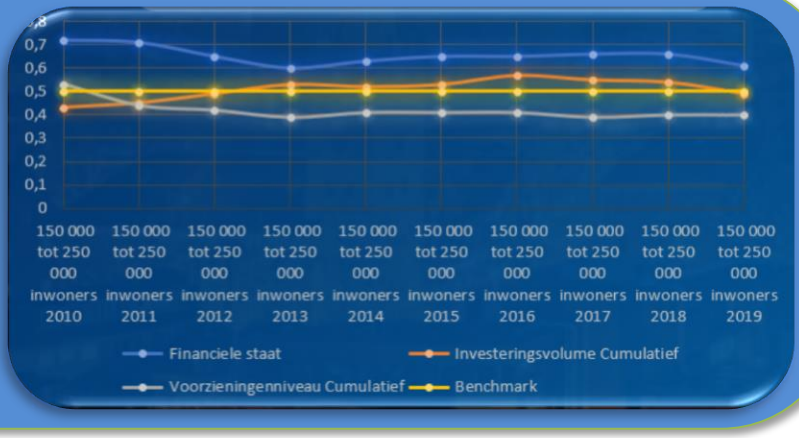
Enschede

- **High investment volume in 2010 and 2011.**
- **Financial state worsened from 2010-2014.**
- **Investment volume crashed in 2012.**
- **After 2014 the financial state improved.**
- **Level of facilities increased since the decentralization of youth care in 2015.**



150.000-250.000 Citizens

- **Started with a very good financial state, especially considering a financial recession occurred in 2008.**
- **Due to a high financial state, they were able to keep their investment volume and level of facilities at a decent level.**

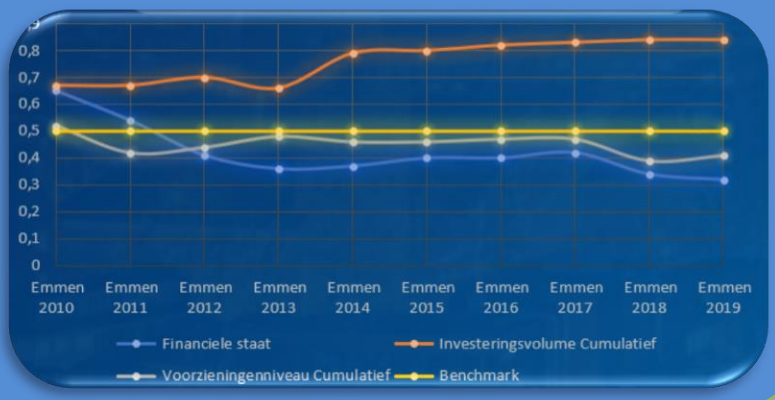


Arnhem

- Started with a good financial state.
- They used their good financial state to increase their investment volume and level of facilities.
- In 2015 they increased their financial state at the expense of their investment volume. They probably made this decision due to the decentralization of youth care in 2015.

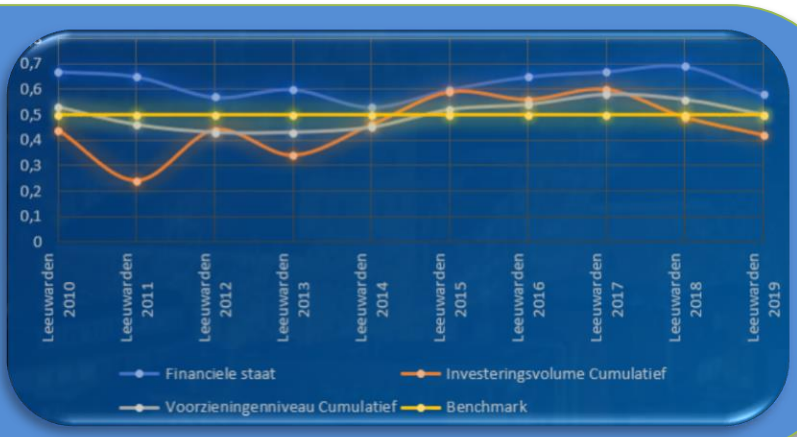
Emmen

- Started with a good financial state.
- Kept their investment volume high at the expense of their financial state.
- Since the last couple of years their financial state and level of facilities decreased further.



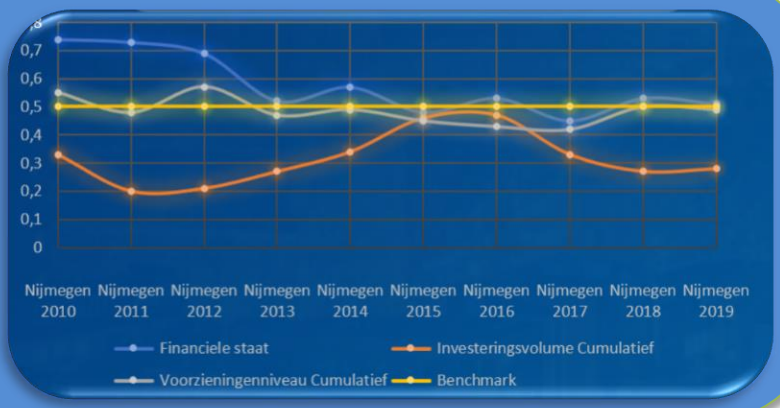
Leeuwarden

- Started with a good financial state.
- Investment volume and level of were under the norm between 2010 and 2014.
- Since 2015 they were able to improve their financial state, investment volume and level of facilities.



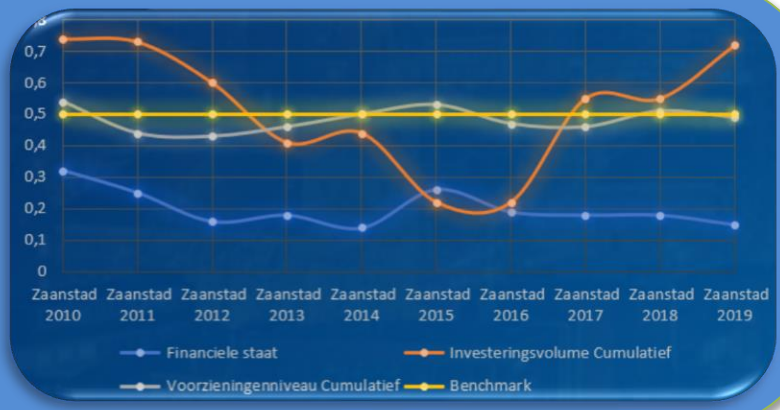
Nijmegen

- **Nijmegen started with a solid financial state.**
- **Their investment volume was low in the period 2010-2014.**
- **In 2015 and 2016 they substantially increased their investments but that was only temporarily.**
- **From 2017 onwards the investments decreased again.**
- **The level of facilities has slowly decreased over the past decade.**



Zaanstad

- **Their financial state has always been very low.**
- **They still had many years in which the investment volume was high. The level of facilities shows a continuous pattern.**
- **The decentralization of the social domain in 2015 is noticeable in their investments.**
- **Considering their poor financial state it is questionable whether Zaanstad can keep their investment volume high.**



The data shows that municipalities used different policies to handle the financial setbacks from the recession in 2008 and decentralization of the youth care in 2015. This results in very different performances among the reference municipalities based on their decisions. For all municipalities except Leeuwarden, there seems to be a correlation between the financial state and investment volume. The financial state increases at the expense of the investment volume and vice versa.

The municipality's performance model can show which policy a municipality applied based on past data. The model can also be used to predict the impact a different policy will have on future performance. So by using the model the councillors can make decisions based on their goals to steer their financial state, investment volume and level of facilities into the desired direction, which aligns with their financial policy.

5.2 Enschede's trends in detail

Model performance: Enschede started with a high investment volume in 2010, but it decreased since 2012. At the same time, the financial state in the period 2010-2014 also worsened. Since 2014 a noticeable increase in the financial state had occurred. At the same time, the investment volume decreased. The level of facilities slightly increased in 2015 and went up to 0.69 in 2019. This increase could be explained due to

the extra social facilities Enschede had to offer after the decentralization of youth care in 2015. Since 2014 the financial state has increased, while the investment volume has decreased.

Assets: In the period 2008-2012 Enschede increased their total debt by €100 million which resulted in a total debt of €671 million. In the period 2010-2012 their equity decreased from €160 million to €100 million (-37,5%), the reserves (largest part of the equity) went from €154 million to €99 million (-35,7%) and the value of their ground went from €115 million to €70 million (-39,1%). Their fixed tangible assets decreased by 17% from 2012 (highest year) to 2019. Less money was borrowed to third parties from 2010 until 2019. In the period 2011-2014, the debt per citizen exceeded the income per citizen.

Costs/Income: From 2014 to 2019, the debt per citizen decreased (from 4080/citizen to 3370/citizen) while the income per citizen increased (from 3920/citizen to 4680/citizen). In 2014 (before decentralization of youth care) the social domain was 68% of the municipal fund and in 2015 (after decentralization) it was 77%. In 2010 the municipal fund was 57% of the total income and in 2019 62%.

5.3 Explanation trends Enschede

We used discussions with the employers of Enschede and literature to find out whether the outcomes of the municipality's performance model are recognizable and to find answers/reasons why these trends occurred. The past trends of the dashboard were recognized and expected by the employers, see the following paragraphs in this section.

Before 2014

Enschede's policy until 2012 was to stimulate recovery from the crisis in 2008 by making large investments. This period was called 'Enschede levert op'. Many large investments were made in this period like the 'Nationaal Muziekkwartier', ice rink ('ijsbaan') and 'Scholingsboulevard'. This increased the investment volume, which as a result decreased the financial state due to the extra debt and lower reserves. Due to increasing debt and a decreasing income as a result of the crisis, the debt per citizen exceeded the income per citizen.

In 2012 the Dutch ground prices decreased a lot as a result of the economic recession after the financial crisis. Enschede's resilience and reserves decreased a lot because Enschede had a large ground position due to their policy of actively buying and selling ground to expand the city. Because of the large ground positions and the devaluation of the values of these positions the financial state of Enschede took a big hit.

New policy in 2014

In order to improve the financial state Enschede decided to adopt a new financial policy in 2014. They decided to postpone investments and only apply maintenance on assets when it was absolutely unavoidable, like broken roads. For 5 years they did no maintenance on schools. To decrease risks they borrowed less money to third parties. They also decided to use a savings program from which €7 to €10 million per year

was added to the reserves. Their new policy resulted in an increasing financial state at the expense of their investment volume.

Present performance 2020

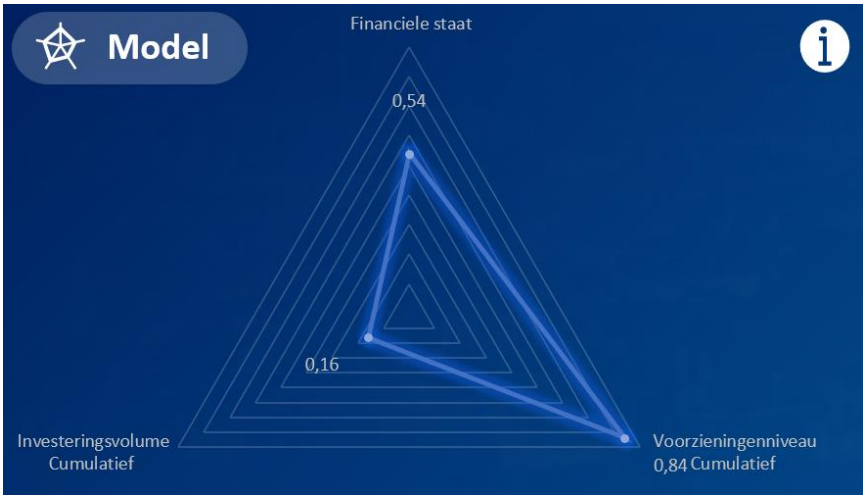


Figure 14: Radar graph of the municipality's performance model for Enschede in 2020

The investment volume is under the norm (0.5) and their financial state and level of facilities are sufficient, see Figure 14. The low investment volume is mainly due to a decrease in fixed tangible assets and a lower ground value, which are a result of the policy to decrease investments and decrease their total ground positions.

Since 2015 municipalities have taken over tasks in the social domain from the central government. This has had a noticeable impact on the performance of Enschede. The tasks in the social domain were taken over by the municipalities. However, the central government only partially compensated for the added tasks. Therefore municipalities did not have enough funds to pay entirely for the added tasks. They handled this by decreasing their total budget for investments. This meant that many of their current investments were neglected and very few new investments were made and thus the investment volume decreased. They did not use their reserves for this increase in costs because their goal was to keep their financial state high. As a result, the investment volume decreased further.

Future performance

See Figure 15 for the future expected performance of Enschede. Enschede's financial state increases due to lower debt and a lower tax producing capacity (so improved). 2020 was a very good year because Enschede received a lot of government funds for Covid-19. They were able to increase their reserves due to the extra government aid and postponed investments as a result of Covid-19.

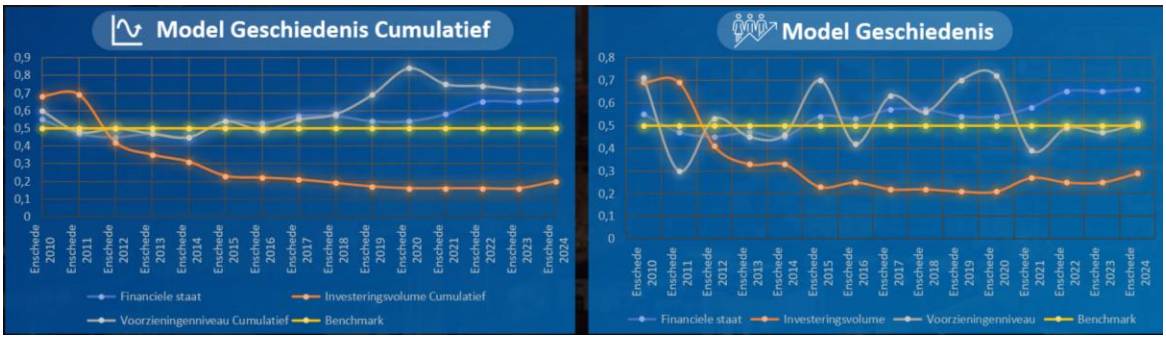


Figure 15: Performance of Enschede

In the left graph of Figure 15, the cumulative score, the investment volume remains at a similar level. However, in the right graph, the absolute values which give a better year by year indication, the investment volume increases slightly. This happens because more maintenance and renewal of school buildings are carried out. However, the investment volume is still very low. The net investing quote approaches 0% (was negative for many years) which implies that Enschede is indeed investing enough to keep the same investment volume in the future. This is an improvement compared to the constantly decreasing investments over the past decade. So the results of the model are in line with their goal to carry out more maintenance to their assets to increase or keep their value.

The level of facilities will remain at a steady and high level. The increase since 2020 might have happened due to an increase in social issues in Enschede which means that the facilities they offer must be increased as well.

5.4 Recommendations for Enschede

As mentioned in Chapter 1, Enschede's population growth over the last decades is a lot lower compared to the Dutch average and other municipalities with 100.000-300.000 citizens. The prediction is that after 2025 the population size will even decrease. Then Enschede can become a shrinking region. This can be due to very low investments (among other things urban development and new residential areas) over the past decade compared to itself and other municipalities. Because the proportion Enschede receives from the municipal fund is mainly based on population size, Enschede needs to cut even more costs if its population decreases. As a result, the investment volume will decrease further, which will in the long term result in an even larger decrease in population. The lack of investments and shrinking population is a vicious circle Enschede needs to escape.

Investment advice

Our advice is to increase investments. On one hand because after years of budgeting Enschede's financial state is good due to high reserves and low debt. This gives them room to acquire more debt to increase investments. On the other hand, because it is necessary to keep Enschede an attractive and growing city in the future.

We recommend making investments that result in the qualitative and quantitative growth of the city. The goal of qualitative growth is to attract more young talent to the city who will further increase the prosperity in the city. This is in line with Enschede's goals mentioned in Chapter 1. The goal of quantitative growth is to make sure that the total population size keeps increasing in the future. We also recommend that Enschede focuses on investments that will increase their earning capability. Currently, Enschede is very dependent on the money they receive from the government. Enschede can achieve this by focusing on urban development and building new residential areas. This can increase their population which will result in higher OZB income. OZB is the largest income source that a municipality makes itself. Additionally, the larger population will result in more income from the municipal fund. By making the right investments that ensure qualitative and quantitative growth in the city, Enschede will remain an attractive and growing municipality in the future and thus can ensure that its financial vitality remains strong.

Based on their current budgets for 2021-2024 their financial state and level of facilities are expected to improve even more, up to a score of 0.66 and 0.72 respectively. The investment volume remains at a low level with a very slight increase. We would not recommend increasing the financial state, but rather improve the investment volume. Rather than lowering debt (currently in budget) we recommend acquiring €33 million in debt, which will not have a large negative impact on the financial state. In 2019 Enschede's reserves had to be at least €46 million to pay for potential risks. We recommend having at least double this amount in the reserves, so they should not take more than €66 million for investments out of their reserves (€158 million in reserves in 2020). To keep their financial state sufficient (above 0.5), the solvency ratio can decrease to 22.5%. Assuming that Enschede indeed increases their debt by €33 million over the upcoming years, they can still take €14.5 million out of their reserves before their solvency ratio is 22.5%. By acquiring €33 million extra debt and using €14.5 million out of the reserves, the financial state will over the long term balance out to roughly 0.5 which is sufficient.

Combine this with the already budgeted extra investments until 2024, then the net investing quote will go (with the additional investments of €47.5 million) up to 2.1% in 2024. This means that Enschede still needs to increase investments even more after 2024 (target is 3%), however, it is an improvement over the currently future expected value of 0.7%. There will roughly be a yearly increase of 4% of the fixed tangible assets, which is higher than the average of all Dutch municipalities. This will bring the investment volume from 0.16 (2020) to 0.36 (2024), which is a significant improvement. Even though Enschede, with our recommendations, will invest a lot quicker than the other Dutch municipalities, the total investment volume is still under the norm and still lower than the score in 2010 of 0.68 (before they started cutting costs). This means that after 2024 they need to keep investing. Unfortunately, their financial state will not allow them to do so. Therefore they must invest in the qualitative and quantitative growth of the city that we recommended in this section. This will increase their income and therefore Enschede can increase their expenditures in the future to either increase the level of facilities or to increase the investment volume even further.

6. Conclusion & Discussion

This research was executed at the municipality of Enschede. The goal of this research was to develop a new method that could assess the performance of a municipality, because Enschede currently lacks a clear overview of their performance, see Section 1.3. for the core problem. This new method should help the municipality of Enschede in its decision-making. Enschede has neglected its investments a lot over the past decade to improve its financial state. During this research, we need to assess the current performance of Enschede and from there determine whether Enschede's financial state allows them to increase their investments.

This research uses the Design Science Research Methodology (DSRM) (Peffers et al., 2007). The goal of this methodology is to create an object which will help to solve the main problem. We decided to develop a model which can assess the performance of a municipality. This model was displayed, in combination with other indicators, on a dashboard. By applying the model to Enschede, we were able to give recommendations.

Model explanation

The model is called the municipality's performance model. It consists of 3 parts namely the financial state, the investment volume and the level of facilities. Each part has its own indicators. The indicators are selected by using literature and then we argued why they are applicable for the model. See Section 3.2, 3.3. and 3.4. for the selected indicators.

We normalized all indicators of the model between 0 and 1, see Section 3.6. The score that an indicator would receive was based on literature about norms for municipality indicators. The normalization was necessary because for each part of the model we constructed a composite variable consisting out of the underlying indicators. Because all indicators now have a score between 0 and 1, the composite variables could be constructed by adding all indicators belonging to the same part. We decided to use Factor Analysis to determine weights for each indicator, see Section 4.1.5. We end up with a final score for the financial state, investment volume and level of facilities.

By calculating all indicators of the model, normalizing the results (to end up with a score per indicator) and combining the corresponding indicators with relevant weights, we were able to assess the performance of a municipality.

Model limitations

There are also some limitations to the model, starting with the total net expenditure used to determine the level of facilities. This decision was made because the total amount of money that a municipality spends after subtraction of the governance and support costs, is the amount that is spent on its facilities. For follow-up research, we would recommend researching whether this is the case in practice and find out whether there is causation and correlation. A potential research question could be: *'Does an increase in expenditures improve the quality and quantity of the facilities in a municipality?'*. With our method, we assume that €1

spent on safety is equally important as €1 spent on youth care to determine the level of facilities. In reality, one facility might be more important for the citizens than another. Research can be done to find out which facilities result in the most prosperity and happiness of the citizens to then determine which weights must be applied to the expenditures on the different domains.

Optionally, follow-up research can be used to develop a completely different method to determine the level of facilities. We already mentioned why counting and scoring all facilities in a municipality is not feasible. It would help the municipality's performance model to research whether there are different feasible methods to determine the level of facilities. These results can then be implemented in our model. Currently, there is not much research on determining the level of facilities in a municipality.

The weights of the indicators (to calculate the composite variable) are calculated with Factor Analysis and used during the analysis in Chapter 5. However, it is difficult to determine which indicators are more important. Option 1, using expert's opinions has the issue that different experts have different opinions on the field, which could result in widely spread results. Option 2, equal weights might in reality not represent the model properly either. Option 3, Factor Analysis determines the correlation of each indicator, based on this the factor loadings are calculated. We calculated the weights based on the factor ladings. We assumed that the correlation between the indicators also determines the importance of an indicator. However, in reality, this might not be the case. So by implementing different methods to determine the weights, the result of the analysis in Chapter 5 might differ.

The norms, necessary to score the indicators, were determined by using literature. However, the norms differed quite a bit between different sources. We set our norms by combining the results of the sources. An optimal norm does not exist and thus other researchers might find different norms more suited. The analysis in Chapter 5 would change if we would apply different norms.

Dataset and dashboard explanation

The model and some other indicators were displayed on a dashboard so that the municipality of Enschede can track its performance. A dataset was necessary to store all relevant data for Enschede and its reference municipalities, see Section 4.1. We built the dataset and dashboard by using some methods of the Effective Dashboard Design by Janes A. et al. (2013). All data, necessary to calculate the indicators, were collected and stored in a dataset. All indicators, see Section 3.9, were calculated for Enschede and the reference municipalities. We used Excel VBA to automatically calculate all indicators and construct the composite variables with relevant weights. By using VBA the dashboard can be updated quickly.

Dataset and dashboard limitations

There are no future budgets for the average of the Dutch living costs, total net expenditure and fixed tangible assets. Therefore these were estimated by using the trend of these values. In reality, these values can turn out differently and thus will result in a different performance for Enschede. However, we expect that the actual values of the 3 subjects of the performance will increase/decrease to a pretty similar degree as the expected values.

Recommendations for Enschede

Since 2012 the investment volume has decreased a lot, see Figure 16. This was necessary to increase the financial state. The level of facilities has improved since 2015. This was mainly due to the extra facilities Enschede has offered since the decentralization of youth care in 2015. Enschede managed to decrease its debt. They also decreased their total ground position. In 2020 the investment volume is far under the norm, while the financial state and level of facilities are sufficient.

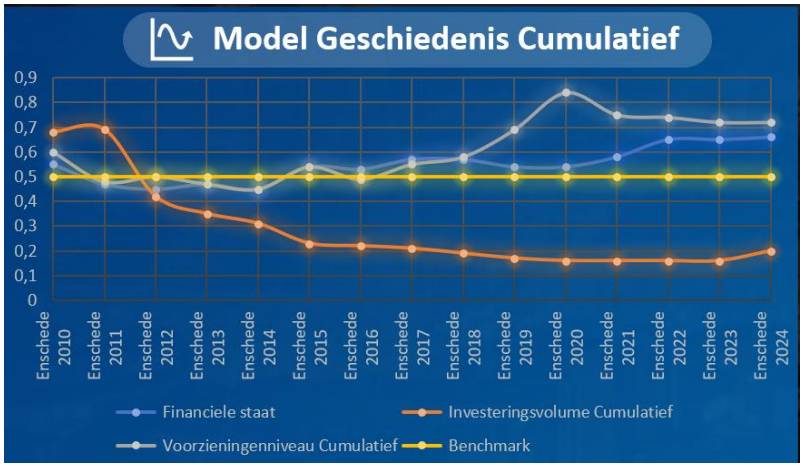


Figure 16: Enschede's performance 2010 to 2024

The answer to the main research *'Can it be justified, by analysing its performance, that Enschede increases its investments?'* is given in Section 5.5. In short, we recommend investing €47.5 million to increase the qualitative and quantitative growth of Enschede by investing more into urban development and new residential areas. The extra funds, necessary to realize these investments, can be acquired by taking €33 million extra loans and using €14.5 million out of the reserves, which will still result in a sufficient financial state while improving the investment volume significantly. It is important that these funds are not all used within a year, but slowly over time. The performance model can be used every year to make sure that the financial state is not decreasing too drastically as a result of these extra investments. Once the investment volume has increased, then we expect Enschede's income to also increase. The extra income can later be used to either improve the level of facilities or increase the investment volume even further. If the financial state worsened a lot due to the extra investments, then the extra income can be used to decrease debt and increase their reserves.

Core problem

The core problem 'There is not a clear overview of their financial position' has been solved by developing the municipality's performance model which can assess the performance of a municipality by analysing the financial state, investment volume and level of facilities. The model and additional indicators are shown on a dashboard, such that the future expected performance of a municipality can quickly be calculated.

Model and dashboard validation

We validated the model statistically by using Factor Analysis. After analysing the results we can conclude that the model is statistically acceptable. The dataset was validated by comparing some of the calculated indicators with published indicators from Enschede.

The usefulness of this research must also be validated by the municipality of Enschede. This was done by interviewing some employees of the concern staff who will use the dashboard which includes the new model to determine the performance of a municipality. We asked these employees to give their views on 4 different subjects. The following 4 subjects are a summary of the interview:

The main problem of the municipality of Enschede: Enschede has had a difficult financial period from 2008 to 2014 due to the financial crisis which resulted in large write-offs on ground. In order to cope with these financial setbacks, Enschede has executed a policy focused on improving its financial position over the past years. They did this by applying a savings program which resulted in a descending investment volume. As a result, the financial state improved. The undesired result of this savings program, which led to a low investment volume, is that Enschede's population barely grew. Because other municipalities were able to grow, Enschede got a smaller percentage of the municipal fund. This meant that Enschede constantly had to cut their expenditures further. This harmed the level of facilities Enschede offers to its citizens. Improving the financial position had undesired side-effects. Enschede now wonders whether it is sensible to increase investments, considering its current improved financial state, and if so, by how much and which specific investments. These are the main questions that must be answered before deciding on the long-term budget. The college of mayor and councillors will discuss this topic with the local council in autumn 2021. We had to execute research that would help in finding a solid solution to this problem.

Research results to solve the problem: The interviewees were very pleased with the new approach that we took during the research. The current method to determine a municipality's performance is to use some common financial indicators like the net debt quote and solvency ratio. These mainly indicate the present financial state. They liked the new approach that we decided to look at the municipality's performance from a broader perspective by comparing the financial state to the investment volume and level of facilities. This new approach shows that the municipality's goal is not to maximize profit but to maximize the social value it can offer. They like that the performance model emphasizes that a proper balance between the financial state, investing to increase the attractiveness of the city and the level of facilities it offers to its citizens, is important.

The interviewees think that the approach we took for the model and research has good leads to do more research. We decided to use a pragmatic approach to determine the level of facilities by analysing the expenditures of a municipality. They think it is plausible that a municipality which spends more on its facilities, will also have better facilities. However, considering that not every euro spend will add the exact same amount of social value, they would like to have a new method in the future which can score the level of facilities more accurately. They also would like to know the exact effects of different specific investments on the investment volume and level of facilities. We concluded that Enschede could invest €47.5 million. However, it is unknown by how much this will exactly increase the different investments and improve the different facilities Enschede offers and how much extra money Enschede can expect to earn in the future

from all different investments. The interviewees would like to see a link between the performance model and theories about the added social value due to specific investments.

The dashboard: The interviewees are very happy with the dataset and dashboard. The dataset consists of budgets and annual reports since 2010 for Enschede and reference municipalities and they think it is easily maintainable by adding new yearly data. They like the graphics of the dashboard and that it displays a clear overview of the performance of a municipality. Since data is available from 2010 and onwards, the interviewees can use the dashboard to analyse trends for different financial indicators. Considering that most graphs contain the values of the reference municipalities with 150.000-250.000 citizens, it gives a good indication about the performance of Enschede relative to other municipalities. They said that the dataset and dashboard are very valuable results of our research. The dataset will be updated in the future to use the dashboard during meetings with the concern staff, the college of mayor and councillors and the financial committee of the local council.

Recommendations and conclusion: Our research was executed simultaneously with the development of Enschede's future budget for the upcoming 4 years released every summer. Enschede needs to make choices on which expenses to spend its budget. The college of mayor and councillors and the local council decided, in combination with the results of our research, to make large investments into the city, starting with €21 million (Gemeente Enschede, 2021). The interviewees said that our research affirms Enschede's expectations that they are able to increase investments considering its financial state and that making investments is an absolute necessity after years of using a money-saving policy.

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Appendix A – Tables and figures

A.1 – Municipal fund indicators

Maatstaven	percentage	cumulatief
1.Inwoners	21,0	
2.Omgevingsadressendichtheid	9,0	30,0
3.Jongeren	7,35	37,35
4.Bijstandsontvangers	7,25	44,60
5.Huishoudens	5,83	50,43
6.Huishoudens laag inkomen	5,83	56,26
7.Lokaal klantenpotentieel	5,36	61,62
8.Minderheden	3,73	65,35
9.Woonruimten	3,65	69,00
10.Woonruimten x bodemfactor	3,56	72,56
11. Regionaal klantenpotentieel	3,06	75,62
12. Oppervlakte bebouwd kernen x bodemfactor kern	2,22	77,84
13. Leerlingen Voortgezet onderwijs	2,17	80,01
14. Ouderen	2,05	82,06

A.2 - Conceptual matrix

Research question	**Research method**	**Operationalization**	**Data gathering method**	**Data analysis method**
1	Descriptive,	Make a list of financial indicators, useful to	Literature study (cross-sectional). Use papers from municipalities,	Make a model out of the list of key ratios, only use key ratios

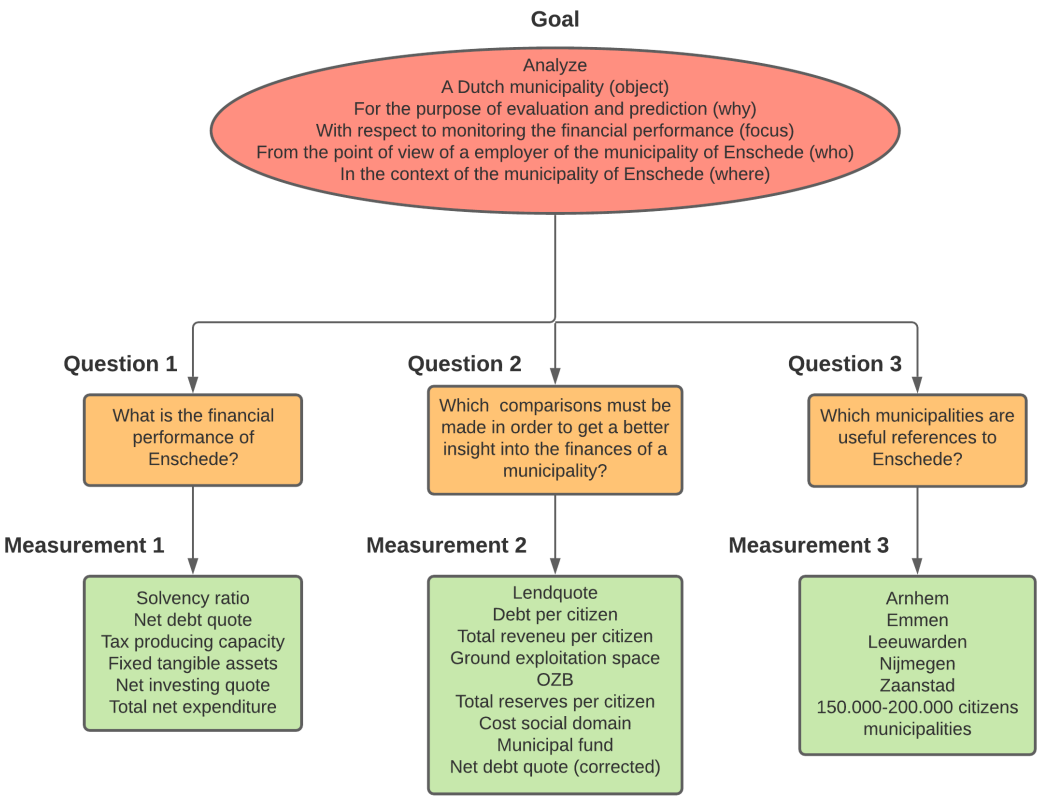
	qualitative research	compare municipalities	scientific databases and search engines to find a list of key ratios for the model	which can be calculated with available data.
2	Descriptive, quantitative research	Make a list of financial indicators to determine the investment volume	Literature study (cross-sectional). Use papers from municipalities, scientific databases and search engines to find a list of key ratios for the level of facilities	Develop a model from the list
3	Descriptive, quantitative research	Make a list of financial indicators to determine the level of facilities	Literature study (cross-sectional). Use papers from municipalities, scientific databases and search engines to find a list of key ratios for the investment volume	Develop a model from the list
4	Descriptive, quantitative research	Add norms to the model	Literature study (cross-sectional). Use papers from municipalities, scientific databases and search engines to find norms/standards of these financial ratios	Check the values of the indicators of the municipalities and compare with the norm
5	Descriptive, quantitative research	List of requirements related to decision making	Interview (cross-sectional) employees of the department of Strategy & Control	Implement the list on the dashboard
6	Descriptive, quantitative research	List of requirements related to insights and comparisons	Interview (cross-sectional) employees of the department of Strategy & Control	Implement the list on the dashboard
7	Descriptive, qualitative research	A concrete method which can be followed step by step	Interview (cross-sectional) employees of the department of Strategy & Control	Find out how to make a dashboard. Determine the structure and which content is appropriate to display.

8	Descriptive, qualitative research	List of reference municipalities based on population number	Structured interviews (cross-sectional) with an employee of the finance team from Enschede and literature study	Compare results with Enschede.
9	Explanatory, quantitative research	Find out how the performance changed and why it changed in this way.	Analyse dashboard	Talk to employers of Enschede and use literature to find out why the performance changed the way it did.
10	Descriptive, quantitative research	Evaluate and study the dashboard	Analyse dashboard	Briefly recap the most important trends of each municipality.
11	Descriptive, quantitative research	Use budgets to determine the future performance	Analyse dashboard	The model with the future performance of Enschede.

A.3 – Tax producing capacity of all Dutch municipalities 2019

194	**Ommen**	101	
195	**Hardenberg**	101	
196	**Drimmelen**	101	
197	**Amersfoort**	101	
198	**Brummen**	100.7	
199	**Alphen aan den Rijn**	100.5	
200	**Landerd**	100.2	
201	**Zundert**	100	
202	**Zandvoort**	100	
203	**Vaals**	100	
204	**Oldebroek**	100	Range 80% to 120%
205	**Nederweert**	100	Sum: 312 of 350
206	**Dronten**	100	Result: 89%
207	**Culemborg**	100	
208	**Amstelveen**	100	
209	**Reusel-De Mierden**	99.9	
210	**Leidschendam-Voorburg**	99.8	
211	**Zevenaar**	99.7	
212	**Zeist**	99.6	
213	**Goeree-Overflakkee**	99.5	
214	**Terneuzen**	99.2	
215	**Ermelo**	99.1	
216	**De Wolden**	99	
217	**Raalte**	99	
218	**Noordenveld**	99	
219	**Middelburg**	99	
	Houten		

A.4 – GQM-Model



Appendix B – Detailed explanations

B.1 – Research design

The main research question is split up into 3 problem statements, each with its own sub-problems, see Section 2.2. Finding solutions to these problems will help to answer the main research question. Literature will be used to answer problem statement 1. For problem statement 2 interviews will be conducted to gather information from the expertise of colleagues of the municipality and to ask for their requirements and insights they need. We will use literature to determine the reference municipalities of Enschede. Problem statement 3 will be solved by analysing the data of the dashboard and applying the municipality's performance model to Enschede's situation.

Problem statements 1 and 2 are both cross-sectional. Problem statement 3 discovers data about the past and future, so it is a longitudinal problem statement. Research questions 1, 2, 3, 4, 10 and 11 are quantitative

questions because they help to measure the performance. The other research questions are all qualitative methods. Not all research has direct analysis methods of the results. However, if results from the interviews are not sufficient, after implementing their requirements into the dashboard/data set, more interviews will be conducted. Problem statement 1 must be answered first, to develop the municipality's performance model. Problem statement 2 is useful for building the data set and dashboard, which must be done before problem statement 3 can be solved. Problem statement 3 combines the results of problem statement 1 and 2. During problem statement 3 the performance of Enschede is analysed with the use of the dashboard which contains the indicators of the model.

For sub problems 5, 6 and 7 interviews will be conducted. For sub problem 5 and 6, literature will also be used. The municipality of Enschede will be interviewed, because they are going to be the direct users of the dashboard. Therefore their requirements are important to implement on the dashboard. We need to find out which insights and comparisons they find useful on top of the already existing model. Once the dashboard is almost finished, it can be tested by the employers of the municipality of Enschede. The employers can give feedback about what they want to have changed. These interviews to test the dashboard can be executed multiple times if necessary. In addition, expertise from accountants will be used to find out more about the current methods that are used to collect data and calculate indicators. There are some reliability issues that we need to discuss. The validity issues of the research can be found in the discussion.

Reliability

In terms of reliability, there are a couple of issues. The government determines which domains and tasks need to be executed by a municipality. This has changed over the years and will most likely also change in the future. Therefore it is important to know that the performance can change, solely based on the changes in these rules, for example the youth care which must be taken care of by municipalities since 2015. The reference municipalities which might be similar now, based on the research questions, might not be relevant in the future. So the dashboard, which has a couple of reference municipalities of Enschede, might need to be changed eventually. Either, these financial comparisons must be taken with a grain of salt in the future, or the list of reference municipalities must be updated and altered. However, we do not expect that the list will change quickly because a municipality's structure will not change drastically after a year.

B.2 – Factor Analysis: Model validation

Why validate the model with statistics?

In this section, the methods used to validate the model are discussed. According to Box (1979), all models are wrong, some are useful. Therefore we need to find out how useful our model is to solve the main research question. The theoretical correlation between the three subjects and indicators has already been substantiated in Sections 3.1, 3.2. and 3.3. We already decided which indicators belong to which subject. This section will be used to explain how we will prove whether the financial indicators and composite variables of the model statistically correspond with each other. This means that the financial indicators cannot just be selected for the model without considering whether the different aspects of the phenomenon

(in this case measuring the performance) are well balanced from a statistical point of view in the composite variable (Nardo et al, 2005). Thus a statistical test must be used to prove that the model is also acceptable from a statistical point of view.

Drawbacks of statistical test

It is important to note that the theoretical substantiation of Chapter 3 are leading and not the statistical tests discussed here. The main reason is that the statistical tests will test correlation and not causation. Causation means that one event is the result of the occurrence of a different event (Australian Bureau of Statistics, 2021). Correlation does not indicate the why and how behind the relationship but it just says that there is some kind of relationship (Singh, 2018). If the results of the statistical tests are leading then indicators might be paired with composite variables that do not actually influence the composite variable. Therefore the theoretical substantiation of the model is leading to determine which indicators belong to each composite variable.

In addition, the results of the statistical test correspond to the current dataset. In the future, the dataset will be expanded. In that case, either these steps must be replicated or the results are not completely accurate. However, we do not expect very different results with an expanding dataset.

Factor Analysis

We must use a statistical method that determines whether the composite variables are built with indicators that can statistically correctly influence the same variable. Therefore we decided to use Factor Analysis. It can be used to regroup variables into fewer variables based on the shared variance (Yong et al., 2013). The main goal here is to model the interrelationships between indicators with fewer variables (Institute for Digital Research & Education, 2021). This is also what we try to achieve by modeling the performance with 3 variables (financial state, level of facilities and investment volume). So by applying Factor Analysis we can check whether the selected indicators load on the same composite variable, for example, whether the solvency ratio and net debt quote indeed influence the financial state. All statistic calculations will be executed in SPSS. We will import the dataset with all calculated indicators into SPSS and execute a Factor Analysis.

Step 1: KMO and Bartlett's test

KMO and Bartlett's Test will be used to test the suitability of the data to do a Factor Analysis (IBM, 2014). This test is a statistic that shows the proportion of variance within the indicators that might be caused by the underlying indicators. A lower proportion means that the data is more suited for a Factor Analysis. If the result of the test is larger than 0.5 the Factor Analysis is actually useful and so the analysis can be continued (Kaiser, 1974).

Step 2: Indicator correlation

SPSS calculates the correlation between each indicator in a correlation matrix. The determinant of the entire matrix must be at least 0.00001 (Field, 2005), otherwise, there is multicollinearity between the indicators.

Multicollinearity happens when 2 indicators are correlated to such a degree that it exceeds a certain limit (Das et al., 2011). One variable can predict another variable quite accurately and this is an issue because then a variable is not statistically significant. In the case that the determinant is lower than 0.00001 one of the indicators, from a pair that has a correlation above 0.8, must be removed (Field, 2005). In order to determine which variable to remove the adjusted R-squared can be used. We must remove one of the indicators and calculate the adjusted R-squared of the model. Then we do the same for the other indicator. A higher adjusted R-squared means that the model fits the data better (Minitab, 2013). So the indicator which resulted in the highest adjusted R-squared for the model should be kept.

Step 3: Composite variables

Another test that can be done with Factor Analysis is to determine which and how many composite variables to use, this is called factor extraction. Each composite variable consists of a set of indicators called loadings, which measure the correlation between the individual indicators and the composite variable (Nicoletti et al., 2000). A composite variable is constructed by taking the indicators which have the largest amount of variability of the total set of indicators. The second composite variable must be uncorrelated with the first and have the second largest amount of variability. This factor extraction is

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	2.43	15.16	
2	2.34	14.60	
3	1.93	12.06	
4	1.58	9.85	
5	.86	5.37	[illegible]
16	.42	2.64	100.00

Extraction Method: Principal Component Analysis.

Figure 17: Determining number of composite variables with eigenvalues by SPSS Tutorials (2021)

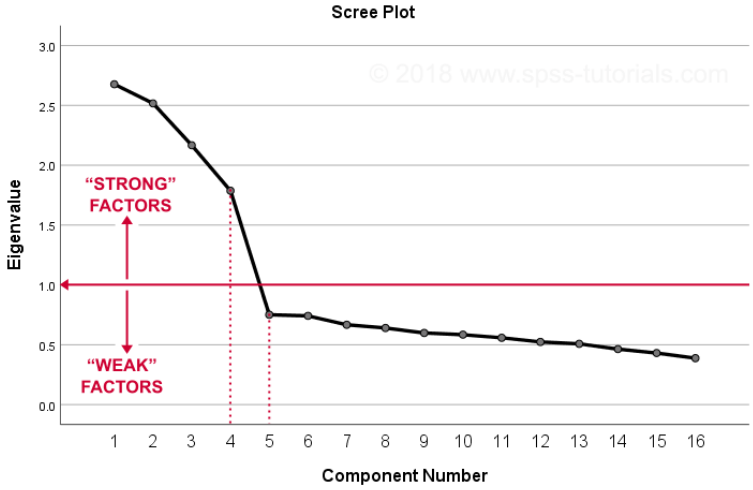


Figure 18: Scree plot by SPSS Tutorials (2021)

mainly interesting to determine the total amount of composite variables to use for the model. There are multiple criteria to select how many composite variables to choose based on the results (eigenvalues). One of them is to use a composite variable for every composite variable with an eigenvalue higher than 1, see Figures 17 and 18. A value higher than 1 explains more variance than a single observed variable (Rahn, 2017). Here we can check whether from the list of indicators we have chosen the correct number of composite variables.

Step 4: Composite variables correlation

The correlation between the indicators on each composite variable (financial state, level of facilities and investment volume) must also be determined. For this, we can also use Factor Analysis. However, SPSS uses the Principal Component Analysis (PCA) algorithm to determine the correlation of the indicators on the composite variables. Principal Component Analysis is a technique to analyse a table of data and describe inter-correlated variables (Abdi et al., 2010) and is very similar to Factor Analysis. The goal is to represent data into composite variables by determining the correlation of all data. Even though the differences between the 2 can result in different outcomes, they are so similar to each other that software like SPSS uses the PCA algorithm for its Factor Analysis (Bock, 2021). We will also use the PCA algorithm during the Factor Analysis because we use SPSS.

The calculated correlation of each indicator on each composite variable will help us to determine whether an indicator affects a subject. This could for example be how much the solvency ratio and net debt quote correlate with the financial state. Based on these results we can decide to leave out an indicator that theoretically would influence the specific subject but statistically does not have a large influence. This step is mainly useful to determine whether an indicator does not have any significant influence on the composite variable at all. However, since the theoretical substantiation already proofed that the indicators influence the different subjects, we do not expect that indicators will be taken out of the model. The execution of these analyses can be found in Chapter 4.

B.3 – Factor Analysis: Weights

As mentioned in Section 3.8, a factor extraction can be used to determine the number of composite variables. The weight of an indicator will be determined based on the proportion of the variance that is explained by the associated composite variable, this is called normalised squared loading. So the individual factor loading for each indicator on its corresponding composite variable must be calculated. Factor loading is the correlation coefficient (relationship) between a variable and a composite variable (Rahn, 2017). SPSS will calculate and show these factor loadings during the execution of the Factor Analysis. The following formula must be applied to determine the weights from all factor loadings:

$$Weight = \frac{Factor\ load\ of\ an\ indicator^2}{\sum_{i=1}^{6} Factor\ load\_i^2}, where\ i\ is\ the\ total\ number\ of\ indicators$$

Applying this formula will result in the weights of an indicator on its corresponding factor. See Figure 19 for an example of the results of Factor Analysis. In the example, the factor loadings for each indicator on each composite variable are calculated. The formula above can be applied with the corresponding factor loadings for each indicator to calculate the weights.

	Factor 1		Factor 2	
Interpretation	Public ownership		Involvement in business operation	
	Factor loadings	Weights of variables in factor (2)	Factor loadings	Weights of variables in factor (2)
Size of public enterprise sector	0.79	0.30	-0.01	0.00
Scope of public enterprise sector	0.77	0.28	0.28	0.05
Control of public entreprises by legislative bodies	0.76	0.27	0.05	0.00
Special voting rights	0.52	0.13	0.48	0.14
Use of command & control regulation	0.18	0.01	0.84	0.43
Price controls	-0.01	0.00	0.78	0.38

Figure 19: Example of Factor Analysis results: state control domain by Nicoletti et al. (1999)

This method would work optimally if the indicators statistically belong to the same 3 subjects (composite variables) that were discussed in Chapter 3, like in the example above. So the solvency ratio, net debt quote and tax producing capacity should belong to the same composite variable, etc. If this is not the case, the sum of factor loadings squared (see formula) must be based on all indicators that belong to the same subject defined by our theoretical substantiation of the model rather than the optimal statistical correlation of the indicators on the composite variables, which are the result of the Factor Analysis. However in that case the weights are determined on indicators that statistically do not belong to the same composite variable, which could give odd results like very small/large and negative weights. The calculation of the varying weights based on the Factor Analysis can be found in Chapter 4.

B.4 – Factor Analysis: Model validation execution

We start by importing the dataset into SPSS. Step 1 is to test the suitability of the data to do a Factor Analysis. This can be figured out by the KMO and Bartlett's test. The result of this test is 0.512. This value is higher than 0.5 and thus the results of the Factor Analysis are useful.

The goal of the second step is to determine the correlation between all individual indicators. The result (determinant) of the correlation matrix is 0.423. A value under 0.00001 indicates a very low correlation between the indicators. A value higher than 0.8 implies a correlation that is too high (multi-collinearity). The result of 0.423 falls well into the range. The individual indicators have an acceptable correlation with each other, see Table 2. There is no multi-collinearity and there are many indicators with a decent correlation with each other. Thus the chosen indicators can be used as part of our model to create composite variables.

	Solvency ratio	Net debt quote	Tax producing capacity	Fixed tangible assets	Net investing quote	Total net expenditure
Solvency ratio	1	0.356	0.017	-0.147	-0.047	-0.045
Net debt quote	0.356	1	0.419	-0.252	-0.437	0.051
Tax producing capacity	0.017	0.419	1	-0.012	-0.129	-0.040
Fixed tangible assets	-0.147	-0.252	-0.012	1	0.434	0.112
Net investing quote	-0.047	-0.437	-0.040	0.434	1	-0.052
Total net expenditure	-0.045	0.051	-0.444	0.112	-0.052	1

Table 2: Correlation matrix of model indicators

Step 3 is used to determine how many composite variables to use to represent the entire dataset. In Table 3 the eigenvalue of each component is shown. A general rule is to use a composite variable if its eigenvalue is higher than 1. In our case, this means 3 composite variables. These three composite variables can explain roughly 69% of the variance. Therefore the choice to use 3 composite variables to represent the data is statistically acceptable.

Component	Total	% of Variance	Cumulative %
1	1.981	33.012	33.012
2	1.110	18.500	51.512
3	1.046	17.427	68.940
4	0.979	16.311	85.251
5	0.531	8.850	94.100
6	0.354	5.900	100.00

Table 3: Total variance explained by data

The final step is used to determine the correlation of an indicator on its corresponding composite variable. The results of this step are shown in Table 4. Based on these results we can check whether the indicators load properly on the same composite variable. An indicator loads properly on the same composite variable if they have a strong positive correlation with the corresponding composite variable. Starting with composite variable 1, the net investing quote and fixed tangible assets have a similar and acceptable correlation. Thus these can be combined into 1 composite variable. Composite variable 2 can be represented with the solvency ratio, net debt quote and tax producing capacity. These 3 indicators have a similar and acceptable correlation with each other. Composite variable 3 mainly correlates with the total net expenditure. Thus the total net expenditure can be used on its own to represent a composite variable.

	Composite variable 1	Composite variable 2	Composite variable 3
Solvency ratio	0.091	0.365	0.487
Net debt quote corrected	0.350	0.746	0.014
Tax producing capacity	-0.178	0.842	-0.035

Fixed tangible assets	-0.847	0.156	-0.186
Net investing quote	-0.821	-0.134	0.217
Total net expenditure	0.060	0.130	-0.869

Table 4: Pattern Matrix

B.5 – Factor Analysis: Weights execution

SPSS uses 3 composite variables to represent the data, just like the model. The results of the weights can be found in Table 5.

	Composite variable 1		**Composite variable 2**		**Composite variable 3**	
	Factor loadings	**Weights**	**Factor loadings**	**Weights**	**Factor loadings**	**Weights**
Solvency ratio	0.091	0.005	0.365	**0.091**	0.487	0.220
Net debt quote corrected	0.350	0.079	0.746	**0.382**	0.014	0.000
Tax producing capacity	-0.178	0.020	0.842	**0.486**	-0.035	0.001
Fixed tangible assets	-0.847	**0.461**	0.156	0.017	-0.186	0.032
Net investing quote	-0.821	**0.433**	-0.134	0.012	0.217	0.044
Total net expenditure	0.060	0.002	0.130	0.012	-0.869	**0.702**

Table 5: Factor loadings and Weights of Indicators

The current results do not apply to our model yet, considering that the factor loadings of all indicators are used to calculate the weights. In order to compensate for this, the sum of the weights of the indicators belonging to one composite variable must be 1. For composite variable 1, it is the sum of the weights of the fixed tangible assets and net investing quote. For composite variable 2, it is the sum of the weights of the solvency ratio, net debt quote and tax producing capacity. The actual weights are shown in Table 6.

	Weights financial state	Weights investment volume	Weights level of facilities
Solvency ratio	**9.5%**	-	-
Net debt quote corrected	**39.8%**	-	-
Tax producing capacity	**50.7%**	-	-
Fixed tangible assets	-	**51.6%**	-
Net investing quote	-	**48.4%**	-
Total net expenditure	-	-	**1**

Table 6: Compensated Weights of Indicators

The results of the financial state are acceptable from a theoretical perspective. The tax-producing capacity is mainly influenced by the OZB. The OZB is the largest income source through which a municipality can directly influence itself. It can be increased in bad financial times to pay for all their unavoidable expenses and thus not create extra debt. Therefore the tax producing capacity is important to determine the financial state. The solvency ratio and net debt quote are somewhat similar. Both indicate the differences between debt and assets, but with a different method. Therefore we do not think that a very low weight for the solvency ratio is an issue because it is compensated by a higher weight of the net debt quote. The investment volume results are also acceptable with roughly equal weights. We conclude that the weights are acceptable and thus they will be used in the model.

B.6 – Interview Steps

- **Goal**: The goal of this interview is to find out which requirements the users of the dashboard have.

- **Focus group**: The focus group will consist of the expected users of the dashboard. These are the members of the concern staff.
- **Size of the group**: The group consists of 5 interviewees.
- **Question route**: For the question route the main themes discussed during the interview need to be determined. In this case, these are the general information, financial insights, dashboard structure and open suggestions.
- **Asking the participants**: The participants are invited by the supervisor with an email.

The following steps are the execution steps:

- **Give an introduction**: We will start the interview by giving a brief introduction. Here we will explain the goal of the interview and the reason why they were chosen as interviewees.
- **Explain question route**: After the introduction, we will explain the question route. Once finished we start asking all questions from the question route in an appropriate order depending on the development of the interview. The goal is to gather all their requirements in order to build a dashboard which they will actually use in practice. This question route takes roughly 1 hour.
- **Make notes**: During the question route, we will make short notes. The notes should have enough detail to be able to incorporate their requirements. At the same time writing the notes should not hinder the interview too much.
- **End**: Once the question route is completed, the interview is finished. We will explain when they can expect the results, in the form of a dashboard with their requirements, of the interview.

The following steps are the elaboration phase:

- **Write down first impressions**: After the interview, we will write down the first impressions. This will include the most important or noticeable takeaways from the interview.
- **Sum up the results**: The final step is to make a list of requirements for the dashboard based on the interview.

B.7 – Interview questions

General information and financial insights

- When do you want to use the dashboard?
- How do you plan on using the dashboard?
- Which decisions would you like to make when using the dashboard?
- What are the most important financial insights that you would like to have?
- Follow up: Is there any information or insights where you do not have a clear overview of (or completely missing) currently?
- Are there any indicators, on the current dashboard, that you do not want to see on the dashboard?

Dashboard structure

- In how much detail would you like to see the financial information?

- Which information do you deem most important?
- Are there any other elements that you would like to see on the dashboard apart from graphs and the model? For example text fields where the user can insert text themselves.
- Are you planning on sharing the dashboard with other, maybe non-finance-related, employers? Follow up: How would this influence the level of detail or additional information for an explanation that is necessary?

Open questions

- Do you have any additional requirements for the dashboard?