University of Twente – Bachelor Thesis European Public Administration

Regional Innovation Policy

Twente & Overijssel in light of the Regional Innovation Scoreboard 2016

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0. Abstract

During the timeframe of 2008 until 2017, the region of Twente followed a self-developed regional policy, called the Agenda van Twente. Its focus was the strengthening of innovation performance. Based

on the Regional Innovation Score (RIS) report of the European Commission in 2016, the province of Overijssel was the only one in the Netherlands to have developed a stronger innovation performance score (+6%). The RIS report also identified several indicators that Overijssel scored lower than average on. In light of the new *Agenda van Twente* (2018), there is a special interest in examining to what extent Twente contributed in making Overijssel the most innovative province and what, according to the RIS indicators, Twente can still improve upon.

After establishing that Twente is indeed the driving force behind innovation in Overijssel through the methodology provided by the RIS, a link between the innovation indicators and corresponding policy instruments within the framework of the regional innovation policy of Twente is established. Based on the indicator data and policy agenda, this thesis argues that a shift from economic policy instruments towards soft would work more beneficial towards increasing innovation performance.

1. **Introduction**

Today's world seems to revolve around all things innovation. There is a seemingly infinite stream of new, efficient products, services and technologies. Behind these outputs are firms and entrepreneurs, each identifying problems to be solved with the newest innovative solution. Innovation is of great importance to governments as it holds an important position in both society and economy. Therefore, governments have a special interest in supporting innovative initiatives, done through so-called innovation policies. The Netherlands, as one of the innovation leaders of Europe (Rijksoverheid, 2016), seeks to stimulate innovative research and development through the means of regional policies. These policies tend to be shaped by "best practice models", derived from similar high-tech areas and well-performing regions. As such, the regional policies applied, are similar across many types of regions (Tödtling & Trippl, 2005). Innovation policies are complex as they are composed of several sub-policies, each aimed at specific social-economic improvement. These policies are highly influenced in the design and implementation process by multiple variables such as globalization (Edquist, 2011), and social - and economic regulation (Blind, 2012). As such, formulating an effective innovation policy remains a challenge.

To aid innovation policy advisors, the European Commission biannually conducts research regarding innovation performance and publishes this information in the European Innovation Scoreboard (EIS). The aim of EIS is to provide a comparative analysis of innovation performance in the EU Member States and its European regions. Using an extensive methodology in which multiple determined criteria are used, the EIS assesses relative strengths and weaknesses of national innovation systems and helps countries identify areas that inadequately optimized. The European Commission publishes a complimentary report called the Regional Innovation Scoreboard (RIS) in which, for each European country, the innovation performance is determined for its European region, so-called NUTS-2 regions. For the Netherlands, NUTS-2 corresponds with the provinces. In RIS of 2016, Overijssel formed the only province in the Netherlands to see an increase in innovation performance (+6%) between 2014 and 2016, compared to the rest of the Netherlands (Commission, 2016a).

One of Overijssel's regions is the region of Twente. Twente has developed and implemented its own innovation policy called the Agenda van Twente in 2008. This policy aimed at developing an innovative and competitive economy in Twente. As the 10-year plan of the Agenda van Twente ends, and a new Agenda is being developed, there is a special interest in knowing in what ways the regional innovation policy can be improved.

As such, two questions can be formulated:

1. To what extent can the increase in Overijssel's innovation performance be accredited to Twente and its regional policy?
2. Assuming that the performance can be linked to Twente's performance, which policy actions relate best to increasing innovation scores?

The scientific dimension of the thesis will take a quantitative approach to innovation evaluation. Using the RIS methodology, a structured approach to the measurement of innovation performance for the region of Twente can be developed and compared Overijssel. With the innovation performance data compiled for the region of Twente, links between the changes in indicator values and policy developments can be drawn. This will enable Twente to see which policy instruments prove effective in improving the innovation performance in the region. By answering these questions, a clearer image of innovative policy instruments is presented that will aid future innovation policy developments.

2. Theoretical Framework

As society and economy are complex concepts, continuously interacting with one another, formulating policy that steers them towards the desired effect remains challenging. This section will take a closer look at the instruments used in policies, and how they can work together in order to reach the desired effect. The theoretical framework lays out how policy, in general, incentivize or decentivize certain objectives. The theory will then be used to link the regional innovation policy of Twente to the categorical performance as measured by the RIS in the analysis section.

2.1 Policy Instruments

Public policy consists of multiple policy instruments. There are actions taken by a government or public authority in order to conform to the objectives of public policy. There are generally three categories of public policy instruments: (1) regulatory instruments, (2) economic and financial instruments, and (3) soft instruments. (Borrás & Edquist, 2013). The instruments can be classified as direct support, such as financial support for firms, or indirect through supportive provisions. Together these tools work to direct society or economy in the right direction.

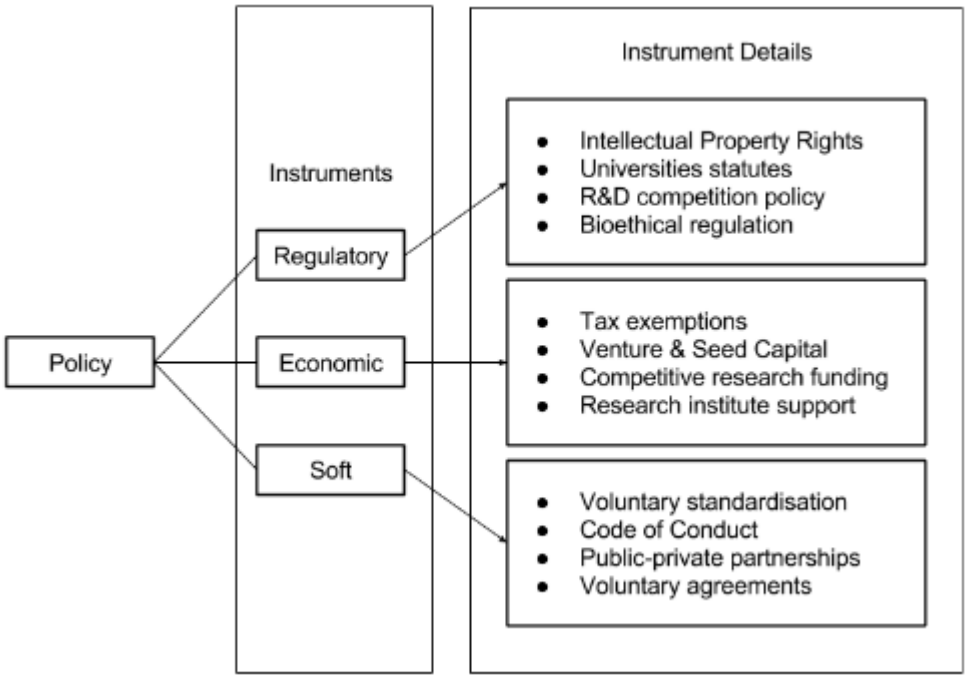

Figure 1The composition of Policy, with examples of instruments

Regulatory instruments use legal tools for the regulation of social and market interactions. These types of instruments rely on laws, rules and directives, which define legal boundaries of actions and are reinforced through sanctions. Regulatory action addresses activities that potentially pose risks for the economy, environment or individuals. The legislation imposed by regulatory instruments aims to be uniform, requiring the capacity, resources and sector specific knowledge to make it work effectively. The usage of regulatory instruments are reserved for national and European governments. Subsidiaries

(provincial, regional) governments cannot alter laws, they can correspond with the ministers and/or state secretaries to formulate new or amend laws.

Economic and financial instruments are used to stimulate incentives and form the predominant instrument used in the formulation of innovation policy. These policies are created with the market in mind, and as such, the usages of these instruments are broad and numerous. Characteristic to these instruments is that they largely influence the development and diffusion products and knowledge (Borrás & Edquist, 2013). The aim is to boost the economy through increasing the access to finance for enterprises and industry producing goods and services (Commission, 2017). This aspect is noticeable in the valorization of knowledge through university spin-offs. This is mainly done through grants and tax cuts or special developed initiatives which aid in setting up enterprises. These instruments tend to be centered on risk sharing with financial institutions in order to reassure other investors and encourage them to invest in innovation. With the aim to focus less on the quantity of students but more on the quality of the given education, usage of financial instruments becomes apparent in the allocation of university funding.

Whilst only largely being complementary to regulatory and economic instruments, soft instruments have become more commonly used over the last decades. Soft instruments do not subject anyone to obligatory measures, sanctions or direct incentives or disincentives by the government or its public agencies. Instead, they provide recommendations, make normative appeals or offer voluntary or contractual agreements (Borrás & Edquist, 2013). These instruments are very diverse, but generally based on persuasion, on the mutual exchange of information among actors, and on less hierarchical forms of cooperation between the public and the private actors. A common example of this tool are dedicated agencies which assume a coordinating and supportive role.

2.2 Incentivizing through policy

The challenge now is how to use the tools in order to incentivize the desired outcome. In *Free Culture* (Lessig, 2004), Lessig formulates a model in which four different modalities of regulations interact to either support or weaken the target of said regulation. The four modalities are: *Law, Norms, Market* and *Architecture*. Each modality has a constricting elements to it, designed in such way to stimulate the target in the desired way. *Laws* constrains by threatening punishments if the legislation is violated. *Norms* have punishment as well, albeit different in nature. Instead of legislative punishment by the state, the punishment is imposed by a community. The *Market* modality constraints through conditions. Whilst intertwined with law and norms, the *Market* imposes on how individuals and groups may behave. The *Architecture* modality refers to the physical constraints of the setting. The four modalities are interactive, and changes to them will reflect on the rest. Notable is the stronger role of *Law*. Lessig's model illustrates how modalities of regulation can be used to incentivize or decentivize though influencing the

severity of the constrains from other modalities. Whilst Twente, as a region, does not have much legislative power regarding *Law*, it can incentivize via *Norms, Market* and *Architecture.*

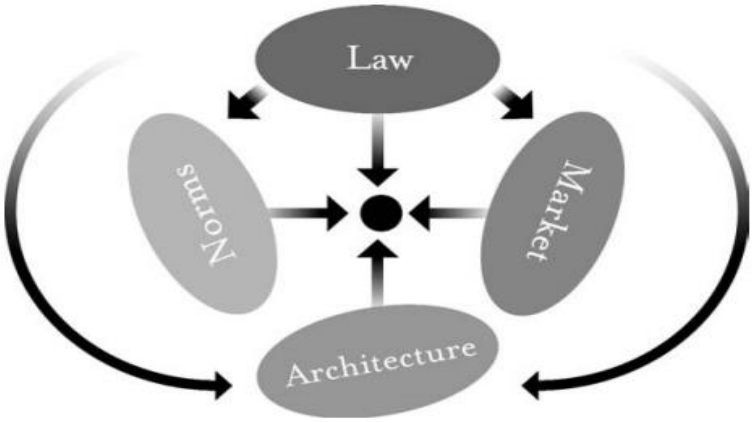

Figure 2 Lessig's Model of Regulatory Modalities (Lessig, 2004)

Lessig's models forms the conceptual framework for what elements a regional government can influence. Of the three policy instruments, regulatory and economic seem the most applicable regarding the stimulation of innovation. Positive economic incentives have become a cornerstone towards innovation. Through the use of subsidies and reduced-interest loans towards new products, whilst upping taxes and tariffs towards inefficient, older products, governments work towards a continuous stimulation of innovative incentives. However, an innovation policy should not just be an increase of inputs into a innovative ecosystem, it should aim to improve the overall willingness to innovate. One way to achieve this is by developing instruments that influence innovation processes in regards to the market. By pairing an innovative policy with an industrial policy, a sectoral shift can be facilitated. This is the case in Twente, where there is a declining manufacturing industry, and an increase in high-tech industry.

The Agenda of Twente (Regio Twente, 2008-2017) was mainly centered around economic incentives, aimed at benefitting the Twents innovative ecosystem, with the role of the regional institutions being limited to facilitation, connection and branding. The Agenda was made with the intention of making Twente a productive and wealthy region where people could work and live nicely. In order to achieve this, an investment of 80m euro was made, of which 35.6m was reserved for the innovation program. The Agenda facilitated cooperation between the regional government, educational institutions and businesses. Using the conceptual framework established by Lessig in conjunction with policy instruments and their usage, an evaluation for Twente's regional policy can be made.

Policy specifically aimed at improving innovation performance is an intricate process. Whilst the most common practice in innovation policy is the usage of economic instruments such as funding, it is not without its risks. Subsidies or venture capital purposed for supporting the development of innovative

firms may prove ineffective if the firm fails to become successful. In order to formulate better innovation policies, it is necessary to know in which areas innovation performance is under performing (Borrás & Edquist, 2013). In this study, the methodology of the Regional Innovation Scoreboard is used as it provides a systematically basis for evaluation of innovation performance for numerous criteria.

3. Methodology and Data Collection

The Regional Innovation Scoreboard indicated Overijssel's with an innovation performance increase. Whilst this portrays a positive development, it is still rather vague in describing what is being done right. In order to improve regional innovation policy, a clear image of the strong and weak points of a policy has to be established. This can be done through the process of innovation measurement. This section takes an look at several innovation measurement methodologies: the input/output method, systems of innovation, and the methodology used in the RIS. After evaluating the methodologies, explanation will follow as to how the methodology can be used to evaluate and improve policies.

3.1 Research design

Two research questions were identified in the introduction, these were:

1. To what extent can the increase in Overijssel's innovation performance be accredited to Twente and its regional policy?
2. Assuming that the performance can be linked to Twente's performance, which policy actions correspond best to the increased innovation scores?

In order to answer these questions, the research design is build up in two distinct section. The first, quantitative, section is dedicated to finding out if Overijssel's innovation performance progression can be attributed to Twente and its public policy. With the RIS methodology setting forth a set of innovation indicators for Overijssel, the aim is to establish the RIS innovation indicators values, based on statistics for Twente. As not all data required for the indicators is tracked or publicly available, an approximation of the required data has to be made. This will be done on basis of existing trends and advice from statistical experts.

After determining the origins for the innovation performance increase, the second, qualitative, section of the research will be aimed at evaluating the regional policy of Twente (Agenda of Twente) and linking the changes in qualitative and quantitate data to the separate innovation indicators of the RIS.

This will enable the possibility to quantify the Agenda of Twente in terms of RIS innovation indicators, and singling out key indicators that contribute to an increased innovation performance. The ability to have an innovative policy quantified in separate indicators forms the basis for a quantified approach to policy evaluation. It will give policy advisors the possibility to monitor the effects of their policy and

notice, through the use of indicators, in which aspects the policy falls short and address this shortcoming accordingly.

3.2 Data Collection

For the initial quantitative aspect of the study, a lot of data over a timeframe from, preferably, 2008 until 2016 is required. The database of Eurostat, CBS (national statistics bureau) and Twente Index (regional statistics bureau) contain an extensive amount of data, which allow the data to be used in the formulation of standardized scores according to the methodology of the RIS. These scores would enable Twente to compare themselves with every European region in the 2016 RIS report. However, the region of Twente does not have data of the requirements set by the RIS. This is as the CBS does not keep track of the all the required RIS variables on a sub-provincial level. Besides the lack of data for several indicators, some of the data that is tracked is strictly confidential. Unless involved directly in the EIS/RIS research, this data is unobtainable. As such, the values and calculations for some of the RIS indicators for Twente have to be approximated.

To combat the lack of data, cooperation with the regional statistical bureau, Twente Index, resulted in reasonable approximations.
These limitations do hinder the overall comparison between Twente and Overijssel. As these are not exact figures, the values ought to be recalculated once the required data becomes available for the region of Twente (approx. Oct 2017). For now, the reasoning for the approximated data for each of the RIS indicators is explained in *Section 4*. This data will give a quantified evaluation of the regional innovation policy, which can be compared to the overall performance of Overijssel. This gives the possibility to examine what indicators are Twentes' strengths and weaknesses. Linking the indicators to policy instruments will indicate what type of instrument is beneficial towards progressing innovation performance.

Regarding the evaluation of the Agenda of Twente and relating it towards the RIS indicators in order to see which were impacted more than average, an empirically qualitative research will take place. Through interviews with a selection of stakeholders in the regional public policy process, such as policy formulation, evaluation and measurement, a better understanding is achieved. The experts to be interviewed, will be based on their participation in Twente's regional regulation process, be it on regional or provincial level. As there is a special interest in addressing the innovation weaknesses as indicated by the RIS, policy advisors will be asked on their input regarding the lower than European average scores for these indicators. Their input on how the approximated data is linked to the policy, will aid in expanding the knowledge regarding the innovation policy mix.

3.3 Measuring Innovation Methodologies

The next sections (3.4 till 3.6) will discuss three different approaches to making innovation measurable. Two common approaches are the *Input/output* and the *Systems of Innovation* methods. As a third method, the RIS methodology is used as it takes elements from the previous two methods. This in an important element of the study as it builds up to the linkage between policy and the quantification thereof through innovation measurement methodologies.

Some background information regarding innovation measurement is required before diving into the details of the RIS. Whilst everyone has a certain idea of what innovation is, defining it is not as easy as it seems. Granieri and Renda (Granieri & Renda, 2012) give the following definition: (a) the creation of new (or the efficient reallocation of existing) resources (b) which contribute to progress. However, innovation is not just the formulation of a new and stronger product of resources. The Oslo Manual (Development, 2015) goes as far as defining four types of innovation: Product, Process, Marketing and Organizational innovation. Formulating a policy that supports these developments is a difficult task. When designing innovation policy, the selection of policy instruments must be done in relation to the actual problems identified in the innovation system (Borrás & Edquist, 2013). These problems are identified through measurements, analysis or comparative studies. Innovation indicators are commonly used as they allow for statistical measurements on multiple governmental levels.

3.4. Input / Output Method

The main approach of measuring innovation is mainly measured through surveys. These surveys can be divided into two approaches: the *input* of innovation activity/focus of firms and the objective *output* of the innovation process (Smith, 2005). The *in/output* method allows governments to get an overview of how their efforts translate into certain effects on society and/or the economy.

3.4.1 The Input Approach

The Organization for Economic Co-operation and Development (OECD) is one of the most widely recognized organizations regarding innovation indicators. The OECD formulated the now known Oslo Manual as a consensus in the pursuit of an innovation manual. Through cooperation with the European Commission, Eurostat and DG-Enterprise, the Oslo Manual became a vital part in the formulation of the Community Innovation Survey (CIS). The CIS was formulated in an attempt to collect internationally comparable direct measures of innovation outputs (OECD, 2017). “The harmonized survey is designed to provide information on the innovativeness of sectors by type of enterprises, on the different types of innovation and on various aspects of the development of an innovation, such as the objectives, the sources of information, the public funding, the innovation expenditures etc. The CIS provides statistics broken down by countries, type of innovators, economic activities and size classes” (Eurostat, 2017). Initially the CIS looks at the technological innovativeness of a product. In order to do so, the product is defined based on its progression in comparison with similar products, its projected sale success relative to similar innovative products. As such, the *input* approach allows a consistent evaluation of product

changes, innovationess and consumer success, ultimately leading to a successful way to measuring innovation. The data collected by the CIS is then used to formulate the annual European Innovation Scoreboard (EIS) in which the strengths and weaknesses of countries and regions are highlighted.

3.4.2 The *Output* Approach

One of the most prominent examples of the *output* approach is the SPRU database, developed by the Science Policy Research Unit at the University of Sussex. This database contains information on major technical innovations in British industry, covering sources and types of innovation, industry innovation patterns, cross-industry linkages, and regional aspects. The data is comprised of 4,300 innovation (outputs) between 1945 and 1983, as determined through a broad panel of technical experts from a diverse selection of sectors.

The *output* approach is a strong way to measure innovation. Due to the technical nature of involved in the measuring process, as well as the researchers (experts) who preform the assessment(s), the output approach allows for a close determination of the technology itself, through an independent expert. This results in a historical perspective on technological development and a more accurate portrayal of actual innovative outputs. However, as the *output* has to be proven 'significant' enough in order to be true innovations, this approach is threatened by sample selection bias: only new outputs tend to be deemed innovational, contrary to routine incremental product innovation. In order to avoid this, it is important to identify the sample firms and filter out those firms which are not willing to innovate and therefore do not engage in any innovation activity for reasons other than obstacles. This avoids counterintuitive evidence of a positive relation between intensity of innovative investments and perception of obstacles to innovation (Pellegrino & Savona, 2013). This approach coincides with the guidelines set by the Oslo Manual and the CIS. "The Oslo Manual and CIS identified different degrees of product innovation by asking firms to distinguish between sales of products new to the firm only, products new to the industry, or products that were wholly new" (Smith, 2005). The implementation of the *output* approach by extensive databases such as the SPRU database efficiently portrays the different types of innovative activity across different types of industry. Due to the broad sectoral research approach, the SPRU database essentially forms the foundation for the concept of system of innovation in which three major engineering sectors (mechanical engineering, instruments and electronic engineering) form the main sectors in terms of the flow of innovations into other sectors.

3.4.3 The Strengths and Weaknesses of the in/output system

The *in/output* approach to policy evaluation ensures a quantifiable approach to measuring what efforts are used to facilitate innovation, and the consequential products. This forms an excellent measuring tool for economic policy tools. The quantification of efforts and results enables policy makers to standardize policies and compare them. The disclaimer remains that policies do not perfectly translate between

settings. However, it would enable quicker comparisons and, in doing so, finding the 'best practice' policy models easier.

However, the system is still limited. It remains unclear whether the input actually translates into output. Following the same principle of policies, there are many factors interacting with each other that may, or may not result in the desired effect of the policy. It is impossible to establish a clear causal relationship between a new policy (input) and an increase in innovative productivity (output). The possibility of multiple confounding factors influencing a certain indicator of innovation cannot fully be anticipated. The input method is most used in combination with evaluation of projects made within the policy framework. Whilst this does not qualify as direct output evaluation of the innovation system, it does evaluate what the outputs for the system are and the progress made within the framework.

3.4 Systems of Innovation

There is the need for a genuinely dynamic view of policy formulation and policy interaction which highlights the trade-offs and tensions inherent in any policy mix and to promote open debates about them (Flanagan, Uyarra, & Laranja, 2011). Whilst the *input*/*output*-method enables a structural approach to the progression of innovation, it is a static approach. It does not contain the dynamic element that is embedded in the nature of innovation itself. Systems of Innovation (SI) pay special attention to the flow of technology and knowledge.

Innovation policy instruments are closely related to the different activities of the innovation system (Edquist, 2010). The SI approach aids in the comparison of differences between different economies, innovative performances, and the consequential further development of policy. The SI approach is a comprehensive approach regarding innovation policy contexts. The approach places the learning process of innovation at its center, trying to encompass important determinants of innovation, thus making it possible to include organization, social, and political factors in the addition of economic determinates. The approach is very much like the innovation process itself: interdependence, non-linearity, focused on both product and process innovation and it has an emphasis on the role of institutions (Edquist, 2010).

The SI approach is not without its flaws of conceptual diffuseness. Whilst the concept of the system provides a means to evaluate dynamic systems better, the boundaries of the SI uses are not specified. There are no clear instructions to what is to be included as part of the system, or what is to be excluded. The reasoning behind this is that as innovation is a continuous evolving process, the definition of the system is to be kept open and adaptable to newer systems. As such, the SI approach loses a great portion of its scientific validity. Due to the lack of clearly defined concepts, the SI approach tends to be used as a conceptual framework that synergizes towards the innovative nature of these systems.

3.4.1 Strengths and Weaknesses of the Innovation Systems approach

The SI approach is a versatile approach that can be applied in multiple forms of policy context, such as regional and national governments and even on international levels. The SI approach is particularly attractive as it forms an adaptable way to understand the differences among different economies' innovative performance, whilst providing support towards further development of policies.

One of the most prominent features of the SI approach is the role of knowledge. Whilst most policy evaluation approaches tend to see the process of innovation as an exogenous process, the SI approach acknowledges the process of combining elements of old and new knowledge into an innovative product. The interdisciplinary and open approach adopted by the SI tries to maintain an 'open' view towards innovation, allowing for the inclusion of organizational, social and political factors, as well as economic ones (Edquist, 2010). The 'open view' towards the innovative process can be seen in the focus on interdependence. It understands that firms tend to cooperate in order to engage in innovative developments. These innovative processes are not just actions as a results of the means provided, but also the interaction between the components within the SI. At last, the role of institutions is considered important to the innovative process as well. Institutions strongly influence innovation process through incentives, regulation and other policies.

The SI approach seems to 'understand' what elements and processes are needed to make innovation happen. By keeping the approach broad enough to incorporate elements vital to the innovative process such as an interdisciplinary and interdependence cooperation, the SI approach provides a strong basis for evaluating innovation policy. Whilst the 'openness' of the SI approach forms one of its strengths, it also is one of its weaknesses. Terms such as institutions are not defined and are left for open interpretation. This open interpretation sometimes results in confusion to what should or should not be considered part of an innovation system.

As the SI approach is conceptual in nature, it mainly aids in the identification of potential indicators that can be used for the *input*/*output*-method, as this method is used to effectively measure the results achieved by innovative policies. Through the conceptual framework provided by the SI, a more accurate estimation of the variable values to calculate the RIS innovation indicators can be made.

3.5 The RIS Methodology

The RIS approximates the innovation performance on first sub-national levels for European countries. It provides data used to share knowledge and best practices on major innovation and industrial policy trends in regions of the European Union. Using innovation indicators as established in the Oslo Manual and data through Eurostat, the European Commission hopes to help policy makers and practitioners at EU, national and regional levels to benchmark their performance and policies and to learn about new

trends and emerging business opportunities that can inform evidence-based policy making (Commission, 2016b). With regards to the recently published EIS & RIS 2017, the measurement framework has been significantly revised. Whilst previous versions, up to 2016, have followed the same methodology, after much consideration, it was deemed that the amendments were needed. These amendments were to:

(1) better align the EIS dimensions with changing policy priorities;
(2) continuously improve the quality, timeliness and analytical soundness of indicators;
(3) ensure that the EIS better captures increasingly important phenomena, including in fields such as digitalisation and entrepreneurship, and that it includes indicators on key areas such as human resources, skills and science-business links; and
(4) provide a contextual analysis of the data presented, examining the effects of structural differences between Member States, in order to provide an enhanced evidence base for policy-making purposes (European Commission, 2017).

As regions are important engines of economic development, innovation performance deserves particular attention at the regional level. Regional Systems of Innovation have therefore become the focus of many academic studies and policy reports. Economic literature has identified three stylized facts: 1) innovation is not uniformly distributed across regions, 2) innovation tends to be spatially concentrated over time, and 3) even regions with similar innovation capacity have different economic growth patterns. However, attempts to monitor Regional Systems of Innovation and regions' innovation performance are severely hindered by a lack of regional innovation data. The RIS addresses this gap and provides statistical facts on European regions' innovation performance. Regional innovation performance is measured using a composite indicator – the Regional Innovation Index (RII) – which summarizes the performance on 18 indicators. The RIS 2017 implements the revised measurement framework introduced in the EIS 2017. Compared to the RIS 2016, regional data availability has improved, as regional Community Innovation Survey (CIS) data are now available for more regions, and regional data are available for more indicators, including International co-publications, Most-cited publications, Public-private co-publications, Trademark applications, and Design applications. Whilst the methodology of the RIS 2017 report takes a more in-depth approach to establishing innovation performance, the methodology of the 2016 report will be used as the innovation performance rise for Overijssel was calculated based on the previous methodology.

The RIS handles three dimensions in order to approximate the innovation performance of regions. These dimensions are *Enablers*, *Firm Activities* and *Outputs*. This approach to innovation forms the common ground between the input/output approach and the SI approach: examining what effort goes into a policy, what results are booked, including looking at what happens in the system and its internal effects. Each of these dimensions has sub-dimensions and corresponding indicators. The greatest challenge that the

RIS faces is that for many of the innovation indicators used, little to no data is available. In order to provide a value for each of the indicators that lacked data, the methodology of the RIS would provide leniency to data collection methods and definitions of some of the indicators such as *Non-R&D innovation expenditures* and *Sales of new innovation products*. This does mean that the data provided is an approximation of the real data. As the missing data can only be collected through a grand scale operation, the data provided by the RIS will be used as it forms the optimal alternative. Regional innovation data for the portion of population aged 30-34 having completed tertiary education, R&D expenditures in the public sector, R&D expenditures in the business sector, EPO patent applications, and Employment in medium-high/high-tech manufacturing and knowledge-intensive services, regional data can be extracted from Eurostat's online regional database. For the EIS indicator exports of medium and high tech products, estimates have been used for Exports of medium-high and high technology-intensive manufacturing industries from a study prepared for the European Commission (Commission, 2016b). The measurement framework of the RIS 2017 report improves the measurement data considerably through the addition of multiple indicators and revision and deletion of indicators already established in the 2016 RIS report. The initial research question is based on the innovation power difference (2014-216), the RIS 2016 Methodology will be used in the following section. There already is limited data availability and most data are educated estimations, in order to prevent data diverting too far from reality, the RIS 2017 Methodology will be discarded. However, once the data required for the RIS indicator methodology is available on a regional level, it ought to calculated according the 2017 RIS methodology as it will provided an update frame of reference with the other participating regions of the RIS 2017 report.

4. Twente's Innovation Indicators

The first part of the analysis aims to asses the scores for the RIS innovation indicators for the region of Twente. As mentioned in the data collection section (3.2), the RIS does not calculate innovation performances on the subsidiary level of Twente. In order to answer the first research question, and to see in what extent can the increase in Overijssel's innovation performance be accredited to Twente, a manual calculation of the performance is required. This means calculating the RIS indicators for the variables of Twente, opposed to the already known variables of Overijssel. To do so, the same methodology will be used that was utilized for calculating the score of Overijssel: the RIS 2016 methodology. Each innovation indicator consist of a numerator and a denominator, together, they produce the specific innovation indicator values. However, there is a considerable lack of required data on sub-provincial subsidiaries. Many of the required data to be used in the numerators and denominators is non-existent. As such, the values to be used had to be approximations based on national/global trends, such as increase in the ICT sector while construction declines or urbanization towards the city, existing preliminary data and advice from regional and provincial advisors, as well as qualitative interviews with

stakeholders of innovation development. What follows are the regional innovation indicators set forth in the RIS. The values of these indicators are index scores. The index scores are the result of a compiled database of the RIS, which contains data from every region of the European countries that participated in the RIS program. The data used by the RIS, in order to produce the index scores, is, in certain cases, a combination of factual and estimated data. A similar process is applicable in this research. There is no factual data for Twente for every RIS indicator. In some cases there was enough data to be sent to the RIS database in order to receive index scores, in other cases there was not. Therefor in the case there was not enough data or none at all, for these indicator scores for Twente, an assumable value based on relevant statistics or logical assumptions. This was determined to be the best course of actions for approximating data without the factual data existing, the suggestion of examining related statistics and basis a value from these would result in best approximations until official data is made public. Certain limitations for the estimations would be that they are unlikely to exceed the performance for the provinces of Noord-Brabant or Utrecht, as they are consistent Innovative Leaders as indicated by the RIS report. On the other hand, Twente is unlikely to perform weaker than a Moderate Innovator as indicated by the RIS report. This gives a better framework towards the estimations of the indicator values. Relatable indicators such as Tertiary Education %, Employment in High-Tech and Exports in High-Tech were also considered relatable. The grouping of indicators as suggested in Section 6, gives a good oversight as to which indicators are likely to be influenced by one another.

As such, the estimated data for Twente, used to be compiled with the RIS 2016 database, in order to receive the Twente index scores as presented in Appendix I, are, preliminary, as the generation of factual data is in the works and aims to be completed by late 2017. As such, it is advisable to recompile the raw data values with the 2016 RIS database in order to achieve accurate index values opposed to the current estimation thereof.

A comparison between Overijssel and Twente in graphical format can be found in Appendix I as well as the corresponsive data.

- Population aged 30-34 having completed tertiary education (%)

This is a general indicator of the supply of advanced skills. It is not limited to science and technical fields, because the adoption of innovations in many areas, in particular in the service sectors, depends on a wide range of skills. The indicator focuses on a narrow share of the population aged 30 to 34, and will relatively quickly reflect changes in educational policies leading to more tertiary graduates.

This indicator is determined by the number of persons in age class with some form of post-secondary education divided by population between 30 and 34 years inclusive.

As there is no exact data for this indicators, the data used to calculate this indicator is based on the data of the number of graduates in Twente from 2008 to 2016 for the following tertiary educations:

voortgezetonderwijs (vo), middelbaar beroepsonderwijs (mbo), voortgezet algemeen volwassenenonderwijs (vavo), and hogeronderwijs. There are approximately 50.000 students within the three major education institutions (ROC van Twente, Saxion, Universiteit Twente) with an increasing amount of students pursuing higher education in Twente. Based on the amount of students overall for tertiary and the respective amount for Overijssel and Twente itself, Twente contains 53% (CBS, 2016) of the overall higher education students. As such the raw data value assigned to Twente was slightly higher than that of Overijssel.

- R&D expenditures in the public sector (%)

R&D expenditure represents one of the major drivers of economic growth in a knowledge-based economy. As such, trends in the R&D expenditure indicator provide key indications of the future competitiveness and wealth of a region. Research and development spending is essential for making the transition to a knowledge-based economy as well as for improving production technologies and stimulating growth.

According to the RIS methodology, this indicator is determined by taking all R&D expenditures in the government sector and the higher education sector and dividing it by the Regional Gross Domestic Product (GDP). Based on WBSO/RDA data (RVO, 2016) for COROP, the equivalent to NUTS 3 regions, Twente scores fourth in the Netherlands with 226 mln. Euro, equating to 73% of the 308 mln. for Overijssel. As Twente also is the national leader of S&O (Speur- & Ontwikkelingswerk), it is assumable that Twente scores higher for the R&D expenditure indicators, both public and private. Respecting the strong position Twente has as indicated by the WBSO/RDA, the raw data values are estimated to be moderately higher opposed to Overijssel.

- R&D expenditures in the business sector (%)

The indicator captures the formal creation of new knowledge within firms. It is particularly important in the science-based sector (pharmaceuticals, chemicals and some areas of electronics) where most new knowledge is created in or near R&D laboratories.

This indicator is determined by taking the R&D expenditures in the business sector and dividing it by the Regional GDP. However, there is no public data regarding the expenditures of private businesses for the indicator for the region of Twente. However, based on the positive aforementioned WBSO/RDA data (RVO, 2016), the estimation of the raw data is slightly higher opposed to Overijssel based on the innovation focus of Twente.

- Non-R&D innovation expenditures (%)

This indicator measures non-R&D innovation expenditure as percentage of total turnover. Several of the components of innovation expenditure, such as investment in equipment and machinery and the acquisition of patents and licenses, measure the diffusion of new production technology and ideas.

This indicator is determined by the sum of total innovation expenditure for SMEs and dividing it by the total turnover for SMEs. The data for this indicator only supplied to the EIS/RIS under the strict condition that that raw data is not made public. With only the compiled score for Overijssel and regional data concerning this indicator, an estimation for Twente was hard to make. These does not seem to be clear indication to suspect this value to significantly differ from the compiled score for Overijssel. Overijssels' index score followed a similar trend to other innovative regions in the Netherlands, such as Noord-Brabant. As such, the values for Twente were assumed to be similar to those of Overijssel. SMEs innovating in-house

Innovative firms with in-house innovation activities have introduced a new product or new process either in-house or in combination with other firms. The indicator does not include new products or processes developed by other firms.

This indicator is determined by the number of SMEs with in-house innovation activities. Innovative firms with in-house innovation activities have introduced a new product or new process either in-house or in combination with other firms. This number is then divided by the total number of SMEs. The data for this indicator is also strictly confidential to participants of the EIS/RIS program. Neither does the CBS share regional data concerning this indicators. With similar trends for all provinces in the Netherlands, there is no clear indication to assume this value to significantly differ from the rest of Overijssel. Therefor the values for Twente will follow the trend similar to Overijssel and not be adjusted to be higher/lower.

- Innovative SMEs collaborating

This indicator measures the degree to which SMEs are involved in innovation co-operation. Complex innovations, in particular in ICT, often depend on the ability to draw on diverse sources of information and knowledge, or to collaborate in the development of an innovation. This indicator measures the flow of knowledge between public research institutions and firms, and between firms and other firms. The indicator is limited to SMEs, because almost all large firms are involved in innovation co-operation.

This indicator is determined by the number of SMEs with innovation co-operation activities, divided by the total number of SMEs. This indicator contains sensitive data and as such, is considered confidential. Therefor only the compiled index score for Overijssel is supplied. Based on the index scores for the Netherlands, the national trend for SME collaboration is rising. Twente is likely to follow this trend. Compared to Overijssel, Twente is likely to perform slightly better due its higher concentration of

SME's and the regional governments' facilitation thereof. As such, the values for Twente are assumed to be slightly higher than those for Overijssel.

- EPO patent applications

This indicator refers to the number of patents applied for at the European Patent Office (EPO), by year of filing. The national distribution of the patent applications is assigned according to the address of the inventor. This indicator is determined by the number of patents applied for at the EPO, by year of filing, divided by the Regional GDP.

The approximated data was based on the Regioscan Gelderland and Overijssel (Maarten van Leeuwen, Oscar Oudega, & Septer, 2016), in which Overijssel applied for 866 patents. Of these patents, 70% originated from Twente, placing it in the Top-5 of the Netherlands. In general Twente averages two patents for each one originating from the rest of Overijssel. The clear distinction between the amount of patents originating form Twente and Overijssel respectively, resulted in the transposition of Overijssels' trend line to accommodate Twentes' performance. As suc, the increased amount of patents results into the higher scores for Twente.

- Product or process innovators (%)

Technological innovation, as measured by the introduction of new products (goods or services) and processes, is a key ingredient to innovation in manufacturing activities. Higher shares of technological innovators should reflect a higher level of innovation activities.

This indicator is determined by the number of SMEs that introduced a new product or a new process to one of their markets, divided by the total number of SMEs. This indicator falls into the confidential data of the RIS. Twente Index keeps tract of the market sector startups position themselves in as well as the amount of startups in the Twente region. As per 2015, Twente counts 2.263 startups of which 5,1% industry, 11,45% marketing, 24,8 information and communication, 5,5 financial institutions, 37,3 consultancy, 3,8 education and 11,95 in other sectors (Index, 2016). These sectors can be divided into product/process innovators and marketing/organizational innovators. Under product/process innovators the following sectors are considered: Industry, Market, Financial institutions. Under market/organizational innovators, Information and Communication, Consultancy and Education are considered. This results in a 22.05% of the 2.263 startups being considered product process innovators and 62,1% marketing/organization innovators. The startups in the Other sector were excluded from the division as it is unclear in which category they would fit. These raw data values were sent to the RIS database to be compiled into the index scores for product/process innovators and marketing/organization innovators for Twente. The results can be found in Section 9.2.

- Marketing or organizational innovators (%)

The Community Innovation Survey mainly asks enterprises about their technological innovation. Many enterprises, in particular in the service sectors, innovate through other non-technological forms of innovation. Examples of these are marketing and organizational innovations. This indicator captures the extent that SMEs innovate through non-technological innovation.

This indicator is determined by the number of SMEs that introduced a new marketing innovation and/or organizational innovation to one of their markets, divided by the total number of SMEs. The process of approximation for this indicator is explained in the indicator for product or process innovators section above.

- Employment in medium-high and high-tech manufacturing and knowledge-intensive services (%)

The share of employment in high technology manufacturing sectors is an indicator of the manufacturing economy that is based on continual innovation through creative, inventive activity. The use of total employment gives a better indicator than using the share of manufacturing employment alone, since the latter will be affected by the relative decline of manufacturing in some countries. Knowledge-intensive services can be provided directly to consumers, such as telecommunications, and provide inputs to the innovative activities of other firms in all sectors of the economy. The latter can increase productivity throughout the economy and support the diffusion of a range of innovations, in particular those based on ICT.

This indicator is determined by the number of employed persons in the medium-high and high-tech manufacturing, divided by the total workforce including all manufacturing and service sectors. Due to a bigger portion of the workforce of Overijssel being situated in the region of Twente (53%, CBS) and a higher frequency of medium-high tech firms as found in the sectoral division (Boogert, 2017), this indicator is estimated to be higher than the value assigned for Overijssel.

- Exports of medium-high and high-tech manufacturing industries (%)

The indicator measures the technological competitiveness of a region, i.e. its ability to commercialize the results of research R&D and innovation in the international markets. It also reflects product specialization. Creating, exploiting and commercializing new technologies are vital for the competitiveness of a region in the modern economy. Medium and high technology products are key drivers of economic growth, productivity and welfare, and are generally a source of high value added and well-paid employment. This indicator is determined by the sum of medium-high and high-tech products, divided by the total amount of exports.

Twente has a high-technology focus. Twente leads in electro technique (4%), mechanical (3%), materials (2%) and nanotechnique (2%), compared to the rest of the Netherlands (Maarten van Leeuwen

et al., 2016). Meanwhile, Overijssel scores high on electro technique, material technology and chemical engineering. Due to a bigger portion of the workforce of Overijssel being situated in the region of Twente, it is assumable that there is an increased production of exports of firms located in Twente. As such, this indicator is estimated to be slightly higher than the value assigned for Overijssel.

- Sales new-to-market/firm innovations

This indicator measures the turnover of new or significantly improved products and includes both products which are only new to the firm and products which are also new to the market. The indicator thus captures both the creation of state-of-the-art technologies (new-to-market products) and the diffusion of these technologies (new-to-firm products).

This indicator is determined by the sum of total turnover of new or significantly improved products for SMEs, divided by the total turnover for SMEs. There is no reason that the value for Twente would significantly differ from the trend Overijssel follows. However, as there is a slightly higher percentage of workforce, innovative firms and exports, the values for Twente will be slightly higher opposed to Overijssel's.

5. Agenda van Twente Policy Instrument Evaluation

Before formulating in answer to the second research question in which the link between the RIS innovation indicators and policy instruments, the policy itself has to be examined. Since 2010, the regional economic policy has been decentralized from the national government towards the provinces of the Netherlands. This made it possible to formulate and implement new regional economic and industrial policies by the provinces itself. Due to the decentralization of the policies, provinces could incorporate some of the already decentralized responsibilities, such as spatial development and infrastructure into the policies. This resulted broader policies, aimed at improving the overall region and its economic system. The decentralization process enabled a more polished and tailored approach to policy mixing in the provinces and their subsidiaries.

The Agenda of Twente was a ten-year investment (2008-2017) plan of the fourteen municipalities of Twente: Almelo, Borne, Dinkelland, Enschede, Haaksbergen, Hellendoorn, Hengelo, Hof van Twente, Losser, Oldenzaal, Rijssen-Holten, Tubbergen, Twenterand and Wierden. The focus of the Agenda of Twente was the strengthening of the economy of Twente. In order to realize this, six aspects were to become the focus of improvement: Innovation, Business climate, Mobility, Leisure Economy, Human Capital and Branding. The regional governmental organization, Regio Twente, has three types of policy instruments they can use to improve these aspects: regulatory, economic and soft. The six aspects will be discussed for each of these policy instruments, examining what role Regio Twente has had in the developments in these aspects.

It is important to note that the effects of policy on the economy and innovation remains a complex question to answer. There is no way of knowing how the region of Twente would have developed without its Agenda. To complicate answering the question even more, the data that can and has been used in this research is subject to many influences. Using the RIS tertiary education indicator as example, it is influence by education quality, student enrolment, job availability, sector focus and so on. The regional government can only influence small sections for each of these indicators. It makes it hard to establish clear causal relationships between a certain regulation and a regional economic development. As such, the question of in what extend policies alter and improve, is mainly answer in forms that are clearly measurable: the inputs and outputs.

In the following sections, the Agenda of Twente will be evaluated per aspects on basis of the inputs and the outputs. After establishing the outputs of the policy per aspect, an evaluation of the policy instruments used for the inputs and outputs, will indicate which instrument can be considered the driving force behind the increase of innovation performance.

1. Innovation

Innovation required the realization of investment projects in the region of Twente and province Overijssel. These investment projects were aimed at the innovative ecosystem of Twente, looking to improve Twente's output. The agenda of Twente has contributed to the economic cooperation within the region. It was essential to create an environment where businesses, governmental institutions and educational institutional could organize together. This environment was supplied in the regional policy in the form of the 'Twentse Innovatieroute'. The objective was to create a strong economy in Twente and increase its competitiveness on both national and international level. This could be achieved by increasing the innovative performance of Twente and facilitating the materials needed to do so.

One of the main economic tools was funding. The province of Overijssel created a € 50 million development reserve for support of the Twente innovation initiative. The provision of these funds was made provided that the Regio Twente made available an equal amount. The resources of the province and the Regio Twente were seen as co-financing. With an equal contribution from business, an investment amount of € 200 million would arise. With the precondition that local authorities could co-finance themselves, contributions from The Hague and Brussels could also be reached at around € 200 million. This resulted in a total investment of € 400 million that could be used to improve Twente's innovation performance.

The cooperation between the institutions, set forth by Twentse Innovatieroute has resulted in numerous projects. These projects were aimed to be as diverse possible within the HTSM sector. This economic policy tool has resulted in more than 3.600 new jobs, international recognition, new research centra; all whilst stimulating the cooperation between firms and educational institutions. This cooperation becomes apparent in Kennispark Twente. Kennispark Twente was founded by the University of Twente, Saxion University of Applied Sciences, Regio Twente and municipality Enschede. It aims to create and strengthen the innovative ecosystem of Twente through valorization and entrepreneurship. Whilst it has multiple successful spin-offs (900, UT) and firms (800, Saxion), it also (co)-formulates innovative programs and agendas to strengthen the international competitive position of firms. The Agenda of Twente and its corresponding financing, has brought many other effects with it on national and international level. The commitments of the Agenda has given Twente the means to profile themselves internationally as a region of innovative knowledge in a competitive economic sector as HTSM. This sector is supplying Twente with more jobs, growing with 1.140 (4%) between 2007-2015, resulting in 10% of the labor market in Twente. This focus is still developing as the industry sector is declining and slowly transitioning into High-Tech.

2. Business Climate

An improvement of the business climate of Twente is important for the establishment of (international) firms. The Agenda of Twente established three goals regarding the business climate: creation of a good

life-work environment, improvement of the special economic structure and attracting high-skilled workers. To support these goals, the Agenda of Twente invested in infrastructure, international education, leisure activities and events. Examples of these projects are the opening of an international school in Twente, World Trade Center Twente (WTC Twente) and the development of 'Centraal Station Twente', an urban business park for international firms and institutions. The accessibility, Human Capital and Branding are discussed more in depth in section 5.3, 5.5 and 5.6 respectively.

Both economic and soft policy instruments influenced the Business Climate. Whilst the connective nature of soft instruments tend to result in productive partnerships, the economical elements regarding funding posed problems. Despite successfully bringing firms, education and the government together, it remains difficult to develop a model of guaranteed return of investment. Many initiatives that have been established or facilitated by the Agenda of Twente funds, such as WTC Twente and Twente Branding, provide support to innovative entrepreneurs. Whilst innovative start-ups do contribute to the innovational performance of the region, not all start-ups are successful. Failed investments result in the still needed role of financial support by the government.

3. Mobility

Good mobility is a perquisite for the development of a functioning economy. A well-developed infrastructure contributes to the logistics and accessibility of the region. Due to Twente geographical location as a border region, it is important to use its unique setting to form the connection between the Netherlands, Germany and further Eastern Europe. A better connection towards the rest of the Netherlands and Germany will work as stimuli for logistic sector and in turn the business climate. With these goals in mind, middle-large infrastructure projects were developed and funded. These include the deepening of the Twentekanaal, in order to facilitate heavier ships, expansions to existing motorways and improved internet facilities for Twentes' businesses. The Agenda of Twente supported these projects by allocating funding (€8.5m), connecting local development firms and aligning the stakeholders. Notable for the mobility program of the Agenda of Twente, is the cooperation from provincial, national and European parties. More than € 980 million co-financing was made available for infrastructure improvements. Dedicated platforms such as Port of Twente and XL Business park Twente, were developed to cluster logistic stakeholders, promoting cooperation and innovation.

4. Leisure Economy

Whilst the Agenda was dominated by innovation, aspects such as Leisure Economy and Sport & Culture arguable also contributed towards Twentes' stronger innovative power. Whilst the main focus was on tourism, the added value of name recognition puts Twente on the (inter)national map. The action plan resulted in more jobs in the tourism sector and more people coming to Twente. This is a clear indication of the growing use of soft instruments in regards to innovative policies. Soft instruments give the

possibility to provide recommendation and norm appeals without subjecting the participants to obligatory measures and/or sanctions.

5. Human Capital

Starting out with an unemployment rate slightly higher (0,2%, 2007) than the national average , the Agenda of Twente aimed to drive unemployment down through a better connection between education and the labor market. There was a serious shortage of high skilled workers, especially in the technical sector. It was made adamant that education had to teach the necessary skills and knowledge to fit the shifting labor market. To counter the gap that existed between education and business, a better facilitation of internships and transition from student to employee were prioritized. Within the framework of the Twente Agenda, investments were made in various projects to improve the connection of education to the labor market. Due to the imminent shortages of qualified staff in technical professions, emphasis has been placed on technical training. Implementation of the Agenda has contributed to the development of more jobs within the technical sector, decease of unemployment and an increase in higher educated workers. However, the youth unemployment has surpassed the national average.

6. Branding

Where the previous action points of the Agenda focus on providing all that is needed for Twente to evolve into an international high-tech region, branding focuses on the uniformity behind it. The region of Twente is characterized by its own cultural identity, based in this industrial past. Branding aims to maintain the Twente spirit from the declining manufacturing industry into the blooming high-tech. Creating a clear regional identity contributes to the profile of a competitive Twente. The Agenda helped set up the communication platform in which all previous aspects of the agenda come together. The Communication Platform brings together the Human Capital and Innovation through businesses in Twente, with the knowledge supplied by the education institutions of Twente.

By ensuring a uniform Twente, it can attain a stronger position outwards, to the province, national and even international level. An important part of the economy is co-financing for projects and it is something most project struggle with. With good regional branding, Twente has a stronger position in acquiring extra funding.

6. Quantifying Twentes' Regional Innovation Policy

In this section, the two parts of research come together. With the values of the RIS innovation indicators formulated for both Overijssel and Twente in Section 4, the differences between the province and region become clear. With the regional innovation policy of Twente set out in Section 5, these differences can now be linked to elements of the regional innovation policy and the corresponding policy instruments. While current innovation policy commonly relies on economic instruments, also present in the Agenda, either through direct or co-financed projects, soft instruments might be more efficient in the end.As described in the previous section, the Agenda of Twente introduced a set of goals to be realized through multiple, separate programs. Each programs was linked to a certain theme that could directly, or indirectly, contribute to the strength of the regional economy and progression towards becoming an innovation leader. The Agenda of Twente is significantly constructed based on economic instruments, specifically funding through subsidies. A common practice by municipalities is to invest in big projects in the region, find co-financing on provincial, national and/or European level, bringing parties and stakeholders together in the process, leading to an increase of cooperation and eventual innovation. This process aids Twente's projects across the boards, further improving indicators such as collaboration, high-tech employment and corresponding high-tech export.

Whilst it remains impossible to link a specific aspect of policy to a single RIS innovation indicator, a broader approach is feasible. By pairing the RIS indicators into four groups, it is easier to establish semi-casual relations between the policy and the indicators. These groups are: Knowledge Investments, Innovative Processes, Innovate Outcomes, and Economical Outcomes (see table below).

Knowledge Investments takes into consideration the indicators of tertiary education, public- and business R&D expenditures. These values are related to what is being invested into the creation of innovative knowledge, similar to the input in regards to the input/output model. Whereas this group is predominantly constructed by the financial instruments, and corresponds to sections Innovation and Human Capital of the Agenda van Twente. When comparing the values estimated for the indicators (Appendix I), there does not appear to be a significant change between the trend lines of Overijssel and Twente. This seems to suggest that there is no significant different impact between either areas solely based on the regional policy.

Innovative Processes looks at the variables that indicate the usage of knowledge: Non-R&D innovation, SME's Collaborating and – Innovating in-house. These indicators correspond most with points 1 and 2 of the Agenda: Innovation and Business Climate. Examining the usage of policy instruments based on the separate indicators, the utilization of soft instruments appears more efficient. Looking at the data for SME's Collaborating and SME's Innovation in-house, Twente has increased and even surpassed the scores for Overijssel. The basis for this increase lays in the facilitation of firms coming together and working with one another. This is a good example of the utilization of soft policy instruments.

Innovative Outcomes is comprised of the Patent rate and the types of innovation brought forth by the innovative process. This group forms the outcome in input/output model. This group is best related to the Business Climate section of the Agenda. The climate dictates the economic structure of the region, influencing the demographic type of firms located and in doing so, their innovation type. Business Climate, as mentioned in the Innovative Process group, is a combination of minor economic and majority soft policy instruments. Reflecting on the data per indicator, Twente has become more productive and generated an increased innovative output.

Economical Outcomes looks at the employment, exports and sales in the high-tech industry. These indicators correspond best to Human Capital (employment) and Innovation (sales and exports) of the Agenda of Twente. However, Climate, Mobility and Branding play a role in this too. Relating to the involved policy instruments, there is no clear dominating instrument. A certain degree of both are involved in the establishing a way to come to Twente, be employed, work in an innovative company and eventually sell an innovative product. Looking at the data for these indicators, there does not seem to be a difference in trends between Overijssel and Twente.

Grouping	RIS Innovation Indicator
Knowledge Investments	Tertiary Education
	Public R&D Expenditure
	Business R&D Expenditure
Innovative Processes	Non-R&D Innovation
	SMEs Innovating in House
	SMEs Collaborating
Innovative Outcomes	EPO patens
	Product / process innovators
	Marketing / organizational innovation
Economical Outcomes	Medium / high technical exports
	Knowledge-intensive employment
	New to Market Sales

Comparing the overall RIS innovation indicator scores for both Twente and Overijssel, most of Twente indicators scored slightly above those of Overijssel. This is to be expected based on the growing technical industry around the region of Twente and the High Tech Systems and Material focus of the Innovatiesprong. Whilst Overijssel has consistently scored as an innovation follower in the context of the RIS, the region of Twente just falls short of being considered an innovation leader (Section 9.2). Referring back the policy theory, the roles of the policy instruments become clear. Whilst Twente does not make much use of the regulatory instrument, the shifts in the use of economic and soft becomes apparent. The need for economic tools, however old, remains vital to innovation. Many projects formulated and implemented under the policy of the Agenda of Twente require substantial funding from multiple levels of government. Noticeable is that the projects that involve multiple governments outside the region of Twente, such as infrastructure, tend to result in a better funding, execution and satisfaction all round. Grand scale projects which transcend regional impact tend to result in improved (inter)national connection. This regional transcendence and connectivity seems to be one of the driving forces behind innovation, the bringing together of major stakeholders. Referring to the SME Collaborating indicator graph in Annex I, a clear increase in this indicator is found.

As indicated by the achievements booked by the Agenda of Twente, the role of economic instruments is dominantly present. Subsidies and investments are the main form in which the Agenda becomes apparent. Economic instruments have, and, will be an important element of innovation stimulation. In the case of Twente, many of its started initiatives have some degree of funding to them. The biggest problem to be faced is the transforming of a financial lifeline from the governmental reserves into a self-sufficient initiative. Some of the projects started by Twente, such as the bureau for tourism (5.4 Leisure Economy), have been terminated as a result. Whilst setting up successful initiatives remains a challenge by itself, careful formulation of performance agreements and its corresponding indicators can result in a realistic and achievable project timeframe. A more thorough formulation of projects based on predominantly soft policy instruments, opposed to economic, may result in a higher success rate of the overall program, and an efficient use of economic resources.

7. Conclusion & Recommendations

After an in-depth analysis of the formulation, implementation and evaluation of policy regarding the innovative system of Twente, as per the methodology of the RIS, the stronger and weaker innovation indicators of Twente were established. By using the available data and trends, together with the advice of statistical experts, approximations of the RIS indicators for Twente were made. These values form a clear answer to the first research question as to what extent the increased innovation performance can be accredited to Twente. Throughout the indicators, Twente scores either similar or better than its provincial counterpart does. Plotting the data per indicator in graphs (Section 9.1), shows increased performance by Twente, compared to for the indicators: SMEs Innovating In-house, Product/process innovations, Market/organizational innovations, New to Market Sales and most notably SMEs Collaborating. As such, it can be concluded that the answer to the first research question is that Twente most certainly can be considered the driving force behind the increased innovation performance indicated in the 2016 RIS report.

Based on the Agenda van Twente (2008-2017), I was able to evaluate how the policy according to its newly established indicators. The indicators were brought in relation to the policy instruments, evaluating them in the process. , and its corresponding action points, influence these indicators. Of the three policy instruments, economic and soft seem the most applicable regarding the stimulation of innovation. Positive economic incentives have become a cornerstone in building innovation. Through the use of subsidies and reduced-interest loans towards new products, whilst upping taxes and tariffs towards inefficient, older products, governments can work towards a continuous stimulation of innovative incentives.

However, despite the well known benefit of these economic tools, there is a clear benefit to be seen in the utilization of soft instruments. The shift from a more controlling government towards a public facilitor makes it possible to seer both social and economic dimensions towards the desired effect. Semi-pubic organization tend to bring the government, education and business together in order to formulate better tailored policies that have a higher chance of success due to the expertise of the experts brought together. Based on the many initiatives Twente has taken in this regard, it has become apparent that this model works. A clear increase in RIS innovation indicators is found as the Agenda of Twente progressed, especially during the 2010 subsidiary action of the Netherlands, giving provinces and their region the possibility to adapt their own policies, and the 2012 ‘re-focus’ of the Agenda. As such, an answer to the second research question, as to which policy actions are related to increased innovation scores, a shift from the commonly used financial- towards soft policy instruments is suggested. Financial instruments will always play a facilitating role towards the pursuit of innovation, however, soft instruments enable firms a more efficient, collaborative alternative.

This research confirms the ideas set forth by Edquist (Edquist, 1997, 2011), in which innovation policy should be aimed at specific targets, translating them into direct objectives and identifying problems in order to solves these by a case by case basis. Without a clear indication of the desired effect and how to translate these in realistically achievable goals, a policy can fail. This remains challenging regarding innovation as innovation keeps changing and accordingly the goals. “Rarely are innovation policy instruments ready or “prêt-à-porter” for the task at hand” (Borrás & Edquist, 2013), as such a continuous monitoring is vital to the success of a policy. The much needed monitoring process has already been established by the European Commission with the introduction of the European Innovation Scoreboard. Providing a clear indication of the progression of innovation performance, it forms an excellent tool for evaluating the success of innovative policies. As such, it is in a government’s best interest to adopt the methodology behind the latest innovation performance measurement methodology as it opens the possibility to self-evaluate and compare best practices on a multi-national scale.

7.1 Recommendations

Based on the research regarding the innovation indicators of the RIS, a policy learning system through systematic evaluation is recommended. Regional economies are very diverse and require region specific policies in order to positively stimulate its economy. There is no one-size-fits-all policy nor is there policy that does not have to be amended upon implementation. However, these amendments ought to be made on systematic evaluation. Whilst direct quantification of policy is improbable, a continuous evaluative of the overall system will indicate in what extent the direction of the policy is translated into reality. If a policy would result in an unforeseen negative change in a non-monitored area, it will be picked up by other variables that are being monitored. Utilization of the RIS innovation indicators and the relation they have towards policy areas and instruments can give ambitious regions such as Twente a stronger position for self-evaluation and for comparison of ‘best-practices’. This can give policy advisors the possibility to get a better understanding of the rapidly changing innovation policies and adapt theirs accordingly.

A second recommendation involves the soft policy instrument usage in relation to connecting small to medium enterprises. As of now, there is a focus on the facilitation of diverse start-ups and innovative entrepreneurs. However, when looking at the survival rate of these start-ups, the percentage is in decline. Despite the usage of carefully considered financial support, there is no guarantee of a return on investment. Using the connective nature of soft instruments, such as Novel-T, the focus should shift away from supporting a multitude of start-ups towards scale-ups, and building start-to-end product development ecosystems. Establishing innovative business parks such as Novel-T will aid Twente is achieving its ambitions.

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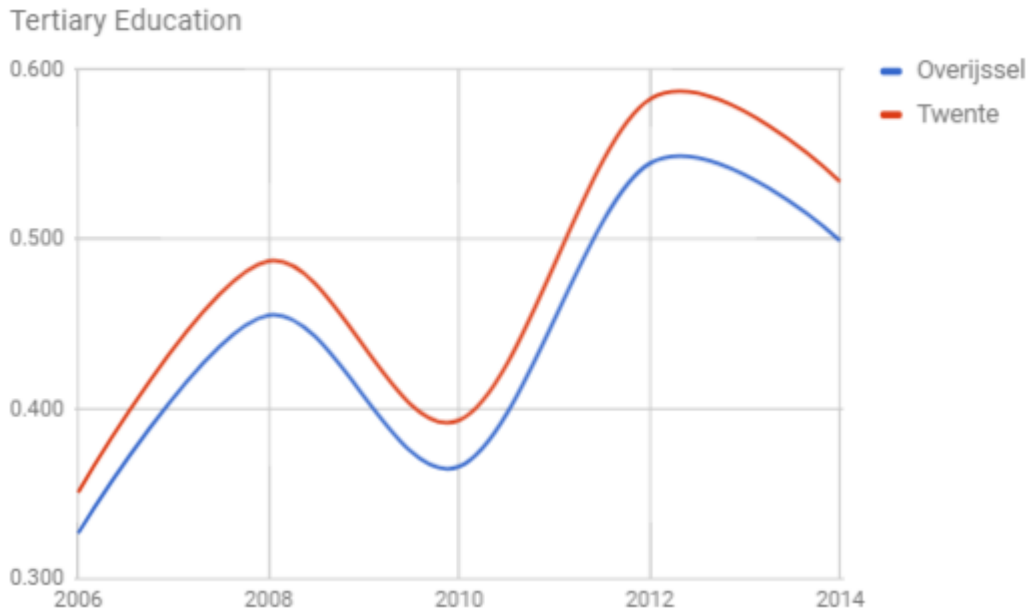
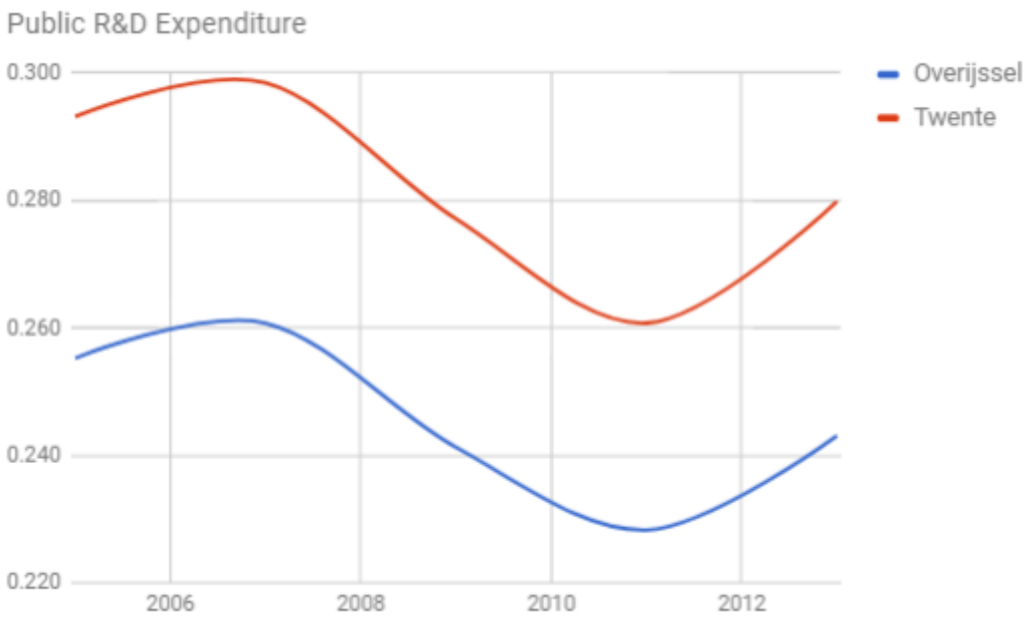
9. Appendix I: Twente's RIS Indicators

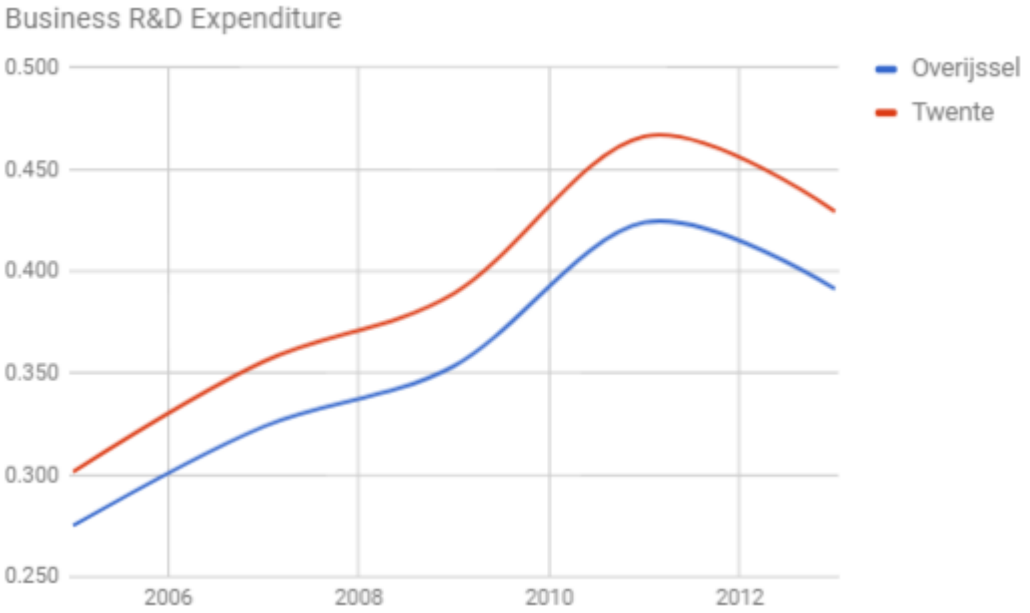
Following graphs indicate the values for each indicators, per year for the provinces of Overijssel, and the region of Twente. The values for Overijssel are directly sourced from the 2016 RIS report. The values for Twente are a combination between compiled raw data in the RIS data base if the statistics were available. For the indicators in which data was unavailable, nonexistent or confidential, estimations based on relevant statistics and input via interviews on the basis of the publicly available index scores for the provinces of the Netherlands. With Overijssel being named a Strong Innovator by the RIS report, values were to be estimated to be weaker than those of Innovation Leaders and stronger than Moderate Innovators, whilst following the national trend lines for each indicator.

9.1 Graphs per Indicator

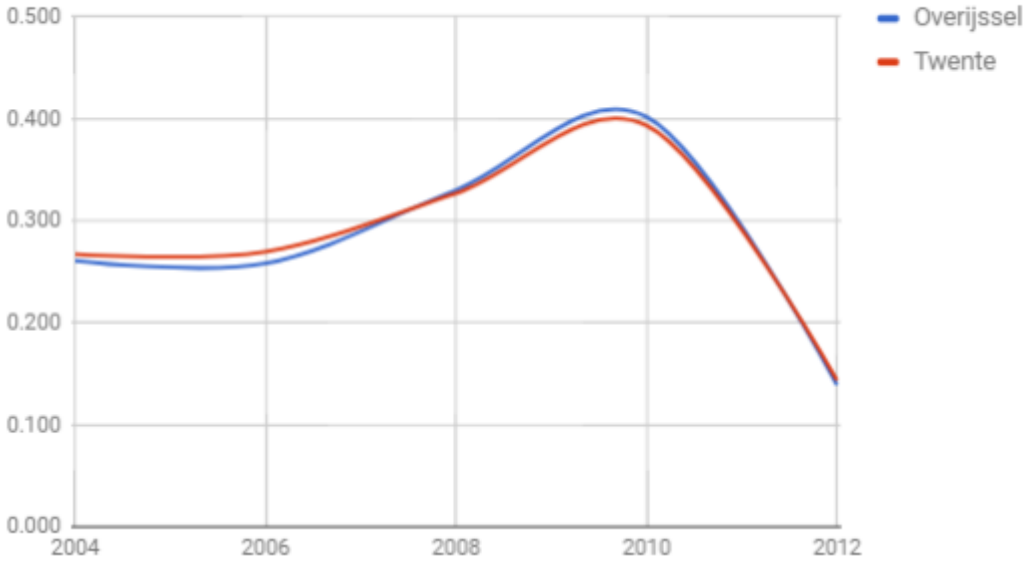
Below are the comparison of innovation index results, per indicator, for both Overijssel and Twente. This provides a clear image in which indicators Twente surpasses the innovation performance of Overijssel. Using the graphs makes it easier to identify the indicators that Twente is improving upon. Consequently, we can establish a link between the indicator and it relevant policy instrument.



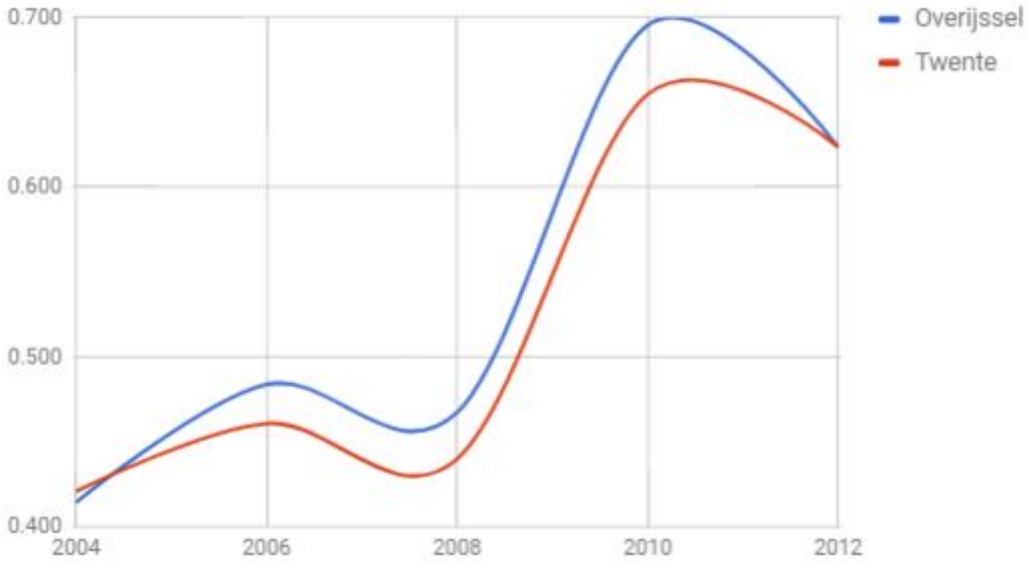

Public R&D Expenditure
0.300
0.280
0.260
0.240
0.220
2006
2008
2010
2012
Overijssel
Twente


Business R&D Expenditure
0.500
0.450
0.400
0.350
0.300
0.250
2006
2008
2010
2012
Overijssel
Twente

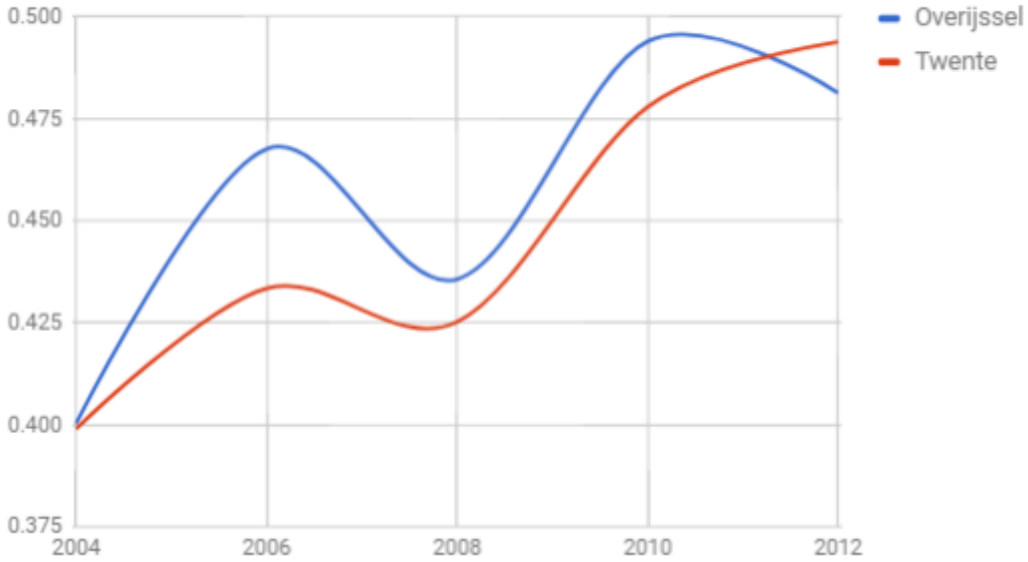
Non R&D Innovation expenditure



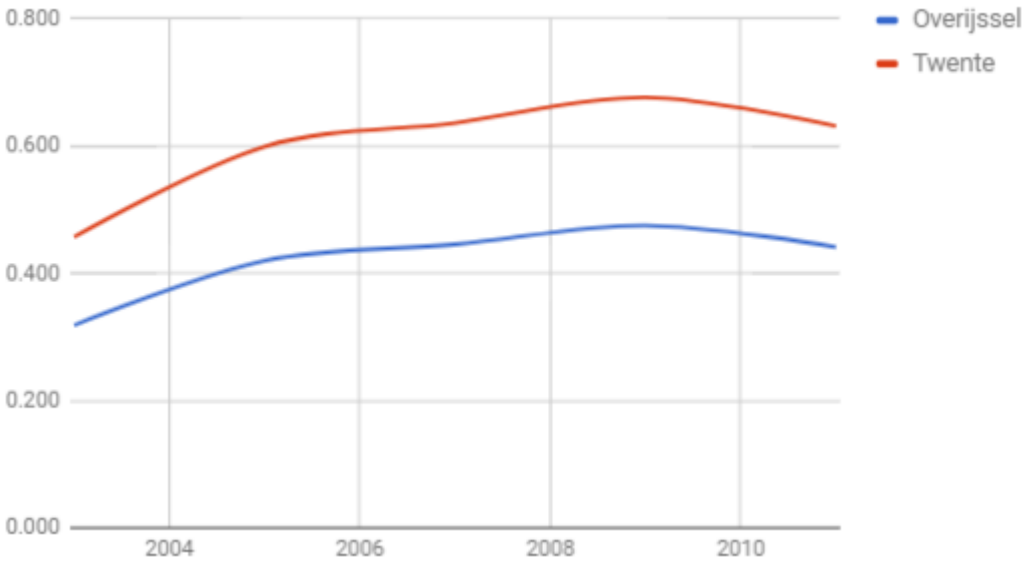
SME Innovating In-house



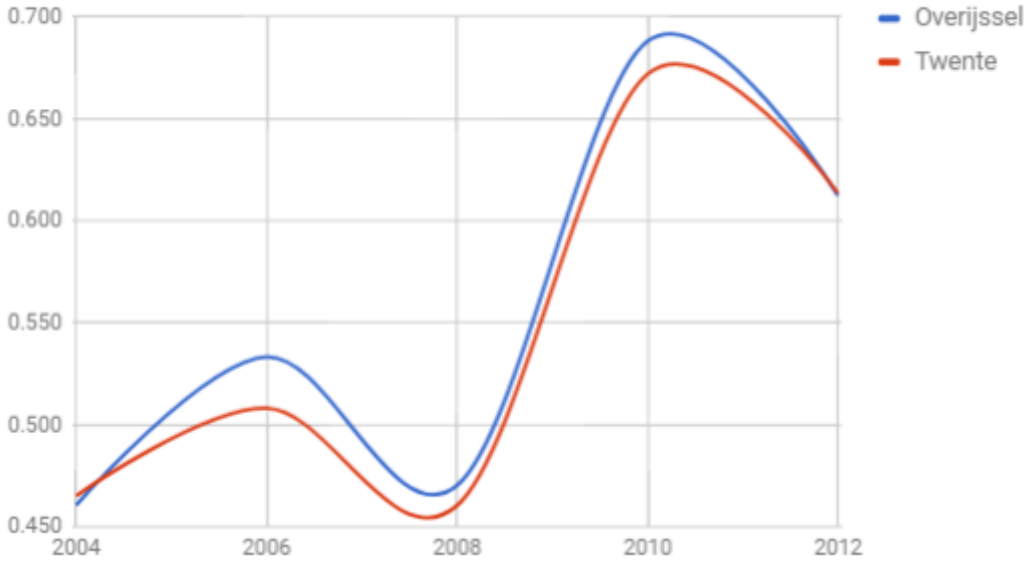
SME Collaborating



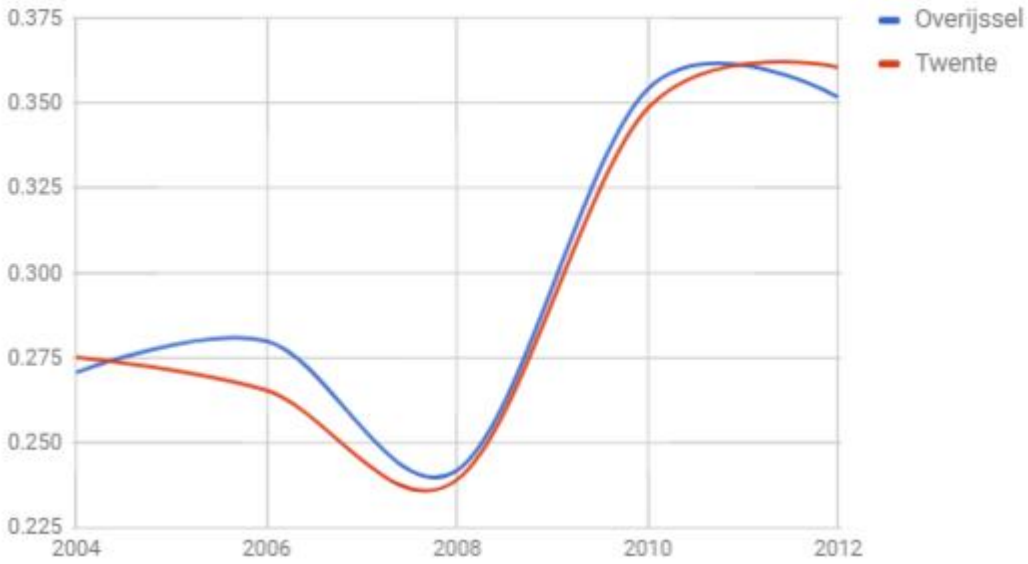
Patent requests

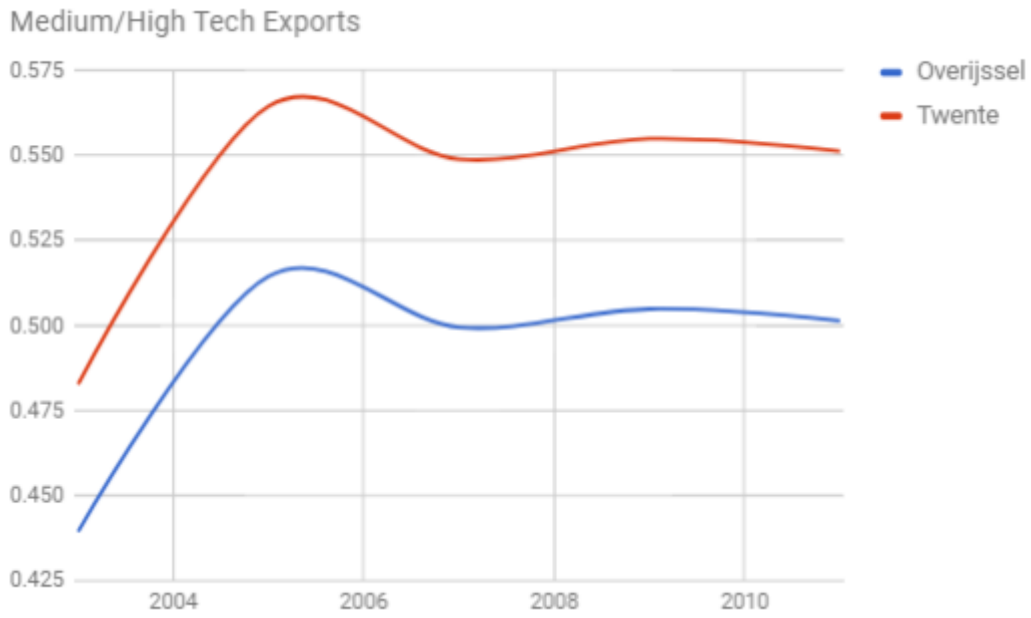


Product/Process innovation

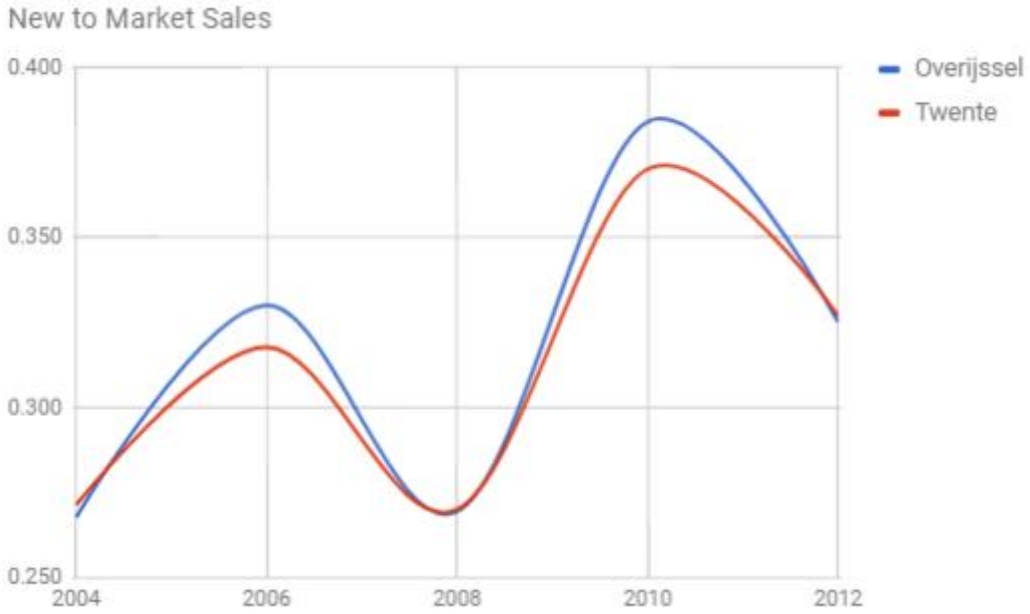


Market innovation




Medium/High Tech Exports
0.575
0.550
0.525
0.500
0.475
0.450
0.425
2004
2006
2008
2010
Overijssel
Twente


Medium/High Tech Employment
0.500
0.450
0.400
0.350
0.300
2006
2008
2010
2012
Overijssel
Twente


New to Market Sales
0.400
0.350
0.300
0.250
2004
2006
2008
2010
2012
Overijssel
Twente

9.2 Data Values per indicator

The data values per indicator below are the results of the compiled raw performance data for each of the indicators in comparison with the European Innovation Index. These values summarize the performance of the region based on the indicators mentioned in section 4.

The values for Overijssel are directly sourced from the 2016 RIS report. The values for Twente are the compiled results of raw performance, estimated through a collaborative effort between public data from CBS and Twente Index, as well as in the input procured during the interviews with experts.

TERTIARY EDUCATION	2006	2008	2010	2012	2014
OVERIJSSEL	0,327	0,455	0,366	0,545	0,499
TWENTE	0,351	0,487	0,393	0,582	0,534

PUBLIC R&D EXPENDITURE	2005	2007	2009	2011	2013
OVERIJSSEL	0,255	0,261	0,241	0,228	0,243
TWENTE	0,293	0,298	0,277	0,261	0,280

BUSINESS R&D EXPENDITURE	2005	2007	2009	2011	2013
OVERIJSSEL	0,275	0,324	0,354	0,424	0,391
TWENTE	0,302	0,356	0,389	0,466	0,429

NON-R&D EXPENDITURE	2004	2006	2008	2011	2012
OVERIJSSEL	0,261	0,258	0,330	0,402	0,139
TWENTE	0,267	0,270	0,327	0,393	0,144

SME'S INNOVATING IN-HOUSE	2004	2006	2008	2010	2012
OVERIJSSEL	0,414	0,484	0,467	0,695	0,624
TWENTE	0,421	0,461	0,440	0,655	0,624

INNOVATIVE SME'S COLLABORATING	2004	2006	2008	2010	2012

OVERIJSSEL	0,400	0,468	0,436	0,494	0,481
TWENTE	0,399	0,433	0,425	0,478	0,494

EPO PATENTS	**2003**	**2005**	**2007**	**2009**	**2011**
OVERIJSSEL	0,318	0,419	0,445	0,475	0,441
TWENTE	0,457	0,599	0,636	0,676	0,631

PRODUCTION PROCESS INNOVATIONS	**2004**	**2006**	**2008**	**2010**	**2012**
OVERIJSSEL	0,460	0,533	0,470	0,688	0,612
TWENTE	0,465	0,508	0,460	0,672	0,614

MARKET ORGANIZATION INNOVATIONS	**2004**	**2006**	**2008**	**2010**	**2012**
OVERIJSSEL	0,271	0,280	0,242	0,354	0,352
TWENTE	0,275	0,265	0,239	0,348	0,361

MEDIUM/HIGH TECH EMPLOYMENT	**2005**	**2007**	**2009**	**2011**	**2013**
OVERIJSSEL	0,383	0,414	0,324	0,336	0,454
TWENTE	0,403	0,434	0,344	0,355	0,473

MEDIUM/HIGH TECH EXPORTS	**2003**	**2005**	**2007**	**2009**	**2011**
OVERIJSSEL	0,439	0,515	0,500	0,505	0,501
TWENTE	0,483	0,565	0,549	0,555	0,551

NEW TO MARKET INNOVATION SALES	**2004**	**2006**	**2008**	**2010**	**2012**
OVERIJSSEL	0,268	0,330	0,269	0,384	0,325
TWENTE	0,271	0,318	0,270	0,370	0,327

Relative scores of Overijssel and Twente to the European Unions average innovation performance.

	2008	2010	2012	2014	2016
OVERIJSSEL	94.9	108.7	100.7	116.5	111.2
TWENTE	102.3	114.5	107.6	112.5	119.9