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International business collaboration between small islands to encourage sustainable development

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Abstract

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Since the world economy today is based on constant economic growth, essential challenges to business development have emerged regarding for example how to manage the growth rate in order to have the minimum environmental impact. The limitations of natural resources have become evidently clear in many different areas, and the need to find sustainable ways of developing societies has become a necessity. Sustainability can be described by three dimensions social, environmental and economical, and all three are equally important in order to reach sustainability. Through a joint collaboration with WCREATE, a company based on the Swedish island of Gotland with the vision of generating value to the whole island, a case study was created. The case study where to investigating business development possibilities of NatWest Island Games, a multinational sport event which Gotland is hosting in the summer of 2017, and a research question was formed: How could a business collaboration between Gotland and the other member islands, originated from the International Island Games Association (IIGA), contribute to the islands business sectors? The purpose of this study has been to investigate the interests of a business collaboration between small islands to exchange experience of sustainable challenges for small islands specifically. This report explores all three dimensions of sustainability through three different methods. The social dimension was explored through a questionnaire sent to a representative of each island, investigating the local level of interests of a business collaboration. The environmental dimension was explored through an ecological research of i.e. the water management on Gotland, in order to investigate how Gotland could contribute with knowledge of managing limited natural resources. The economical dimension was explored through a data mining analysis of statistical data of member islands within IIGA, in order to investigate potential economical relations between the member islands.

This study shows that the result could be achievable through the creation of a collaboration between the islands, in which incentive challenges as how to manage natural resources, attracting new residents and maintain a sustainable tourism industry can be communicated and discussed. Through exchange of retained knowledge and experience, the participating islands can attain new knowledge and take part of already possessed experiences. Furthermore, solutions to some islands challenges may already be invented and can in this way be shared to avoid reinvention of the same solution. By applying this concept of collaboration different aspects such as the freshwater management or the experience of theme packages for tourists on Gotland, can contribute to the business sectors on other islands. In similar ways other islands knowledge and experiences can contribute to the business sector of Gotland.

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Sammanfattning

Eftersom dagens världsekonomi baseras på konstant ekonomisk tillväxt står vi inför stora utmaningar i att vända denna trend och börja utveckla företag med minsta möjliga klimatpåverkan. Då naturresurserna är begränsade är det en nödvändighet att samhällsutvecklingen sker på ett hållbart sätt. Begreppet hållbarhet brukar definieras av tre olika dimensioner som alla är nödvändiga för att hållbarhet ska uppnås, nämligen social, ekonomisk samt ekologisk hållbarhet.

Genom ett samarbete med WCREATE, ett företag verksamt i Visby med en vision om att skapa värde för hela Gotland, har en fallstudie genomförts. Fallstudien syftade till att undersöka vilka affärsutvecklingsmöjligheter det fanns inom den multinationella sporttävlingen NatWest Island Games, som Gotland står värd för sommaren 2017. En frågeställning utformades: Hur kan ett affärssamarbete mellan Gotland och de andra medlemsöarna, ursprungligen från International Island Games Association (IIAG), bidra till öarnas näringssektorer?

Syftet med studien har varit att undersöka intresset för ett affärssamarbete mellan små öar för att utbyta erfarenheter om hållbarhetsutmaningar som små öar har specifikt. Rapporten undersöker alla tre dimensioner av hållbarhet med hjälp av tre olika metoder. Den sociala dimensionen undersöktes genom en enkät som skickades ut till en representant på varje ö, för att undersöka den lokala nivån av intresset för ett affärssamarbete. Den ekologiska studien undersökte hur Gotland har hanterat sina sötvattenproblem och hur de skulle kunna bidra till affärsnätverket med sina erfarenheter av att hantera begränsade naturresurser. Den ekonomiska dimensionen undersöktes genom en statistisk dataanalys av medlemsöarna i IIGA, i syfte att hitta ekonomiska relationer mellan öarna.

Studien visade att ett samarbete mellan öarna skulle vara gynnsamt eftersom de kan diskutera och komma på lösningar till gemensamma utmaningar som begränsade naturresurser, attrahera nya invånare samt upprätthålla en hållbar turistnäring. Genom att utbyta erfarenheter och kunskap skulle medlemsöarna kunna ta del av redan beprövade metoder och lära sig av de andra öarna istället för att uppfinna lösningar på nytt. I ett sådant affärsnätverk skulle Gotland kunna bidra med kunskaper om färskvattenhantering och erfarenheter av temapaket för turister. På samma sätt skulle andra öars erfarenheter kunna bidra till att lösa andra affärsutvecklingsutmaningar på Gotland.

Preface

This master thesis is done within Entreprenörskolan at Uppsala University. Elin Nyström was supervisor, Ulrika Persson-Fischier and Roger Herbert were subject reviewers and Allan Rodhe and Lars-Åke Nordin were examiners. Jessica and Amanda are doing the 30hp master thesis within the master programme in environmental and water engineering and Marcus is doing it within the master programme in computer science. Jessica and Amanda are responsible for chapter 5 and Marcus for chapter 4. The other chapters are written together. Within chapter 5 Jessica is responsible for section 5.2.6, 5.3.2 and 5.4.2. Amanda is responsible for section 5.2.5, 5.3.1 and 5.4.1. The other sections within chapter 5 are written together by Jessica and Amanda.

Jessica Hjelmhagen, Marcus Håkansson & Amanda Karlsson
Uppsala, juni 2017

Populärvetenskaplig sammanfattning

Eftersom klimatet förändras och vi har begränsade naturresurser så är det nödvändigt att hitta ett sätt att utveckla och driva våra samhällen på ett hållbart och långsiktigt sätt. Hållbarhet är ett väldigt brett begrepp som täcker många olika delar av samhället, men huvudmålet är att vi som befolkning ska leva och förhålla oss till begränsade resurser. Det finns flera definitioner av hållbar utveckling, men en av de vanligaste är från Brundtlandskommisionen, 1987, ”En hållbar utveckling är en utveckling som tillfredsställer dagens behov utan att äventyra kommande generationers möjligheter att tillfredsställa sina behov”.

De flesta forskare är överens om att hållbarhet innehåller tre dimensioner som måste samspela för att kunna uppnå hållbar utveckling. En ekologisk, en ekonomisk och en social dimension. Den ekologiska delen innehåller miljö och att hushålla med de resurser vi har på jorden. Den ekonomiska fokuserar på att skapa gynnsamma arbetstillfällen, att kunna försörja sig och tillfredsställa sina mest basala behov. Den sociala delen handlar om värden som mänskliga rättigheter och demokratiskt ledarskap.

När det gäller hållbarhet på små öar så är det intressant att studera just för att det är ett avgränsat område som är extra utsatt på grund av begränsningar både i form av naturresurser och mänskliga resurser. Små öar drabbas generellt sett hårdare av klimatförändringar än vad fastlandet gör, exempelvis i form av mer extremt väder som översvämningar, stormar och torka. Eftersom de flesta öar är beroende av import från fastlandet är det extra sårbart om transporterna av olika anledningar inte fungerar. Begränsat antal människor gör det även svårare för företag att etableras och utvecklas eftersom det kan vara svårt att hitta rätt kompetens.

En ö som möter dessa utmaningar är den svenska ön Gotland. En av de mest omskrivna och välkända utmaningarna för Gotland är vattenbristen, men där finns också kompetensbrist inom vissa branscher och emigration i from av att ung och arbetsför befolkning lämnar ön. Några som vill försöka göra Gotland mer attraktivt för unga och höja kompetensen är företaget WCREATE som bidragit i den här studien. De vill skapa en kreativ mötesplats för företagare på Gotland att samarbeta och utvecklas för att tillsammans uppnå en hållbar utveckling och självförsörjning. De vill göra det genom att utgå från de begränsningar som finns för öar, med väldigt tydliga gränser och en mer utsatt position för transporter och övrig kommunikation. Dessa förutsättningar är inte unikt för Gotland utan finns mer eller mindre på alla mindre öar. Ett internationellt samarbete mellan små öar är International Island Games Association (IIGA) som anordnar spelen NatWest Island Games.

Det här arbetet har varit en fallstudie på detta internationella samarbete mellan små öar och deras intresse och incitament att främja hållbar utveckling inom de tre dimensionerna; social, ekonomisk

och ekologisk. Studien innehöll en undersökning inom var och en av dessa dimensioner. I den ekologiska dimensionen undersöktes vattenbalansen i en av de största sjöarna på Gotland som även används som färskvattenmagasin samt gjorde intervjuer med kommunen om hur de hanterat vattenbristen på ön. Inom den social dimensionen har det undersökts hur ett urval av öborna på öar inom IIGA själva upplever utmaningarna på deras ö och vad de tror om ett nätverk mellan öarna. I den ekonomiska dimensionen har det gjorts en dataanalys mellan ekonomiska samband på tre av medlemsöarna.

Syftet i den här fallstudien var att undersöka intresset för ett affärssamarbete mellan små öar för att utbyta erfarenheter av lösningar för hållbar utveckling på små öar specifikt. Anledningen till att vi undersöker intresset för ett samarbete är att då tidigare studier visar att samarbete mellan parter som har liknande utmaningar leder till nya möjligheter och innovativa lösningar. Andra studier har gjorts när man utrett påverkan på ett samhälle av att vara värd för de Olympiska spelen. Både de direkta och indirekta följderna av värdskapet har studerats och visar till exempel att näringslivet i ett område får ett uppsving under OS och strax efter då det skapas affärer i de möten som sker under eventet. Även mindre sportevenemang har visats sig gynna näringslivet och det affärsmässiga samarbetet.

Men varför behöver affärsutveckling inkluderas när man vill uppnå hållbar utveckling? Genom att först se på definitionen av affärsutveckling som enligt Scott Pollack, 2012, är ”långsiktigt värdeskapande” och sedan definitionen av hållbar utveckling som enligt C. Brennan och J. Cotgrave, 2014, är ”skapa långsiktig stabilitet i den ekonomiska, ekologiska och social dimensionen”, kan man tydligt se likheterna. Vi menar då att ett långsiktigt värdeskapande är nödvändigt för att skapa långsiktig stabilitet inom de tre dimensionerna, och därmed är affärsutveckling en förutsättning för hållbar utveckling.

För att avslutningsvis summera studien och besvara frågan ”Hur kan ett affärssamarbete mellan Gotland och de andra medlemsöarna inom organisationen International Island Games Association bidra till öarnas näringsliv?” Jo, genom att skapa ett samarbete mellan öarna där delad problematik kring till exempel hantering av begränsade naturresurser och befolkningstillväxt kan konkretiseras och diskuteras. Genom ett utbyte av kunskap och erfarenhet kan medlemsöarna få ny kunskap och ta del av redan besittande erfarenheter. Vidare kan lösningar på en ös problem potentiellt redan finnas hos en annan ö och genom att dela kunskapen hindrar man att återuppfinna en lösning på samma problem. Genom att applicera ett koncept för samarbete kan till exempel Gotlands lösningar på vattenhantering bidra till andra öars näringsliv. På samma sätt kan även andra öars kunskaper och erfarenheter bidra till Gotlands näringsliv och fortsatta hållbara utveckling.

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1. Introduction

With a changing climate and a limited amount of natural resources, the need to find a sustainable way of developing and powering societies has become essential. Sustainability is a broad concept covering many aspects of the society, but the main goal is for humans to live on the planet with limited resources. There are several ways to define sustainable development but the most frequently used definition and the definition used further on in this report is the Brundtland Report (Brundtland, 1987) stating "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Sustainability is often described by three dimensions that need to be balanced in order to be reached. The dimensions are social, environmental and economic aspects of sustainability and all parts are as important.

These three pillars of sustainable development are described by Baker (2016), where the social dimension is for example human mores and values, relationships and institutions. The economic dimension concerns the economic development and distribution and allocation of scarce resources. The ecological involves the contribution of the social and the economic dimensions and their effect on the environmental resources.

Since the world economy today is based on constant economic growth, essential challenges have emerged regarding how to manage the growth rate in order to have the minimum environmental impact. The limitations of natural resources have become evidently clear in many different areas. The business sector will have to change and adapt to the new conditions and business development needs to be done within sustainable boundaries. It will be a challenging conversion for companies and the society as a whole.

1.1. Background

International collaborations, to both develop and enhance businesses, have become a natural phenomenon as a result of the growing simplicity and ability for businesses to reach customers all over the world, and not be limited by geographical borders. That businesses can work together in order to solve greater challenges regarding for example market positioning, compressed supply chains, cost effective distribution and enhanced customer value is common knowledge. Additionally, it is not only businesses that are well practised in cross-border collaboration. Institutions such United Nations (UN) and European Union (EU) are specifically formed with the intended purpose of addressing challenges and issues that spans across geographical borders. For example, in September 2015, the UN introduced a new sustainable development agenda, based on 17 goals to be achieved in the next 15 years. Some of the goals are *No poverty*, *Zero hunger*, *Gender equality*, *Climate action* and *Sustainable cities and communities*. Multinational associations do not only discuss international

and domestic challenges and issues. One distinct organization is the International Olympic Committee (IOC) arranging the Olympic Games. For a nation hosting the Olympic Games it creates great regional value in form of for example increased job opportunities, number of visitors and overall social development and infrastructure. Through the Olympic Games it has naturally emerged businesses taking the opportunity of the games as means to improve or build their business. Thus, business development and enhancement have become strongly integrated within the Olympic Games. It becomes explicitly apparent that sport events can have a strong positive impact on the construction and development of businesses. Such an unexploited opportunity could be found within the sport event NatWest Island Games and its participating islands. One of the participating islands and the host of the NatWest Island Games in year 2017 is the Swedish Island of Gotland which will be the outset of this study.

1.1.1. WCreate

A company with a vision and intention to favour the business sector on Gotland is WCreate. WCreate is a company established year 2016 in the largest city on Gotland, Visby. Their method to contribute to the business sector is to be a stimulating and creative meeting point for existing entrepreneurs and companies on Gotland and motivating them to work together in challenges concerning more than one. To coordinating entrepreneurs on Gotland is their intention to make the society on Gotland more self-sufficient and not so dependent on the Swedish mainland. If this method is successful their higher ambition is to establish the concept of WCreate on other small islands around the world, and because of this ambition they have high interest of gaining more knowledge of the situation on other islands. This study is the realisation of that ambition. WCreate were the one that introduced the International Island Games Association in this study as an island network that might be interesting to investigate.

1.1.2. NatWest Island Games - International Island Games Association

An existing and well-functioning collaboration between small islands is the International Island Games Association (IIGA) that is organizing the sport event NatWest Island Games every other year. To be counted as a small island, in their definition, there is a limitation of maximum 200 000 inhabitants. The games started on Isle of man year 1985 and have since then been held 16 times (IIGA, 2017). The member islands are Aland, Alderney, Bermuda, Cayman Islands, Falkland Islands, Faroe Islands, Froya, Gibraltar, Gotland, Greenland, Guernsey, Hitra, Isle of Man, Isle of Wight, Jersey, Menorca, Orkney, Rhodes, Saaremaa, Sark, Shetland Islands, St Helena, Western Isles and Ynys Mon. In June 2017 the Swedish island Gotland will be the host of Island Games and this will be the largest multinational sport event in Europe this year. Parts of the business sector on Gotland, together with the local government, see this as an opportunity to evolve the collaboration between the islands.

The majority of the member islands are located in Europe, mostly around The United Kingdom. The founder members for the Island Games network are Aland, Alderney, Faroe Islands, Froya, Gotland, Guernsey, Hitra, Isle of Man, Isle of Wight, Jersey, Shetland Islands, St Helena and Ynys Mon (IIGA, 2017).The islands that have hosted the games more than one time are Isle of Man, Guernsey, Aland, Isle of Wight, Jersey and Gotland.

The structure of the network is formed as following. International Island Games Association (IIGA) is a company that owns the rights to the NatWest Island Games and the IIGA is run by the IIGA Executive Committee. The executive committee consists of elected representatives from some of the member islands on a 2 year period on the Annual General Meeting by the Member Island Association. It is the executive committee that carries the ultimate responsibility for every NatWest Island Games. The IIGA is ruled by its constitution, guidelines, Sports By-rules and Anti-Doping Rules. Each member island has its own Island Games Association (IGA) and its own constitutions and regulations. The different sports that is exercised in the NatWest Island Games has their own rules and guidelines to make the games as fair as possible (IIGA, 2017). Each member island also has an Island Secretary who works as a single point of communication. All communication between islands goes through the islands secretaries who forward the message to the right person on that specific island.

According to the IIGA there has always been an ulterior motive to the games to ensure that the host island and its residents are left with the most positive legacy. Some impacts they describe as caused by the games are the creation of new sport venues which has potential for events after the games, the creation and modernisation of the infrastructure and the enhancing the host island's international image and demonstrating that they can deliver major events. Many of the previous host islands have delivered a Legacy Report after the games to demonstrate where the investments were put and the outcome of the games (IIGA, 2017).

1.1.3. Gotland

Gotland is a Swedish island rich in workplaces and the number of entrepreneurs per capita is the highest in Sweden. The main industries on Gotland are the tourism industry, the agriculture and food industry and the limestone industry. The agriculture and food industry play an important role and is one reason for the high number of self-employed and entrepreneurs on Gotland. Gotland is one of the most popular vacation destinations for the Swedish population and it has the largest accommodation income per capita in Sweden. During the summer (June to August) the passengers travelling to and from Gotland more than quadruple compared to winter (January to March) and that makes Gotland a very seasonal dependent tourist destination (Region Gotland, 2015a). The all-year-around residents on Gotland are affected by the distinct difference from winter to summer including the infrastructure such as sewage, freshwater supplies and roads. It also contributes to high house prices in the city of

Visby and its surroundings. The possibility to rent an accommodation all year around is another issue rather specific for Gotland. Many property owners prefer to rent their places weekly during the tourist season in order to earn as much money as possible.

The largest city on Gotland, Visby, is on the UNESCO World Heritage List for its well-preserved city centre from the 12th to the 14th century. This attracts many tourists with a history interest with a peak during the Medieval week in the middle of the summer. Visby is also hosting Almedalsveckan, a week where all top politicians with related business sectors and companies in Sweden meet every summer (Region Gotland, 2015a).

There are several organisations on Gotland working in cooperation or in parallel towards the same goal. They want to attract more all-year-around residents, extend the tourist season and attract educated people and companies. Michael Enlund (2017) is the CEO of Inspiration Gotland, a company owned by the municipality of Gotland, working for a positive development on the island. Enlund tells that there are certain challenges for an island like Gotland, and one of them is the transports to the mainland. In order to make it more attractive for people to live and companies to establish it is a requirement to maintain regular and affordable connections to the Swedish mainland.

Enlund is also describing the strategy for extending the tourist season. A predominant majority of the tourists visiting Gotland today are Swedish inhabitants and to attract visitors even after the Swedish summer vacation, they need to develop their marketing abroad. An example is to focus on Germany and other European countries with holidays in September and October. The summer of 2018 a new cruise quay will be completed in the harbour of Visby and thousands of foreign tourists will come on daily basis during high season. This sets requirements on the society, for example all signs and information need to be in English, and possibly other languages, and traders need to have international payment equipment (Enlund, 2017).

Like in many other societies in Sweden, Gotland has an aging population which puts high demand on the welfare. Gotland has a negative net birth and is dependent on immigration to increase the population. Region Gotland has a vision to become 65 000 inhabitants by 2025 compared to today´s 58 000. If a few thousand people more work on Gotland, the region will get in enough taxes to provide for the public service on Gotland (Region Gotland, 2015b).

The level of education is lower on Gotland than in Sweden as a whole and Gotland is struggling to attract competent workers to make the business and public sector thrive. It is a top priority for both the business and public sector to increase the level of education and measures have been taken that is

paying off. One example is the collaboration with Uppsala University that has made the level of education increase the last years (Region Gotland, 2015b).

As a result of low precipitation during the winter season, Gotland has been suffering a lack of freshwater the last summers. The Municipality of Gotland is responsible for the access to freshwater for every citizen connected to the local conduit. During the summer of 2016 the municipality had to do a massive information campaign and a decrease in pressure head in the freshwater conduit in order to make people "save" as much freshwater as possible (Pettersson et al., 2017).

1.2. Purpose

The purpose of this study is to investigate the interest of a business collaboration between small islands, to exchange experiences of sustainable challenges for small islands specifically. By analysing Gotland and the IIGA, potential success factors can hopefully be identified and used for further development of a potential business collaboration. The study will focus on the challenges on Gotland, and based on them, find incitements for an enhanced collaboration.

The underlying research questions to this study are as following;

- How could a business collaboration between Gotland and the other member islands, originated from the International Island Games Association, contribute to the islands' business sectors?
    - What is the level of interest, and what incitements exist amongst the IIGA member islands for an international business collaboration?
    - What collaborational incitements can be found by analysing statistical data of the IIGA member islands?
    - How could Gotland contribute with knowledge of managing limited natural resources?

1.3. Methodology of this study

This is a study of the interest and incitement of a collaboration between small islands to encourage sustainable development, with the premise of sustainable development as a social, economic and environmental dimension. To state the very importance and area of application for sustainable development in a society this thesis has one study for all three dimensions. The social dimension was examined by asking the islanders how they experience challenges on their island and what they think of an island collaboration to encourage sustainable development. The economic dimension was investigated by a data analysis of economic correlations between some of the islands within the IIGA.

The environmental dimension was examined by investigating the freshwater situation of Gotland and how they have handled the freshwater shortage.

According to several researchers (Falkland and Custodio, 1991a.; Lashley, 2013), islands are especially affected of limitation in natural resources and particular small islands are affected. An island could be considered "small" in several aspects, with the two most common being *land area* and/or number of *inhabitants*. For limitation in natural resources the land area is the critical parameter and for competence it is the number of inhabitants. To cope with these challenges more knowledge of the natural resources is needed and how to use them without endanger their future existence. In this study, we take both of these parameters into consideration since the IIGA are using the number of inhabitants as their limitation and with our focus on natural resources we also consider the land area of the islands.

In the following chapters of this thesis we first describe some of the ethical dilemmas this study and these subjects face. The theory chapter examines the concepts of "Sustainable development", "Collaboration" and "Business development" in terms of this case. Further on the three cases for the dimensions of sustainable development can be found in separate chapters. Finally there is a comparative analysis for bringing together these three case studies and discuss the results according to the purpose and research questions.

1.4. Delimitations

This study has its starting point on the Swedish island of Gotland and focuses on the island's business sector and potential enhancement. Furthermore, delimitations within the environmental research is done to only cover freshwater management, as a consequence of the current lack of freshwater on Gotland. The study's focal point is the potential elevation of an island collaboration regarding a sports event, the NatWest Island Games, to originate an international collaboration between small islands in regards to both international and domestic challenges. Delimitation within the research is that only the 24 member islands of the NatWest Island Games are studied and interviewed. Additionally, interviews and questions are performed on individuals within the IIGA and individuals working on Gotland, both affiliated in the private and public sector. A data mining analysis is performed with the goal of analysing statistical data of member islands, with the intended purpose of finding incitements for a collaboration. Due to limitations of both time and resources, delimitations are done within the performed data mining analysis. Thus, statistical data is collected from the three islands Gotland, Aland and Guernsey.

1.5. Ethics

1.5.1. The ethical dilemmas our study has encountered

As said in the purpose of this study we have investigated the interest of a collaboration between small islands. Ethical dilemmas researchers have to relate to have been described by Bryman and Bell (2011) and divided into four parts; the information requirement, the consent claim, confidentiality and the usage claim.

The information requirement states that all participants should be informed about the study and its purpose and that it is optional to take part. In the questionnaire that was sent to the 24 member islands of IIGA we informed about the study and its purpose. The participants in the questionnaire had the ability to choose to quit the questionnaire at any time. Other parts of the study include interviews to gain knowledge of the situation on Gotland and everyone was informed about the study and purpose in advance and had the option to not contribute. All analysed data was public and collected from official webpages or handed by employees.

Consent claim states that all participants within the study must give his or hers consent of contribution, without being forced or pressured. They will also reserve the rights to quit or withdraw their involvement or contribution, without any demands of explanation. The interviews and questionnaires in this study have always been optional and informative about the purpose of the interview/questionnaire. We have realized, in this case as well as in the case regarding the information requirement that we could have been more explicit in our instructions and descriptions in order to avoid misunderstanding and ignorance for those who participated in the questionnaire.

The confidentiality states that information about the participants should be confidential. In the questionnaire, we did not ask about the participant's names and other personal information but since we asked about which island they represent they are not completely anonymous and could therefore be tracked even though we do not use their names.

The usage claim states that information about individuals is only to be used in research purposes. In our research, the information gathered about respondents from the questionnaire is only going to be used to help us understand how the network of Island Games is constructed and how a new potential network can be constructed. The derived results and recommendations will not be based on the information of particular individuals. It will instead be based on the analysis of the combined answers, thus no information about specific individuals will be used in our results and recommendations.

1.5.1. The ethical dilemmas for the subject in general

Ethical dilemmas in the subject of Sustainable development start in the established reality that sustainable development is something desirable. That sustainable development is seen as essential and that the term often is in no need for further explanation, even though a recognized definition does not exist, is a problem.

One important dimension of sustainable development is covering what rights we must consider future generations when so many people live in poverty and misery today. Is it really warranted to consider the life quality of future generations before we solve existing problems? In this study we observe sustainable development in the long term and consider that solving future sustainable issues also can help to solve issues of today. In an ideal world, all parts of sustainable development should be equal but with the circumstances of today it is problematic how to value them. For some people, environmental hazardous businesses are the only possible way to make profit and in their case survive. Can all dimensions of sustainable development have the same priority? Should either the environmental, social or economic dimension be prioritised? In this study, we have tried not to value any dimension in order to stay as objective as possible. Though, it is important to draw attention to the different problems and dimensions of sustainable development with a view from all different perspectives. The case for this study is a development of the business sector on islands, with focus on the private institutional sector and not as much on other important actors in a society. For a society to function in a desirable and sustainable way several actors need to be motivated, for example the public institutional sector and the university.

2. Theory and literature review

2.1. Sustainable development

The concept of sustainable development has been discussed since the seventies and the most established definition is the Brundtland World Commission on Environment and Development (WCED) from 1987. The Brundtland World Commission states that "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The Brundtland definition is rather general and allows a wide range of different interpretations. Sustainable development has also been described as "Providing a good life for everybody" and "Safeguarding a healthy nature" (Isaksson and Garvare, 2003). From those definitions, it makes clear that sustainable development regards two stakeholders; the nature and humanity. The challenge is to find a sustainable way for those stakeholders to exist in symbiosis and not obliterate each other. Sometimes it can occur a contradiction between the two different approaches of sustainable development. With the conditions of today, providing a good life for everybody has a negative impact on the environment and it is a huge challenge to provide everybody with a good life without ruining the nature (Isaksson and Steimle, 2009). The biggest difference between sustainable development policy and environmental policy is the concept of conserving resources to the future and not only act in the short-term.

Most scientists agree that sustainable development includes both an economic, environmental and social dimension (Brennan and Cotgrave, 2014.; Baker, 2016). The economic dimension is about combating poverty and ensuring that all people can afford meeting their basic needs. The environmental dimension focuses on the ecology and conservation of material resources in the long term. The social dimension regards values like fundamental human rights and a democratic leadership. The overall goal of sustainable development is to create a long-term stability of the economic, environmental and social dimensions. In order to do so all three dimensions need to be integrated, see Figure 1.

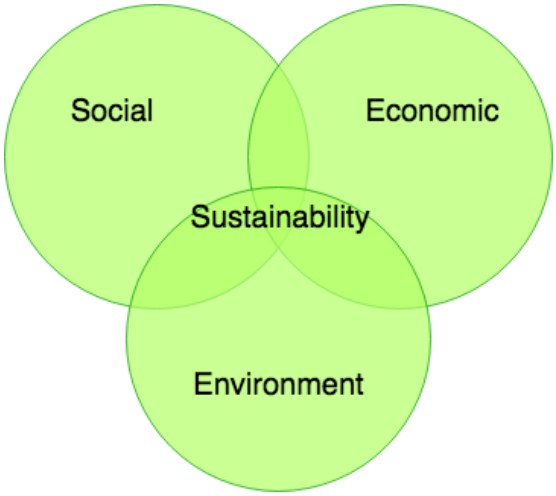

Figure 1. The three dimensions of sustainable development (Baker, 2016).

Even though all these dimensions are important, it happens that the environmental dimension gets more attention in contexts about sustainable development (Brennan and Cotgrave, 2014). All dimensions can be seen as resources and the environmental aspect is the most limiting resource and a precondition for the social and economic dimension. Without natural resources, economic resources will lose their value (C. Brennan and J. Cotgrave, 2014). Because of the strong resource relationships between the nature and economy and the fact that nature is an indispensable prerequisite for human life, there are arguments that nature should be considered as the primary stakeholder of business (Isaksson and Steimle, 2009).

There are challenges in balancing the three aspects of sustainable development and the broad definition allowing so many different interpretations can in some ways be problematic. Since the definition covers both time and space it is hard to agree on what measures should be done immediately and what can wait in order to reach sustainability. The criticism against sustainable development is often concerning the broad definition and the interpretation that the concept is just made up of empty words. The concept has become a trend word used in all possible contexts and because of that in some ways lost its content (Liu, 2003). Some scientists claim that the concept of sustainable development should be extended and include more than three dimensions. Common aspects to widen the concept with is a legal, technical and political dimension (Pawłowski, 2008).

In September 2015, the United Nations (UN) decided on 17 sustainable development goals. The aim of the goals is to end poverty, fight inequalities and prevent climate change. The goals are based on the millennium development goals but take them further to make sure all countries take responsibility and they are now considering all parts of sustainable development. The goals are not legally binding but all countries need to follow up the progress in implementing the goals.

2.2. Sensitivity of islands

Climate change is affecting all parts of the globe in different ways but small islands are generally more affected than the continents. Because of their geographical locations and distance to the continents, islands are often more exposed to extreme weather and they are vulnerable if a natural disaster occurs (Falkland and Custodio, 1991a). As a consequence of global warming and rising sea levels, small islands suffer a high risk of flooding. Flooding can cause problems for the people living close to the coast and it can also destroy crops. Several small islands around the world have unique ecosystems and species that now is endangered due to the new conditions (Lashley, 2013).

The changing climate is also causing an increase in intensity, frequency and duration of extreme weather such as storms, droughts and rainfalls. Surrounded by the sea the small islands are often very exposed to storms and in case of extreme weather the transports to mainland will likely be cancelled. Since islands have a limited area of land and natural resources, cancelled flights and ships will soon become a big problem if the island is dependent on imports (Lashley, 2013).

There are plenty of islands paying attention to this isolation that is likely to occur during extreme weather conditions. An example is Hawaii that is developing the idea of island self-sufficiency and sustainability. Studies from Hawaii show that to reach self-sufficiency land for both food and energy production is needed. Depending on the population size in relation to land area it can occur a land use conflict regarding how to optimize the land to provide the people with enough energy and food (Kim et al., 2015)

Politically it can be a barrier for islands that are not self-governed because they have to relate to their nation's politics and laws. Additionally, a good relationship between local authorities and the government is a necessity to develop and reach self-sufficiency for non-self-governed islands (Gupta, 2014). Self-governed islands have the ability to make decisions more freely. However, having the ability to freely make decisions is not equivalent with island sustainability and prosperity.

2.3. Tourism development on small islands

Tourism is a fast growing business sector on islands (McElroy, 2003.; Graci, 2013). In many cases the development has taken place the last decades resulting in a high pressure on infrastructure, both immaterial, like cooperation between stakeholders (Graci, 2013), and material infrastructure, like roads, electricity, sewage and water (Baldacchino, 2006). Island states that are self-governed often have a faster tourism-business development than islands that are not, and according to Baldacchino (2006) a major cause is that foreign investors on these islands get more opportunities to handle unopposed. Why that is the case Baldacchino describes as the locals on self-governed islands do not

have any “mainland” to fall back to in job opportunities or education and need all these components on the island, making them more open to the foreign investors. A problem with foreign investors is that they often do not have as much insight in the community and its challenges to be as useful as they potentially could be.

This faster tourism-business development can be both positive and negative depending upon which perspective that is seen. An approach with a sustainable tourism development may be positive in most cases but requires a large effort for the concerned. A recently new term for sustainable tourism development is the concept of Ecotourism that is a conscious way of traveling that contributes to the local economy and conservation of protected areas while educating travellers in the local culture and nature (Gössling and Hultman, 2006).

The concept of “Warm Water and Cold Water Islands” (Baldacchino, 2006) is a division of islands around the world. The warm water islands are islands located in tropical areas as Philippines or Caribbean, and cold water islands are islands located in temperate or cold areas as The Baltic Sea or The North Atlantic. Baldacchino sees a difference in the tourism business in these two divisions where cold water islands have lesser but more dedicated tourists that do not stay for so long time and warm water islands have a lot more tourists that stay longer and appreciate convenience. Many of the warm water islands have troubles with the developing rate of the tourism industry and it has reached such proportion that turning it into a sustainable development may cause immense efforts. But not trying to reach sustainability may have an even higher price, an uninhabitable island (Baldacchino, 2006.; Graci, 2013).

In the discussion of “Warm versus Cold Water Island Tourism: A Review of Policy Implications” of Baldacchino (2006), it is discussed that many small-island economies are undergoing a big change with a decline in the traditional business sectors as fishing, mining and agriculture and instead the tourism industry is increasing. An interesting difference is that islands with a low developed tourism industry often lie far from the mainland and have a small population and are often forgotten by the centralized policy makers. The effect is that the local politico-economic powers that the mainland neglects is treated by small local groups that often have a one-question-focus. An oligopolies group of that kind is known to be stuck in old traditions and to not find interest in something new, for example tourism development. Baldacchino (2006) claims this could be a major cause for low tourism development rate in such islands. However, it is also stated that this is not a bad thing but rather a possibility to create a sustainable tourism industry.

2.4. Collaboration

In order to be able to take advantage of the above mentioned creative possibility, and to avoid decisional power only be granted to a few, a strong and well-functioning collaboration between local and centralized authorities is essential. As described in chapter *2.2 Sensitivity of islands*, a good relationship is a necessity to develop and reach self-sufficiency and sustainability.

A collaboration is widely recognized as an evolving process of alliances working together in a problem area (Gray, 1989.; Plummer et al., 2006.; Jamal and Stronza, 2009.; Graci, 2013). A commonly used definition for collaboration is the one by Gray (1989), "a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible." Another used definition is from Gray (1985, p.912), "the pooling of appreciations and/or tangible resources, e.g., information, money, labour, etc., by two or more stakeholders to solve a set of problems which neither can solve individually." These two definitions are pretty similar but the second one has "appreciation and/or tangible resources" as its premises when the first one has just "problem". One could say it is a matter of interpretation how similar these definitions are.

The structure of a collaboration can vary, one frequently used structure is "Collaboration through partnership" which is described by Graci (2013) as a "loosely coupled system of organizations and individuals that belong to various public and private sectors, who come together in order to reach certain goals, unattainable by the partners individually." One type of collaboration through partnership is a public-private partnership that is one key principle for a successful management by bringing together organizations from different parts of the community to establish goals and create framework that they all follow (Foggin and Munster, 2003.; Berresford, 2004). The purpose of a partnership is to produce consensus that will lead to new opportunities and innovative solutions (Graci, 2013). According to Carbone (2005) it is critical to have a partnership between the producer, the supplier and the consumer for the need of the community to be integrated together with a sustainable use of the environment and providing profits to the stakeholders.

Two general obstacles to collaboration, described by Selin and Chevez (1995), are a centralized planning process and an institutional culture that impeding collaboration with local groups. A decentralized planning process, with small working groups, or a larger flexibility may be solutions for those obstacles. Gray (1989) has listed obstacles that may be too formidable to overcome; basic ideological differences, one stakeholder has power to take unilateral action, past interventions have been unsuccessful, issues are too threatening because of historical antagonism or legitimate convener can not be found.

2.5. The Partnership Model

In correspondence to the previous chapter Lambert (2010) has developed a model to assist the construction of strong business relationships, with the intent of solving or avoiding obstacles similar to the ones listed by Gray (1989). Additionally, Carbone (2005) describes the critical need of a partnership between producer, supplier and consumer, which strengthens this demand of a strong well developed business relationship. The name of the model is *The Partnership model* and it is originally developed within supply chain management.

Partnership is defined as a *tailored* business relationship based on mutual trust, openness, shared risks and rewards in order to gain performance greater than what would be achieved without the presence of partnership. The model aims to properly structure the business relationships between partners in order for the parties to gain ways to leverage the unique skills and expertise of each organization and furthermore even remove competition. Elevating business relationships into partnerships is very costly in regards to both time and effort required to achieve alignment and thus a company cannot and should not partner with every potential party. To ensure that a relationship truly benefits from a partnership, it is important that the limited resources are dedicated only to the relationships with the greatest prospect and business value (Lambert et al., 2010).

The partnership model consists of four fundamental elements *Drivers, Facilitators, Partnership components* and *Outcomes*. The element is structure in correspondence to how the elements are connected to one another, illustrated in Figure 2.

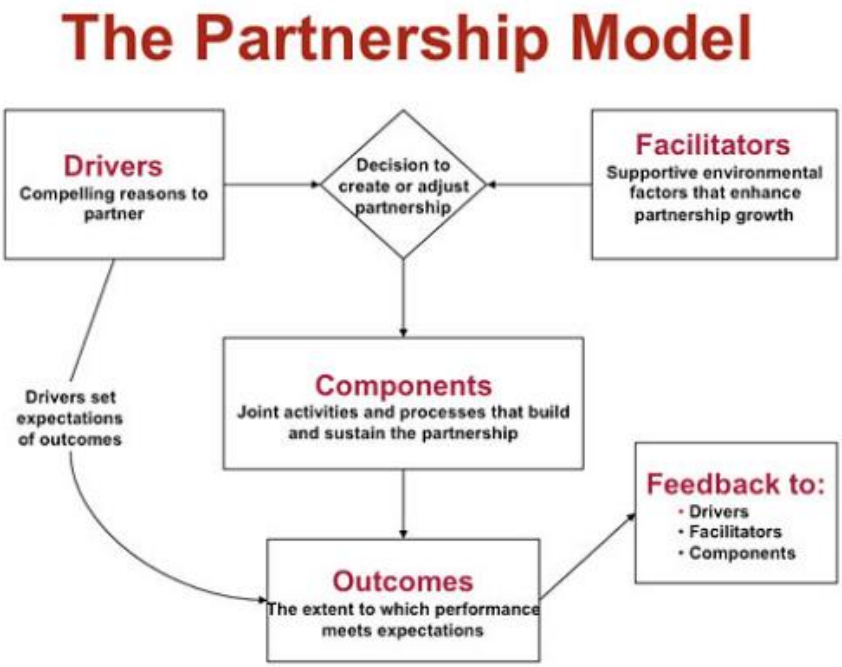

Figure 2. The Partnership Model (Lambert et al., 2010. with permission).

The first element is the Drivers, which are the essential reasons why the parties should establish a partnership and set the expectations of outcomes, see Figure 2. These reasons are the expected benefits from elevating the relationship into a partnership and they are divided into four subcategories, the expected improvement of asset and cost efficiencies, customer services, enhanced market advantages, profit growth and stability. The chance for a partnership to be successful strongly relies on the strength of the drivers. The second element is the Facilitators. The Facilitators measure how well the potential partners can collaborate and, in combination with the drivers, increase the probability of success, see Figure 2. It consists of the environmental factors which exist in all business relationships and will not quickly change. These factors include, for example, the compatibility of the corporate cultures, the compatibility of the management philosophy and techniques, the degree of symmetry and mutuality between the partners. The third element consists of the manageable elements within a partnership, the Partnership components. These components include methods of planning and communication, joint operating controls and activities, the level of trust and commitment and how risks and rewards are shared between the partners. The potential of the partnership is achieved through the implementation of these components. The fourth and last of the elements making up the partnership model is the Outcomes and are a product of the implementations of the components, seen in Figure 2. The outcomes are based on the performance of the partnership and how well the drivers were achieved. The outcomes are reflected by the results of for example profit enhancement, improved service, reduced costs, competitive advantage in market positioning and market shares. These results in turn gives feedback to how the partnership can and should be adjusted in the future and the process iterates back to the first element (Lambert et al., 2010).

2.6. The Tourism Partnership model

Like the previous described Partnership model, the Tourism Partnership Model describes how a partnership could be developed through the iteration between different central elements. The Tourism Partnership Model is a model developed by Selin and Chevez (1995) in order to understand collaborative processes in the field of environmental resources. The model is based on their own research and published work from several other researchers (McCann, 1983.; Gray, 1985 and 1989.; Waddock, 1989). The definition of collaboration they use is from Gray (1985, p.912), "the pooling of appreciations and/or tangible resources, e.g., information, money, labour, etc., by two or more stakeholders to solve a set of problems which neither can solve individually." With the definitions of stakeholders by Selin and Chevez (1995) as follow, "individuals, groups and formal organizations who have a perceived interest or impact on a particular resource." Their view of collaboration is as an emerging process rather than in a rigid state of organization, and their model being process-oriented with methods that must be tailored to the unique demands of the situation.

The Tourism Partnership model operate by collaborative process divided into five phases; Antecedents, Problem-setting, Direction-setting, Structuring and Outcomes. The first phase, Antecedents, describe the motivation or forces that can lead to collaboration between different partners. This phase is based on the work by Waddock (1989) who identified it to seven motivation factors; Crisis, Broker, Mandate, Common vision, Existing networks, Leadership and Incentives. The second phase is Problem-setting and that is the first developmental stage in a collaboration. In this phase, the participants realize that to achieve something in the issue it will require collective action. That can be summarized in six following themes, recognize interdependence, identify stakeholders, consensus on legitimate stakeholders, common problem definition, perceived benefits to stakeholders and perceived salience to stakeholders. The third phase is called Direction-setting and is the phase where the goals and purpose of the collaboration is set. Subjects for this phase are as follow; establish goals, set ground rules, joint information search, explore options and organize sub-groups. The fourth and second to last phase a collaboration is undergoing according to this model is the structuring phase and in this phase the organization for the continuing collaboration is established, like formalizing relationship, assign roles, tasks elaborated and design monitoring and control systems. The last phase is the Outcomes and that is the result of the previous phases, which can be divided into programs, impacts and benefits derived. The Tourism Partnership model has a cyclical shape and deliver feedback from the outcomes to the earlier stages and investigates the interest for another collaboration or continuing with the previous (Selin and Chevez, 1995).

2.7. Triple helix model

Both the Partnership model and Tourism Partnership model demonstrates the essential factors in order for a partnership or collaboration to function. In similarity with previous description of the need of collaboration within governmental institutions on islands, there exists a greater need of collaboration. This need of collaboration is not only within public institutions but to include private and academic institutions at the same time.

The institutional sectors public, private and academic, that formerly operated at arm's length, are increasingly working together with rising patterns of interconnections emerging in the innovation process. In the course of developing new innovation environments, institutional and national boundaries may be transcended. Additionally, national innovations are regionalized and internationalized as innovation processes take place across national boundaries, through cooperative arrangements between regions and businesses (Etzkowitz and Leydesdorff, 1995).

In the 1990s the concept of the Triple Helix of university-industry-government relationships was initiated by Etzkowitz and Leydesdorff (1995). The concept interprets the shift from an industry-

government set in the Industrial Society towards a growing relationship between university-industry-government in the Knowledge Society. The Triple Helix states that the potential for innovation and economic development in a Knowledge Society lies in the ability for university, industry and government to generate new institutional and social formats for the production, transfer and application of knowledge. Lawton Smith and Leydesdorff (2014) describes in their paper *The Triple Helix in the context of global change: dynamics and challenges*, a Triple helix approach with means to understand a context in which universities, businesses and governments would co-innovate to solve global economic challenges. The authors stress that the crucial issues, to understand the context, are under which conditions the three functions wealth generation, organized knowledge production, and normative control can operate synergistically. Additionally, Lawton Smith and Leydesdorff describe the Triple Helix model of university-industry-government relations as three alternating coordination spheres of activity, shown in Figure 3.

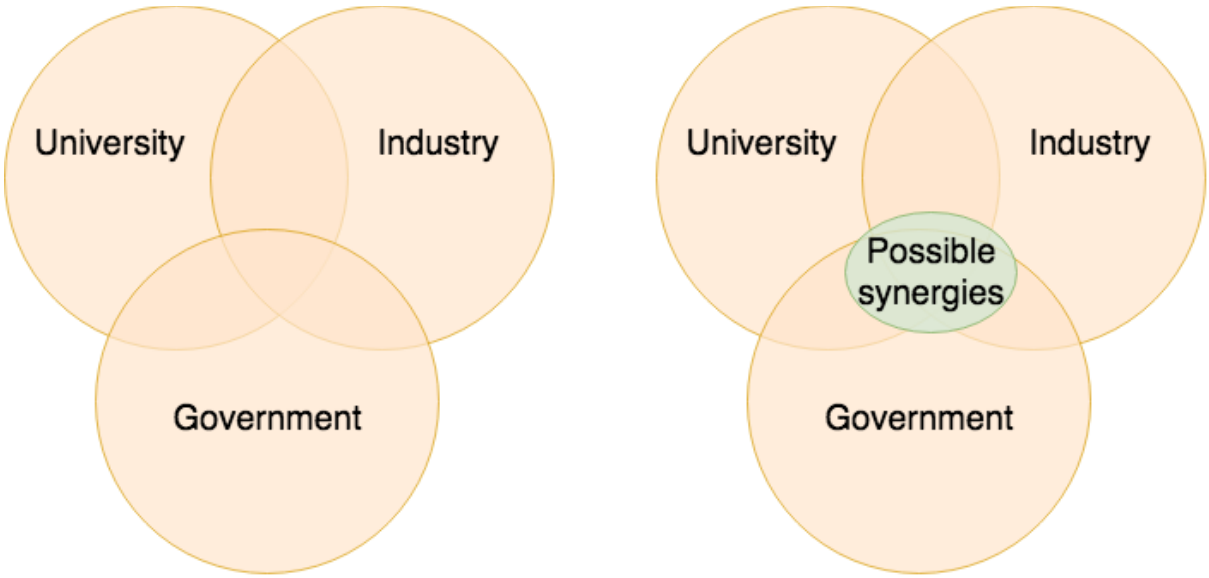

Figure 3. Illustration of the three spheres of activity within Triple Helix.

As illustrated in Figure 3, the relationships between the three spheres remain in transition because each of the partners establishes its own differentiating task. From this, a trade-off can be created between integration and differentiation, as possible synergies can be explored and shaped where the three spheres overlap. Furthermore, the relation between the spheres can be described as a three-dimensional space between university, industry and government, each representing an axis within the space. From this three-dimensional space, innovations are generated as output indicators for science and technology, and function as inputs into the economy, creating a knowledge-based economy. This knowledge-based economy contributes to the political economy by ensuring that the social organization of knowledge as R&D is developed back into the system, and thus the generated innovations influence the overall economy (Lawton Smith and Leydesdorff, 2014). Through this

collaboration and creation of a knowledge-based economy, long-term value creation is possible in order to generate sustainable business development.

2.8. Business development and relationships

Scott Pollack, contributor to Forbes magazine, defines in his article *What, Exactly, Is Business Development?* In 2012, business development to be *the creation of long-term value for an organization from customers, markets, and relationships*. He also highlights the fact that there are probably as many definitions to what business development is as there are individuals trying to answer the question. However, analysing his description, he means that for a business to succeed in constantly growing its organization, the value, for example money, knowledge, company trademark etc. must persist over time. Business development is not about the ability to create quick value that is gone tomorrow as easily as it came today. Furthermore, Pollack describes the customer to be the people paying for the product or service provided by the business and the market to be specific sections of customers divided, for example, geographically. Relationships, the last of the three attributes in his definition, is described as the fundamental role to create long-term value. He means that building, managing, and leveraging relationships that are based on trust, respect and a mutual appreciation of each other's value is essential to the success of any business development attempt.

The importance for business to have a strong relationship to its partners, employees, customers and suppliers could be seen as obvious and natural. However, in the book *Developing relationships in business networks* by (Håkansson and Snehota, 1995) the authors describe the relationships between industrial companies, organizations and institutions largely neglected by scholars of both economics and management. First now the subject of business relationship is rapidly growing.

Business development can be divided into four process characteristics *adaptation, cooperation and conflict, social interaction* and *routinization* (Håkansson and Snehota, 1995). For two companies to establish a continuous existing relationship, mutual adaptations of some kind have been found to be a prerequisite in order for successfully building such a relationship (Hallén, 1989). The adaptations branch from the need to coordinate the activities of the individuals and companies involved and is divers and frequent. For example products, routines and rules of conduct are constantly modified and adapted within a relationship between companies in order to become more efficient. Within business relationship elements of cooperation and conflict have been found to coexist. There is an inherent conflict about the distribution of benefits and value from a relationship. While conflicts can occur, the concern for cooperating and creating value, which is the fundamental purpose of the relationship, generally directs the parties towards constructive solutions (Håkansson and Snehota, 1995). All relationships essentially consist of personal bonds and convictions which make social interaction an

important role within business relationship. It is necessary for individuals, within the relationship, to become committed beyond strictly duty content. From this trust emerges as one of the factors influencing the business relationship and its activities (Dwyer et al., 1987). Business relationships are often complex and informal in several ways. One element of complexity is within the number, type and contact patterns between individuals involved in the relationship. It has been found that several people frequently have direct contact within international business relationships. It even becomes more complex by the variation of individuals involved, for example different organizational roles and personal backgrounds. However, the relationships tend to become institutionalized, regardless of its complexity. Routines and rules of behaviour emerge in the more important relationships companies maintain. These emerging routines assist in managing the complex needs to coordinate individual activities within the business relationship (Håkansson and Snehota, 1995).

2.9. Business development through sport events

Studies have shown that hosting big sport events, such as the Olympic Games, could be beneficial for the regional economy and business sector. Even though the cost for arranging an event in the size of an Olympic game is high, the total revenues could possibly exceed the total cost of the event. It is a huge primal cost to host the Olympics and arenas and infrastructure need to be built or developed. The preparations create lots of job opportunities and it is also an investment in for example the infrastructure. With all people visiting and spending money during the games a lot of the money will return (Preuss, 2004). After calculating all the direct costs and incomes, it is very complicated to get a full picture of all the values created during a sport event and it also depends on what time period is studied. In conjunction with sport events, like the Olympic Games, there is a good opportunity for all kind of people to meet and network. There is a long tradition of people from the business sector coming together and networking during the games (Glynn, 2008).

This kind of business meetings and experience exchange is common even when it comes to smaller sport events. Many smaller regions are using this strategy as a part of arranged sport events in order to make the economy develop. Studies have shown that to maximize the business benefits of a sport event the engagement barriers need to be low which occurs when businesses have skills, information, coordination, capital and strategic direction to become involved (Mackellar, 2015).

2.10. Corporate social responsibility

As mentioned in chapter *2.8. Business development and relationships*, business relationships are important to create long-term value and as a result generate sustainability. The last decades an increasing number of companies have chosen to focus more on sustainability. Some companies have

realized that with an environmental and social awareness they can also save money and make profit. Reduced raw materials and less waste will be beneficial for both for the environment and the economy for example. The customers are also getting more and more into environmental and social issues and to integrate all parts of sustainability could be a way to attract new or keep customers. To have a sustainable approach is called Corporate social responsibility (CSR) and that is the responsibility the companies have by affecting the society at small and large scale. CSR is about taking responsibility both in an economic, environmental and social perspective in order to reach sustainability (Ammenberg, 2012). Economic responsibility is about maintaining profitability in the company and ensure that the employees working for the company and subcontractors have rights and employments. Environmental responsibility is to act and choose raw materials that is beneficial for the environment, renewable energy sources and to make sure the using of the product have as small negative impact on the environment as possible. Social responsibility can be both internal and external. The internal social responsibility is to ensure there is a balance among the employees when it comes to age, sex, ethnicity, religion and disabilities e.g. The external social responsibility regards the customer group and intend to make sure no customers are discriminated because of the product (Ammenberg, 2012).

Even though it is positive with increasing sustainability awareness among the companies there are some companies abusing it. It is easy to develop a strategy in words but to concretize it requires more effort. There are companies marketing themselves as environmentally friendly but in fact they do not stick to their well written environmental strategy. This is called greenwashing and is a common problem making it hard for the customers to really know what the company is doing for the environment and what is only empty words (Walker and Wan, 2012).

The definition of business development as *the creation of long-term value* (Pollack, 2012), is similar with the description of sustainable development as *creation of long-term stability of the economic, environmental and social dimensions* (C. Brennan and J. Cotgrave, 2014). Creating long-term value is necessary for the creation of long-term stability within the three dimensions and thus business development is a qualification for sustainable development.

3. The social dimension of Sustainable development

3.1. Background

For the case study of the social dimension of sustainable development, information from the people living on the member islands of IIGA was used. By finding out how the islanders perceive the situation and conditions of the islands, more knowledge can be gathered about cultural aspects and social values of the inhabitants.

To gather more knowledge of the current situation in the social dimension of sustainable development the member islands in the network International Island Games Association (IIGA) answered a questionnaire. This questionnaire was sent to Island Secretaries of respective member island. As said in chapter *1.1.2. NatWest Island Games - International Island Games Association*, the network has existed since the first games in 1985, with Isle of Man as a host of the first game. 15 islands were competing in the first games with a total of 700 competitors. The network has during the years grown to include 24 islands, 14 different sports and around 1300 to 2400 competitors.

3.2. Constructing a questionnaire

The role of a questionnaire is to provide a standardized interview across all subjects. More exhaustive, the questionnaire can be described as the medium of communication between the researcher and subject. A standardized interview means that all questions asked should be asked in the same way to all respondents. This is important because if the questions are not asked in the same way it will be almost impossible for the researcher to interpret the answers. Additionally, with large-scale surveys it is impossible to handle and interpret data without a standardized question format (Brace, 2008). Coherently with the highlighting of the importance of standardized interviews above, the format of a questionnaire determines how easy it is for interviewers and respondents to read and understand the questions and answers, meaning that the quality of the data becomes heavily influenced by the questionnaire format. In formatting the questionnaire there should be some clear prioritisation between respondent's and interviewer's needs, where the respondent's needs should receive the highest priority and the interviewer's needs next highest priority. Furthermore, when designing the questionnaire numbering the questions will create two advantages. The first one is that respondents are more likely to notice if they missed a question. For example, the respondent just answered question three and while reading question five they realize that they have missed question four, and systematically goes back to answer question four. The second advantage is that by using only a few questions, the numbers will help indicating to the respondent that the questionnaire is not difficult and will be fairly easy and quick to answer (Bradburn et al., 2004). When designing questions in a

questionnaire it is crucial to think about the purpose of the study, that is, what is the fundamental objective with the survey. From the purpose, some question may become elementary, for example if the purpose is to research how many people, in a region, driving cars, you may want to ask if they have a driving license. The objectives and purposes of the study need to be turned into a set of information requirements, and from these requirements design questions that will collect the information and together form a questionnaire. The purpose with the questionnaire is not simply to take the study objectives and write a question corresponding to each one. That is far too simplistic and will produce unreliable and misleading information (Brace, 2008).

3.3. Execution

The questionnaire were sent to all member islands of the International Island Games Association as means of gaining deeper understanding regarding the different islands interests in environmental issues, and furthermore their potential commitment towards a more intimate collaboration regarding industry and commerce as a whole. To investigate the interest of a collaboration, the questionnaire was sent to the Island Games secretaries at all 24 member islands. To get as many responses as possible, the questionnaires were sent from the coordinator in Sweden, Per Wallstedt. After two weeks, a reminding mail was sent. The questionnaire contained 10 questions regarding the coordinators engagement in Island Games and for example their opinion on what challenges their islands are suffering. The purpose with the questionnaire was to find out if other islands have the same challenges as Gotland and if they would be interested to work together with these challenges in a small island collaboration.

In order to get as objective answers as possible, the questions were formulated as "What is the general opinion about this" instead of asking about the island secretaries personal opinion. Nevertheless, the answers will still be subjective to some extent. It was also clarified in the introduction text that this potential collaboration would not affect the island secretaries' workloads since the purpose was to create the new collaboration in parallel instead of extending the existing one. The introduction text of the questionnaire is as follows:

"The purpose of this questionnaire is to investigate the potential of a co-working organisation between member islands of the IIGA in questions regarding business development and natural resources. The intent is for Islands to start collaborate and discuss common issues, for example challenges with tourism and the scarcity of freshwater supplies. The intention is to create a separate collaboration with your island included and not to increase the workload or affect the original network of IIGA. We are aware that you may not have the insight in every specific topic we are asking

about but we are very grateful for your opinion. We would very much appreciate if you took the time to answer following questions regarding this potential collaboration."

The purpose of the first questions was to get information about the island secretary of every specific island. The questions were investigating how long time they have been involved in the Island Games and if it is their primary employment or if they have another occupation beside the engagement (and if so, what kind of occupation). The reason for asking that kind of questions was to know more about the people in the network and their commitment. In the following question the coordinator was supposed to fill in to what degree their island was suffering from challenges in the three issues *natural resources* (for example freshwater shortage), *industry and commerce* (for example absence if businesses or issues related to tourism) and *emigration* (people leaving the island). The examples given for every issue were to make it easier for them to understand the question and also because Gotland is having these challenges. The answers to choose from was none at all, low, moderate, high, very high and don't know. An underlying purpose with the questionnaire was to raise the awareness that other islands may suffer from the similar challenges, so one question were regarded to what degree the coordinators think other islands are suffering the same or similar challenges as described in previous question. The island secretaries also got a chance to write down what they perceived to be the general opinion about the primary challenge of their island at the moment.

The questionnaire finally asked if the islands are active in any other island collaborations similar to island games. In the last question the coordinators got to rate (on a scale from 0 to 100) to what degree their island would be interested in a joint collaboration, working together toward solving these challenges. The question was asked in order to find out which islands that was already aware of their challenges and also had an interest to solve these problems in a collaboration.

3.4. Results

It was 14 of the 24 island secretaries in the network that answered the questionnaire. When analysing the respondent's answers, it becomes quite clear that the islands are both similar and different in the ways they view and prioritize challenges. Additionally, there is a huge differentiation between the occupations of the respondents, which gives a broad perspective of how different groups of society view the domestic challenges. For example, one of the respondent works as a CTO for an insurance company, another one works as a teacher and a third is a retired engineer. A consistent similarity between the respondents, found when examining the results, was that all but one have been engaged in the International Island Games Association for more than five years, additionally more than half of the respondents have been participating for more than ten years. That indicates a strong and loyal

commitment towards the network between the islands. Furthermore, this would also indicate a strong relationship between the communicators, through the time spent and experience of working together. Examining question five, *To what degree is your island suffering from challenges in: Environmental resource, Industry and commerce and Emigration?*, it is found that the most general challenge of the islands is the challenges regarding emigration. Additionally, the challenges regarding environmental resources are interpreted to be the issue the islands suffer from the least. However, when analysing question seven where the islands are free to state what they believe to be their island's greatest challenge, most of the respondents claim that their island suffers mostly from a combination between emigration and poor communication to the mainland. As mentioned in the beginning there are some differences between the islands view on their domestic challenges. From the research it was found that some islands are having very specific and individual challenges, for example Cayman island is engaged in managing the global changes regarding offshore jurisdictions within the financial sector. Continued, Aland is trying to manage financial stability towards the Finnish government. However, the islands have strong similarities regarding their perspective view of how other islands suffer from the same or similar challenges. 85 percent of the respondents have answered that they think other islands are suffering to a high or moderate degree from similar challenges. Analysing question ten, *To what degree would your island be interested in a joint collaboration working towards solving these challenges?*, see Table 1, almost half of the respondents indicate that they are more than 66 percent willingly to participate in such an international collaboration, one has even stated a 100 percents interest. Furthermore, the remaining respondents stated a moderate enthusiasm towards a potential collaboration, and only two of the respondents have actively declared a non interest in participating in a joint cooperation.

*Table 1. The Island Secretary's answers on the 10th question in the questionnaire "*To what degree would your island be interested in a joint collaboration working towards solving these challenges?"

Islands	Degree of interest for a joint collaboration
Saaremaa	75%
Western Isles	70%
Åland	53%
Jersey	56%
Sark	0%
Hitra	51%
Cayman Islands	75%
Isle of Wight	3%
Orkney	71%
Greenland	50%
Menorca	100%
Faroe Islands	46%
Rhodes	66%
Alderney	50%

3.5. Discussion

The questionnaire was sent to all 24 member islands with 14 islands answering. The questionnaire was answered by the island secretary on each island and the answers are therefore affected by that specific person's interests, experiences and characteristics. When analysing the results based on only one person's opinions it can be problematic to make fair conclusions. It is also reasonable to assume that the island secretaries are not well understood with all issues and to what degree their island is suffering different challenges. For example, when asked about what kind of challenges the islands were suffering, it was expected to result in more islands with natural resource challenges. It is questionable if there actually are not any challenges regarding natural resources on the questioned islands or if the people answering just are not aware of them. The latest option might be the more likely due to all the literature and studies saying natural resources are especially challenging on small islands. On the other hand, some islands in the IIGA are not considered as being small islands according to the land size criteria. On Gotland the municipality has been very clear with the freshwater shortage and they have managed to communicate it to the residents. It is possible that the communication from local authorities to the residents is not as good on other islands.

The majority of the answering islands were interested in an enhanced islands collaboration. Only a few islands answered with a very low degree of interest of cooperation and a reason for that could be that they misunderstood the question and thought it would mean more workload for them personally. The ten islands that did not even answer the questionnaire could also be considered as uninterested in a collaboration, but it is also likely there are other reasons for not answering, such as not having time.

Instead of having distinctive challenges with natural resources, several islands answered that they were having issues with emigration. Most likely it is because of the same reasons as for Gotland. Young people are leaving the island to study in other cities and the islands struggle to attract competent workers to the companies. That so many of the islands think other islands are having the same challenges is a good requirement for a further collaboration and emigration could be an example of a challenge to solve together. There are therefore both interest and incitements amongst some of the IIGA member islands for an international business collaboration.

4. The economic dimension of Sustainable development

4.1. Background

As previously explained Economical sustainability is a criteria for reaching general sustainability. Business Intelligence and Data mining are today two rapidly growing trends within business development and proven methods for businesses to produce new business strategies, which is all within the sphere of Economical sustainability. For the case study of the economic dimension of sustainable development, a data mining analysis was done over statistical data from three of the member islands within IIGA. The intended purpose was to find incitements for a potential business collaboration with economic benefits. Using data mining analysis as means to gain knowledge of potential economic benefits has become a growing and high valued method for business to enhance their business development. The performed analysis had the goal of finding a general overview of the islands and research similarities and dissimilarities between them.

4.2. Business Intelligence

Today, and over the past few decades it has been a radical movement in which we create, use and look at data. Twitter feeds, Facebook streams, Netflix views, Google queries, all pile up to become almost insurmountable heaps of data. These examples of raw data contain information about popular queries, clicks-per-view, user activities, user experiences and user profiles. The ability to extract business value clocked in these heaps of data has become highly desirable. However, as described by Loshin (2013) these heaps are not only stored within structured data systems, they are captured, stored, managed, shared and distributed across different file formats, representative structures, and even unstructured data assets. This render the extraction of hidden gems of business value complex and presents a great business challenge (Loshin, 2013). Furthermore, describing that today different sets of data are both used and reproduced, simultaneously feeding operational and analytical processes with the intention of achieving different business objectives. He means that using these sets of data for their original purpose limits their capabilities and is a thing of the past. For business to gain the ability to navigate through and properly use data has become highly appraised, especially within business strategy and decision-making. Heesen (2016) strengthening this assertion and states in their book, *Effective strategy execution: improving performance with business intelligence*, that analytical capability is important to support managers with the right information at the time they need it. However, both Loshin (2013) and Heesen (2016) claims that it not the quantity of data that is supplied that is important, rather the *"right"* information. What they mean is that instead of providing people, with strategical or decision-making roles, with *all* the data. It is much more beneficial providing them with specific information needed to support making optimal decisions and take specific actions.

Additional Loshin (2013) suggest that delivering trustworthy intelligence to the right people when they need it, strengthen rational and confident decisions. Selene Xia and Gong (2014) summarize this in their article *Review of business intelligence through data analysis*, and link this to quality management. Because it require process management and tool quality in combination with committed leadership. Furthermore, Selene Xia and Gong (2014), states in order to enable more effective strategic decision-making raw data has to be transformed into meaningful and useful information. The transformation of raw data into profitable business plans is all within the subject of *Business Intelligence, BI*. The Data Warehousing Institute defines business intelligence as:

> *The processes, technologies, and tools needed to turn data into information, information into knowledge, and knowledge into plans that drive profitable business action. Business intelligence encompasses data warehousing, business analytic tools, and content/knowledge management.*

This definition well encapsulates the transition from raw data, into information, into knowledge that can efficiently be used in managing both strategic and operational decision. Furthermore, it highlights the processes and tools used to achieve the transition. In addition, Selene Xia and Gong (2014) describe BI to consist of subclasses for example, concepts of data mining (DM) and data warehousing (DW).

Today there is a great demand on innovative BI products and business analytics software and according to Louis Columbus (2016), worldwide revenues is expected to grow from nearly 122 billion dollars in 2015 to more than 187 billion dollars in 2019. Which is an increase of more than 50% over a five-year period.

So is there a way to practice this rapidly growing and proved concept, in order to improve strategy and decision-making within for example the business sector of Gotland?

As described in previous chapter and *An* existing and well-functioning collaboration between small islands is the International Island Games Association (IIGA) that is organizing the sport event NatWest Island Games every other year. To be counted as a small island, in their definition, there is a limitation of maximum 200 000 inhabitants. The games started on Isle of man year 1985 and have since then been held 16 times (IIGA, 2017). The member islands are Aland, Alderney, Bermuda, Cayman Islands, Falkland Islands, Faroe Islands, Froya, Gibraltar, Gotland, Greenland, Guernsey, Hitra, Isle of Man, Isle of Wight, Jersey, Menorca, Orkney, Rhodes, Saaremaa, Sark, Shetland Islands, St Helena, Western Isles and Ynys Mon. In June 2017 the Swedish island Gotland will be the host of Island Games and this will be the largest multinational sport event in Europe this year. Parts of

the business sector on Gotland, together with the local government, see this as an opportunity to evolve the collaboration between the islands.
The majority of the member islands are located in Europe, mostly around The United Kingdom. The founder members for the Island Games network are Aland, Alderney, Faroe Islands, Froya, Gotland, Guernsey, Hitra, Isle of Man, Isle of Wight, Jersey, Shetland Islands, St Helena and Ynys Mon (IIGA, 2017).The islands that have hosted the games more than one time are Isle of Man, Guernsey, Aland, Isle of Wight, Jersey and Gotland.

The structure of the network is formed as following. International Island Games Association (IIGA) is a company that owns the rights to the NatWest Island Games and the IIGA is run by the IIGA Executive Committee. The executive committee consists of elected representatives from some of the member islands on a 2 year period on the Annual General Meeting by the Member Island Association. It is the executive committee that carries the ultimate responsibility for every NatWest Island Games. The IIGA is ruled by its constitution, guidelines, Sports By-rules and Anti-Doping Rules. Each member island has its own Island Games Association (IGA) and its own constitutions and regulations. The different sports that is exercised in the NatWest Island Games has their own rules and guidelines to make the games as fair as possible (IIGA, 2017). Each member island also has an Island Secretary who works as a single point of communication. All communication between islands goes through the islands secretaries who forward the message to the right person on that specific island.

According to the IIGA there has always been an ulterior motive to the games to ensure that the host island and its residents are left with the most positive legacy. Some impacts they describe as caused by the games are the creation of new sport venues which has potential for events after the games, the creation and modernisation of the infrastructure and the enhancing the host island's international image and demonstrating that they can deliver major events. Many of the previous host islands have delivered a Legacy Report after the games to demonstrate where the investments were put and the outcome of the games (IIGA, 2017).
1.1.3. Gotland the island of Gotland is part of a network of island coming together around a sports event called Island Games, and as additionally described in chapter *Scott* Pollack, contributor to Forbes magazine, defines in his article *What, Exactly, Is Business Development?* In 2012, business development to be *the creation of long-term value for an organization from customers, markets, and relationships*. He also highlights the fact that there are probably as many definitions to what business development is as there are individuals trying to answer the question. However, analysing his description, he means that for a business to succeed in constantly growing its organization, the value, for example money, knowledge, company trademark etc. must persist over time. Business development is not about the ability to create quick value that is gone tomorrow as easily as it came today. Furthermore, Pollack describes the customer to be the people paying for the product or service

provided by the business and the market to be specific sections of customers divided, for example, geographically. Relationships, the last of the three attributes in his definition, is described as the fundamental role to create long-term value. He means that building, managing, and leveraging relationships that are based on trust, respect and a mutual appreciation of each other's value is essential to the success of any business development attempt.

The importance for business to have a strong relationship to its partners, employees, customers and suppliers could be seen as obvious and natural. However, in the book *Developing relationships in business networks* by (Håkansson and Snehota, 1995) the authors describe the relationships between industrial companies, organizations and institutions largely neglected by scholars of both economics and management. First now the subject of business relationship is rapidly growing.

Business development can be divided into four process characteristics *adaptation, cooperation and conflict, social interaction* and *routinization* (Håkansson and Snehota, 1995). For two companies to establish a continuous existing relationship, mutual adaptations of some kind have been found to be a prerequisite in order for successfully building such a relationship (Hallén, 1989). The adaptations branch from the need to coordinate the activities of the individuals and companies involved and is divers and frequent. For example products, routines and rules of conduct are constantly modified and adapted within a relationship between companies in order to become more efficient. Within business relationship elements of cooperation and conflict have been found to coexist. There is an inherent conflict about the distribution of benefits and value from a relationship. While conflicts can occur, the concern for cooperating and creating value, which is the fundamental purpose of the relationship, generally directs the parties towards constructive solutions (Håkansson and Snehota, 1995). All relationships essentially consist of personal bonds and convictions which make social interaction an important role within business relationship. It is necessary for individuals, within the relationship, to become committed beyond strictly duty content. From this trust emerges as one of the factors influencing the business relationship and its activities (Dwyer et al., 1987). Business relationships are often complex and informal in several ways. One element of complexity is within the number, type and contact patterns between individuals involved in the relationship. It has been found that several people frequently have direct contact within international business relationships. It even becomes more complex by the variation of individuals involved, for example different organizational roles and personal backgrounds. However, the relationships tend to become institutionalized, regardless of its complexity. Routines and rules of behaviour emerge in the more important relationships companies maintain. These emerging routines assist in managing the complex needs to coordinate individual activities within the business relationship (Håkansson and Snehota, 1995).

2.9. Business development through sport events sports event has been historically proven advantageous grounds for business development. However, the question remains, how can BI as a concept contribute to develop the business sector of Gotland?

With hope of finding an answer to the question, this study has applied the concept of BI upon the island of Gotland and the Island Games network. To clarify, the study has research a possible transition from raw data, into information, into knowledge, into plans for future business actions.

4.3 Raw data and data structure

As previously described the quantity of data in our day-to-day life is immense. However, when consider the fundamentals of data, what is data?

In the book *A dictionary of computer science* published by Oxford University Press (Butterfield and Ngondi, 2016) raw data is defined as:

> *Data in the form in which it reaches a computer system from the outside world: data that has not been vetted for correctness, nor sorted into any sequence, nor processed in any other way.*

In similarity, Loshin (2013) describes raw data as:

> *Data is a collection of raw value elements or facts used for calculating, reasoning, or measuring. Data may be collected, stored, or processed but not put into a context from which any meaning can be inferred.*

Both definitions states that in order for data to be perceived as "raw", the collected data must not be validated, altered, refined or processed in any way. Furthermore, according to Loshin the data must not even be put into a context enable any form of implication.

As previously mentioned Selene Xia and Gong (2014) described two different subclasses of BI, in which one were data mining. On this topic, Han and Kamber (2011) states in their book *Data mining: concepts and techniques*, that there exists different forms of data, although one of the most basic forms for mining applications are database data. To clarify, the different forms of data all consists of raw data. The difference lies in the way the data is structured. Han and Kamber (2011) further describes the structure of database data, or more precis a relational database, to be a collection of tables, each assigned a unique name. Each table consists of a set of attributes (columns) and a set of tuples (rows). Practically, tuples represents objects which is described by the attributes values, as illustrated in Figure 4.

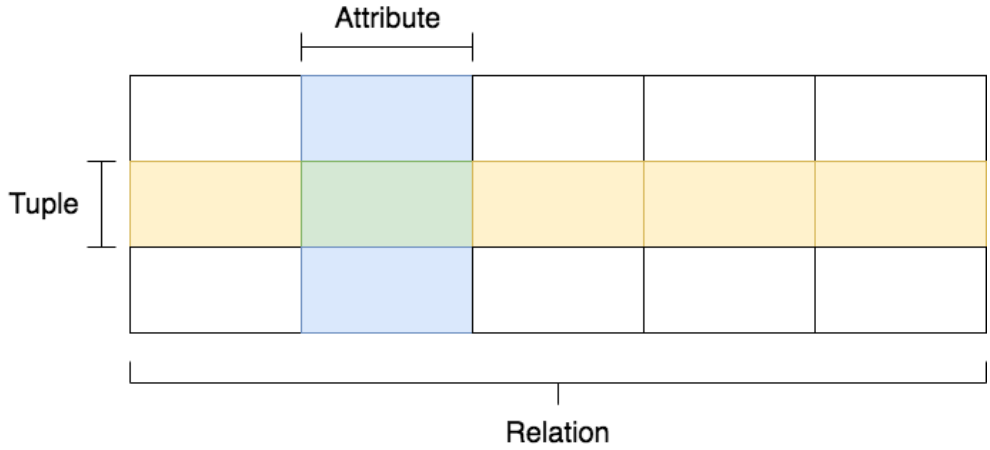

Figure 4. Simple illustration of a table in a relational database.

4.4. Data mining

As previously described the vast growth of available data sets, for example sales transactions, stock trading records, product descriptions, sales promotions, company profiles and performance, has made managing these data sets a business necessity.

The field of data mining has been born from this necessity as a means of transforming the vast amount of available data into organized knowledge. Describing the same transition as previously defined in the concept of BI. An example of such a transformation could be the widely known search engine Google, which receives hundreds of millions of queries every day. Each individual query can be considered as a transaction. Over time, interesting patterns were found in the search queries that couldn't be gathered by study individual data. Google discovered a pattern in search queries co-relating to flu trends, they found a close relationship between people searching for flu-relating information and people actually having the flu. By using data mining as a tool, Google's *Flu Trends* can estimate flu activity up to two weeks faster than traditional systems can (Han and Kamber, 2011).

However, what is data mining actually?

One definition of data mining would be Ahlemeyer-Stubbe (2014) general description of data mining:

> *Data mining means extracting information from meaningful data derived from the mass of figures generated every moment in every part of our life.*

When reading between the lines the definition is coherent with the previous description of data mining to be a tool for transforming data into information. However, in Ahlemeyer-Stubbe's definition

information is to be extracted from *meaningful* data. The immediate question would be, How do you know if your data is meaningful? Raw data is not to be validated, altered, processed or even put in a context as explained in the previous chapter *As* previously explained Economical sustainability is a criteria for reaching general sustainability. Business Intelligence and Data mining are today two rapidly growing trends within business development and proven methods for businesses to produce new business strategies, which is all within the sphere of Economical sustainability. For the case study of the economic dimension of sustainable development, a data mining analysis was done over statistical data from three of the member islands within IIGA. The intended purpose was to find incitements for a potential business collaboration with economic benefits. Using data mining analysis as means to gain knowledge of potential economic benefits has become a growing and high valued method for business to enhance their business development. The performed analysis had the goal of finding a general overview of the islands and research similarities and dissimilarities between them. 4.2. One could argue that this makes Ahlemeyer-Stubbe's definition of data mining to be incoherent with the description of the cycle of transition from raw data, into information, into knowledge and then turned into beneficial action plan.

Han and Kamber (2011) submit another definition of data mining to be:

> *Data mining is a process of discovering interesting patterns and knowledge from large amounts of data. The data sources can include databases, data warehouses, the Web, other information repositories, or data that are streamed into the system dynamically.*

In this definition data is not described as to meaningful in *advance* of processing in, rather the data becomes meaningful *after* it has been processed. However, it has to highlighted that both definitions is coherent in their fundamental description of data mining to be a process or means of extracting or discovering information from some data.

Within data mining there are different techniques in which data can be transformed into information, much depending on the aim of the mining process, for example finding the best customer profile. In the article *Data mining techniques* written by Brown (2012) published by IBM, Brown explain some key techniques including examples when they may be used. The three most common and frequently used techniques are *Association, Classification* and *Clustering*.

4.4.1. Association

In a presentation by Orsborn (2016), lecturer at Uppsala University, he defines Association as discovery of rules, or more precise produced dependency rules which will predict occurrence of an

item based on occurrences of other items. In addition to this both Brown and Orsborn are describing an example where Association is used to finding customers buying habits. In Brown's example he describes that by applying Association mining you could find out that a customer always buy cream when they buy strawberries, and thus suggest the next time they buy strawberries that they might also want to buy cream. This is a simple example of how Association rule mining can be applied and used to increase sales.

4.4.2. Classification

Classification is described by Han and Kamber (2011) to be composed of a two-step process. The first step consists of a learning step, here a classification model is constructed, and the second step consists of a classification step in which the model is used to predict class labels for given data. Orsborn (2016) describes this in his presentation as to find a model for class attribute as a function of the values of other attributes. For example, it is fairly easy to classify cars into different types such as sedan, 4-wheel drive and convertible by identifying different attributes such as number of seats, car shape, driven wheels. Given a new car, it could be assigned to a particular class by comparing the attributes with the already known definition (Brown, 2012).

4.4.3. Clustering

Different from classification, which analyse class labelled data based on its learning step, clustering analyses data without the need of the data to be class labelled. It is much common for data not to even be class labelled before analysed and clustering can be used in order to label groups of data. The fundamentals of clustering are based on maximizing *intraclass similarity* and minimizing *interclass similarity*. Objects of data with high similarity and high dissimilarity are grouped together forming clusters. More specific, this means that objects belonging to the same cluster not only have a high similarity in comparison to one another, but they also have a high dissimilarity to objects belonging to other clusters. Each generated cluster then forms a class of objects, from which rules can be derived (Han and Kamber, 2011). In conformity with the above, Linoff and Berry (2011) also states that clustering is about segmenting a heterogeneous population into a number of more homogeneous subgroups, called clusters. Additionally, they describe clustering as a prelude to some other modelling, for example to be used in order to find different classes of customers depending on their buying habits as a first step effort in market segmentation.

4.5. RapidMiner

As previously concluded data mining is the process or means of extracting information from data. In practice, data mining tools are used to realize this transformation. RapidMiner is one example of such

a tool, through which data can be compiled, processed and displayed in order to turn raw data into valuable information.

Hofmann et al. (2014) describes in their book *RapidMiner: Data Mining Use Cases and Business Analytics Applications,* RapidMiner as a system which supports the design and documentation of an overall data mining process. It has an almost comprehensive set of operators, and the way the system is structured makes it express the control flow of the process in a distinct and general manner.

Hofmann et al. (2014) further explain these structures as similar to notions of programming languages; however they underscore that no programming is needed. With RapidMiner the user can structure a mining process by drag and drop preferred operators and functions. The structure is visualized by boxes that are linked or nested, which simplify presentation and understanding. Additionally, the authors argue that modelling is only a small part of an overall data mining process, the largest part is the pre-processing face. Their argumentation is enforced by Chisholm (2013) who claims in his book *Exploring Data with RapidMiner: explore, understand, and prepare real data using RapidMiner's practical tips and tricks* that Modelling, Evaluation and Deployment phases represents 20 percent of the effort in a data mining process. These phases concern model building for predicting, testing and deploying data in real use. This part most people regard as data mining in general, but as stated before this is only a small part of the overall process.

4.6. Execution

To research possible similarities or differences between islands within the NatWest Island Games, data were collected from different islands in order to conduct a data mining analysis. Described in chapter *4.4.3.* Clustering, clustering analysis has the satisfactory quality of deriving classes based on objects high similarities and high dissimilarities to one another. In order to find similarities and dissimilarities between the islands a clustering operator was chosen as a means of conducting the data mining analysis.

The specific islands that the data were collected from were Guernsey, Aland and Gotland. From Guernsey the data were extracted in the form of a excel sheet, from their government homepage (https://www.gov.gg/ff, accessed: 14/3-17), called *Facts and Figures 2016 Supplementary Data*. Regarding both Aland and Gotland the data were collected from their respectively national bureau of statistics, specifically the ÅSUB (Ålands statistik- och utredningsbyrå) and SCB (Statistiska Centralbyrån). The collected data were combined in a data set called *Data set of Islands*. Categorically, the data that was collected included information regarding, for example gross domestic product, employment rate, total number of companies, circulation of companies, passenger

movements, numbers of visitors, population level, population age rate, water consumption per capita and energy consumption per capita.

The data set were then imported into a designed data mining process within RapidMiner. The process was structured in following way: Data was imported and sent to a preprocessing operator called *Replace missing values*, which were designed to set all missing values to zero. The processed data was then sent to a clustering operator called K-Means which as the title entails, was based on the algorithm k-means. The results can then be presented and analyzed through for example various charts. The need of using a preprocessing operator derives from the means of cleansing the data of missing values. In this case every attributes does not have a corresponding value assigned to it and the process is design to set all these missing values to zero so they do not affect the result. In coherence with the previous description of clusters, the clustering operator partition the imported data into clusters based on maximizing intraclass similarity and minimizing interclass similarity.

4.7 Results

Results from data mining analysis of statistical data from the islands of Gotland, Aland and Guernsey.

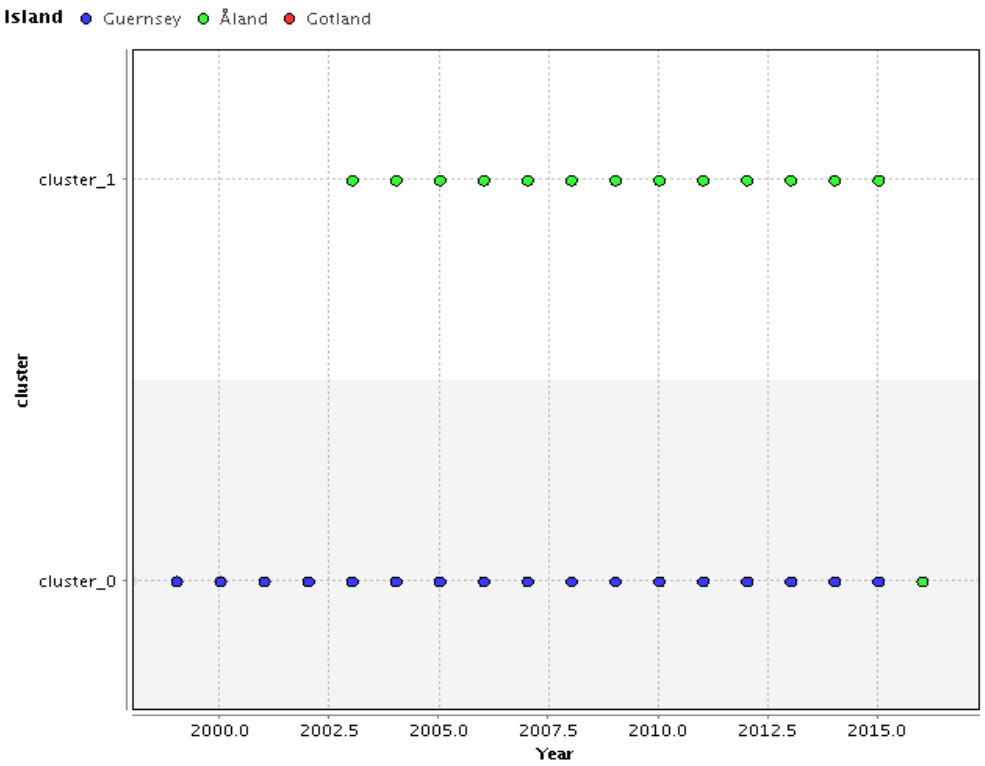

Figure 5. Illustration of clusters and assigned islands.

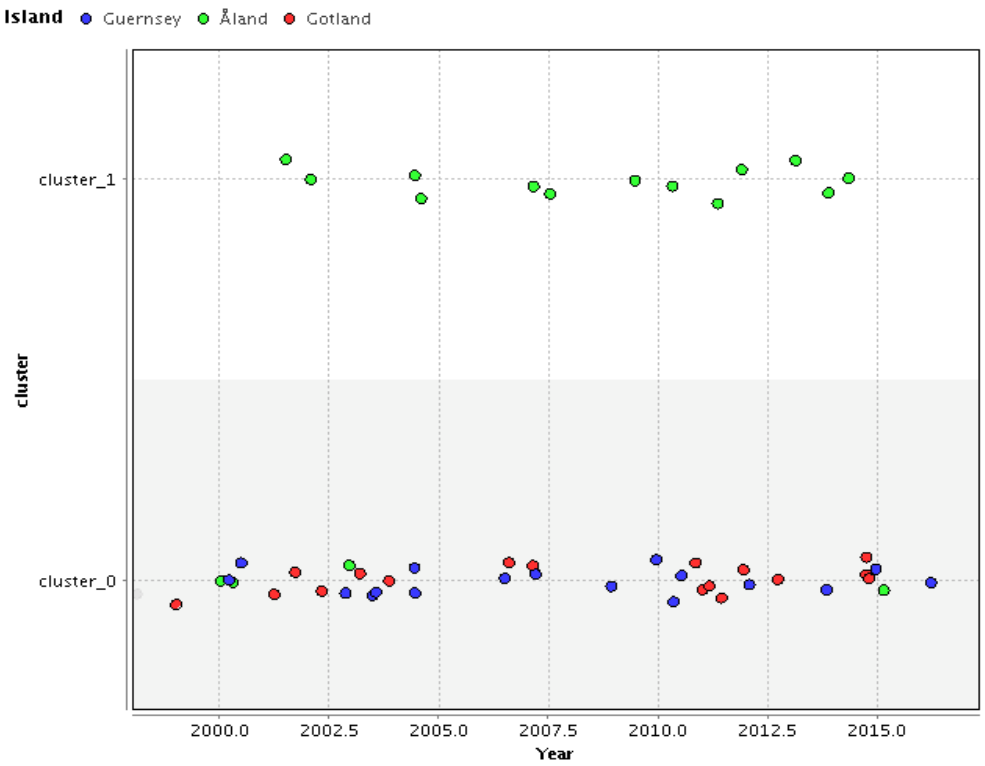

Figure 6. Illustration of clusters and assigned islands with applied jitter.

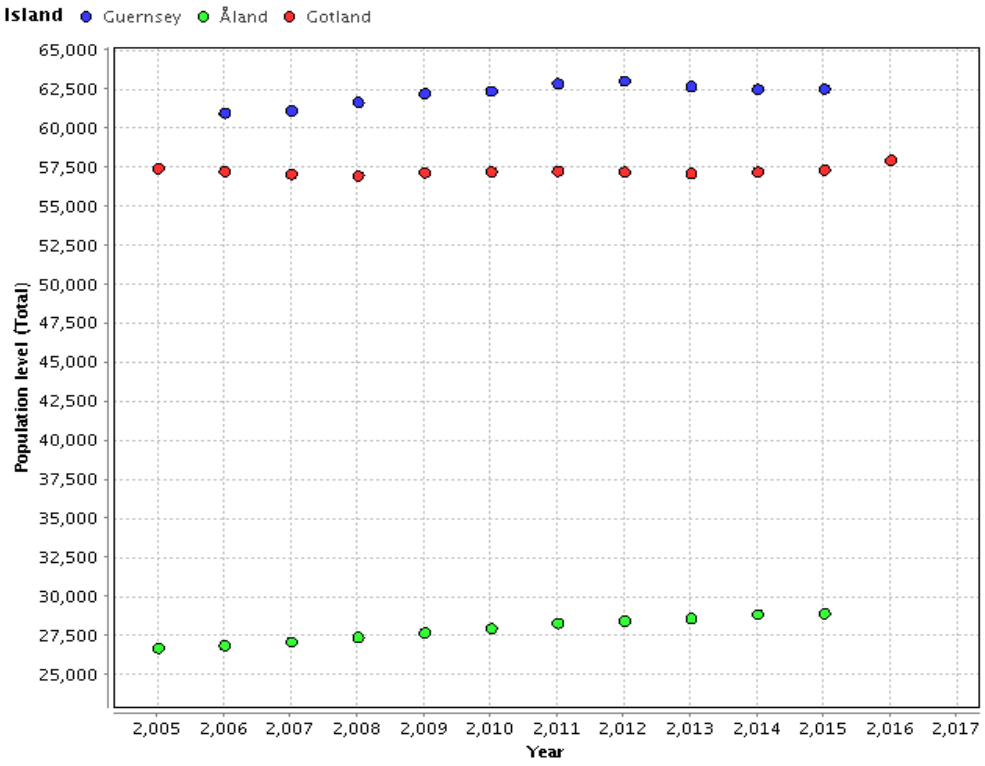

Figure 7. Illustration of islands population level between the years of 2005 and 2016.

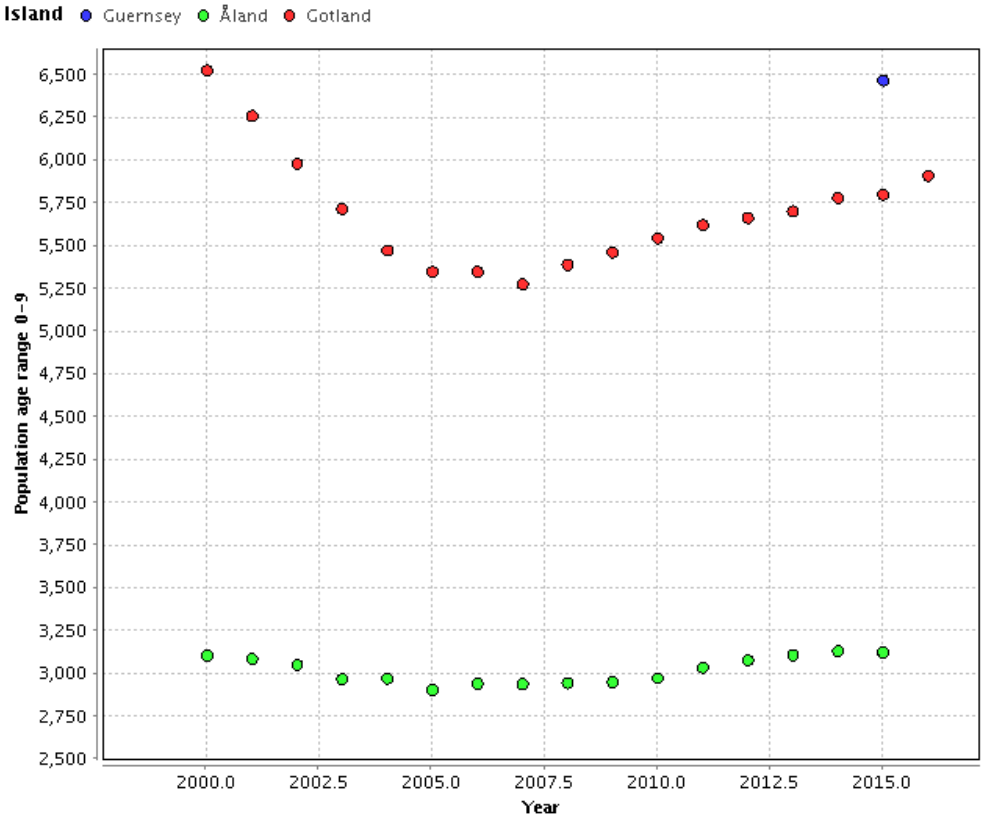

Figure 8. Population level between 0 to 9 years.

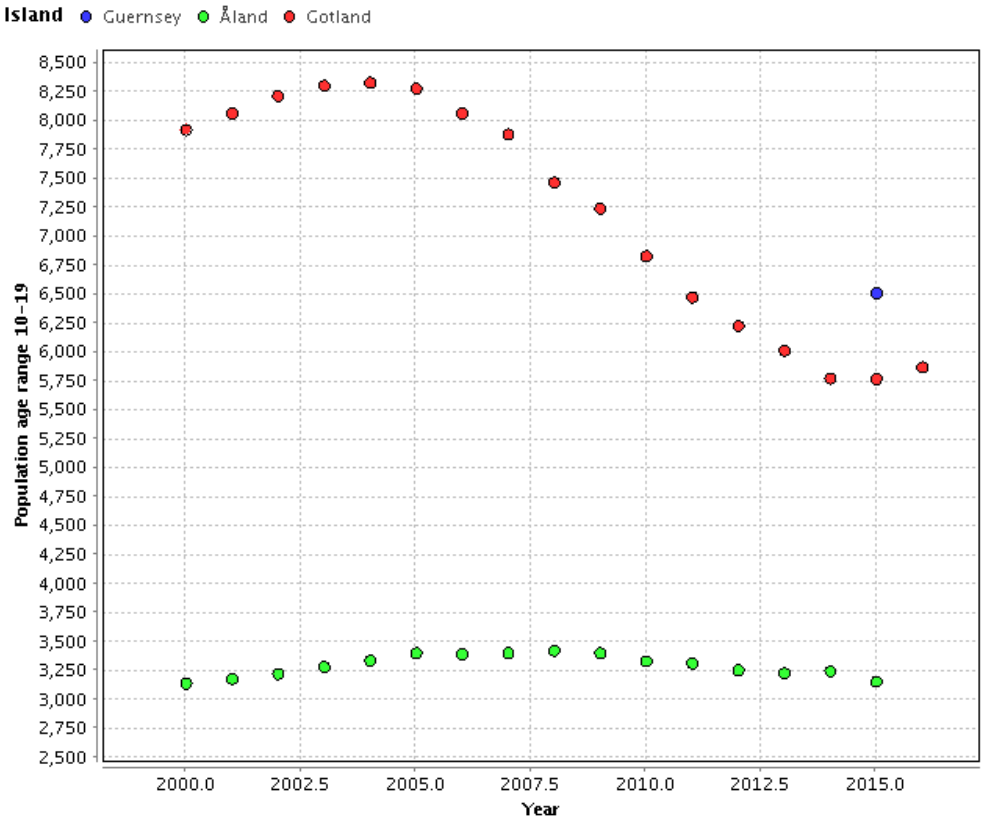

Figure 9. Population level between 10 to 19 years.

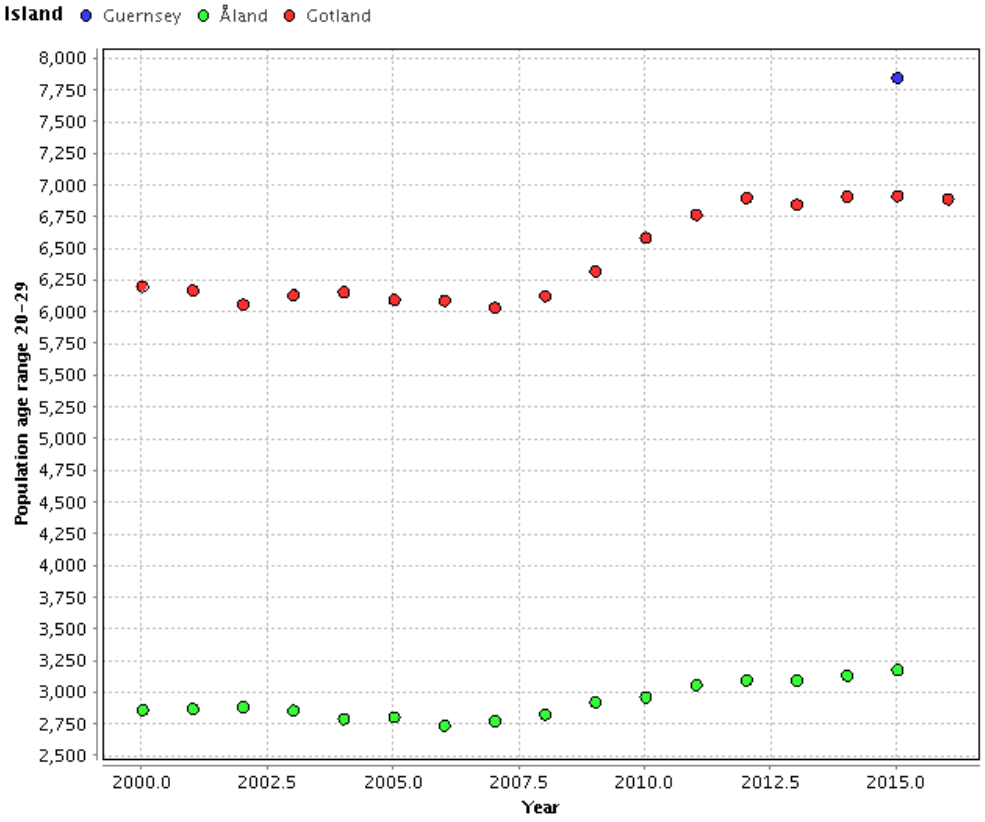

Figure 10. Population level between 20 to 29 years.

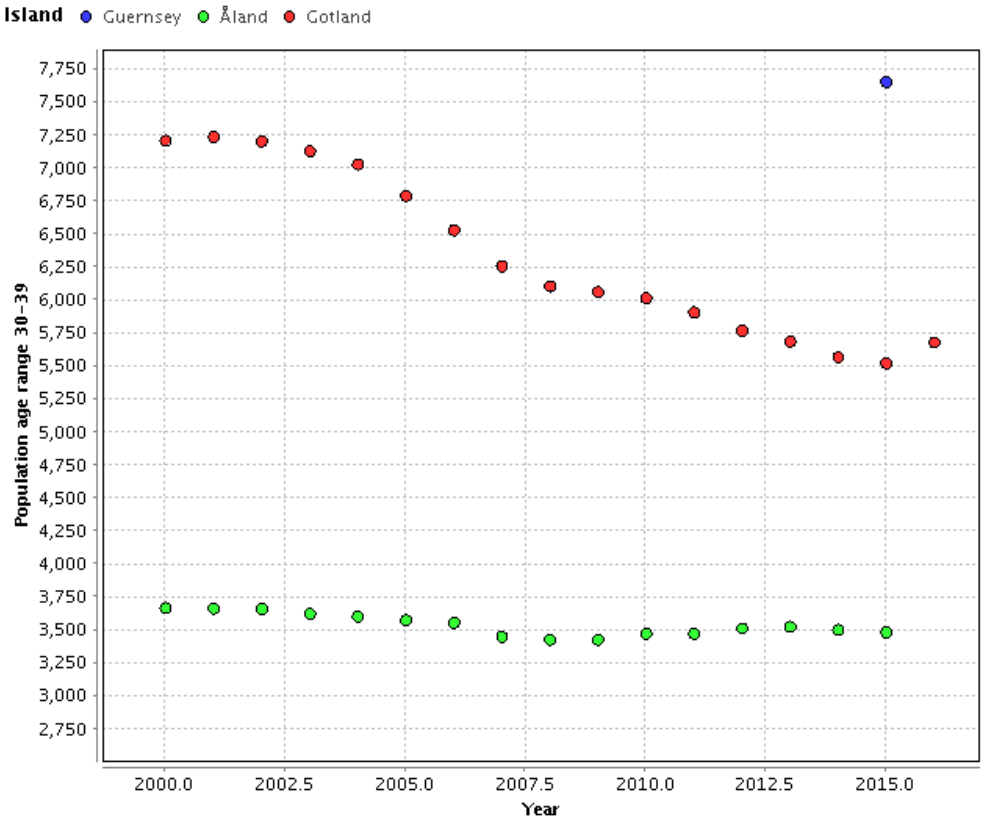

Figure 11. Population level between 30 to 39 years.

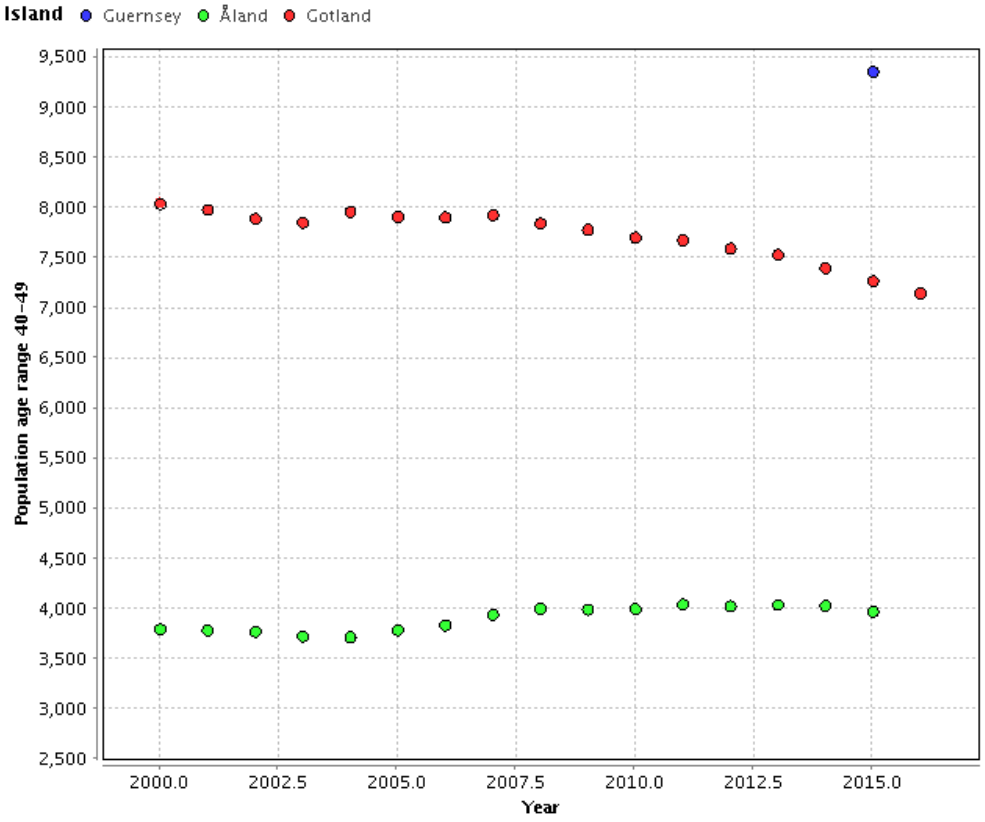

Figure 12. Population level between 40 to 49 years.

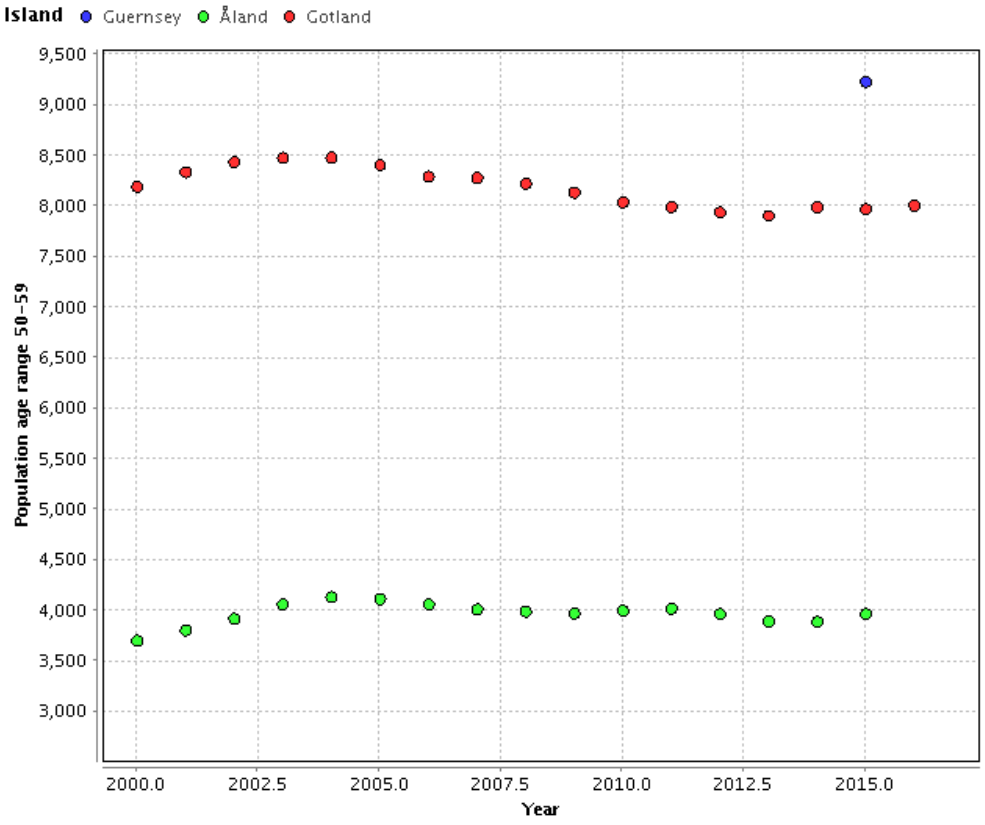

Figure 13. Population level between 50 to 59 years.

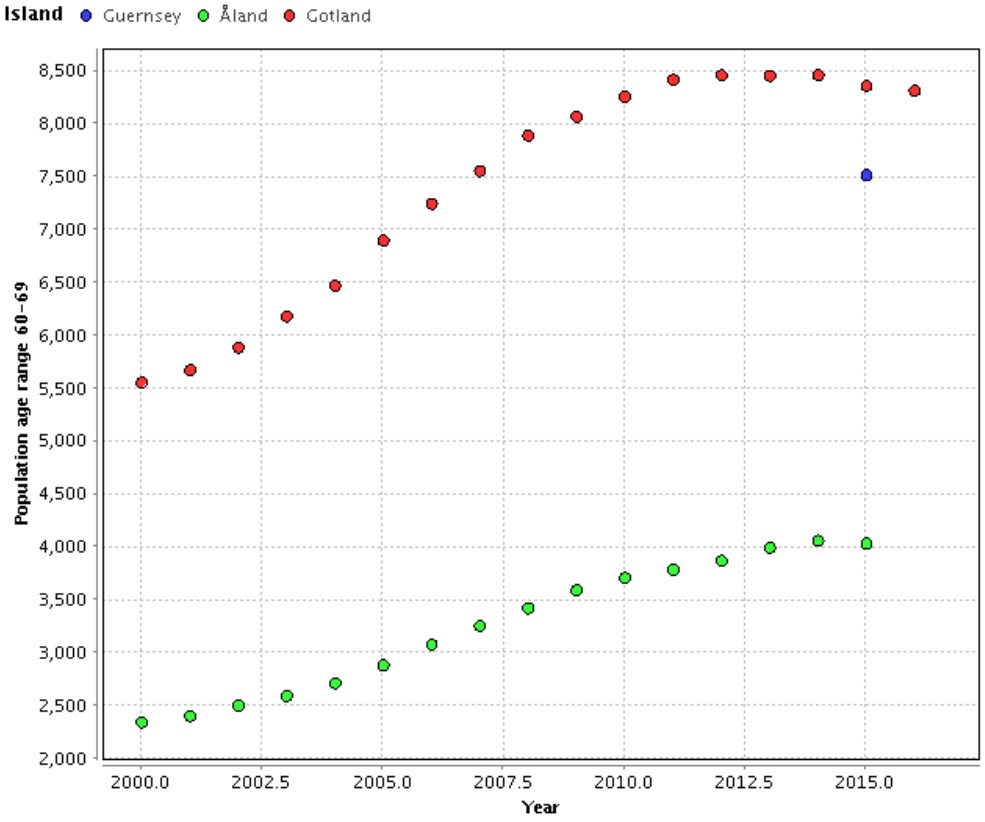

Figure 14. Population level between 60 to 69 years.

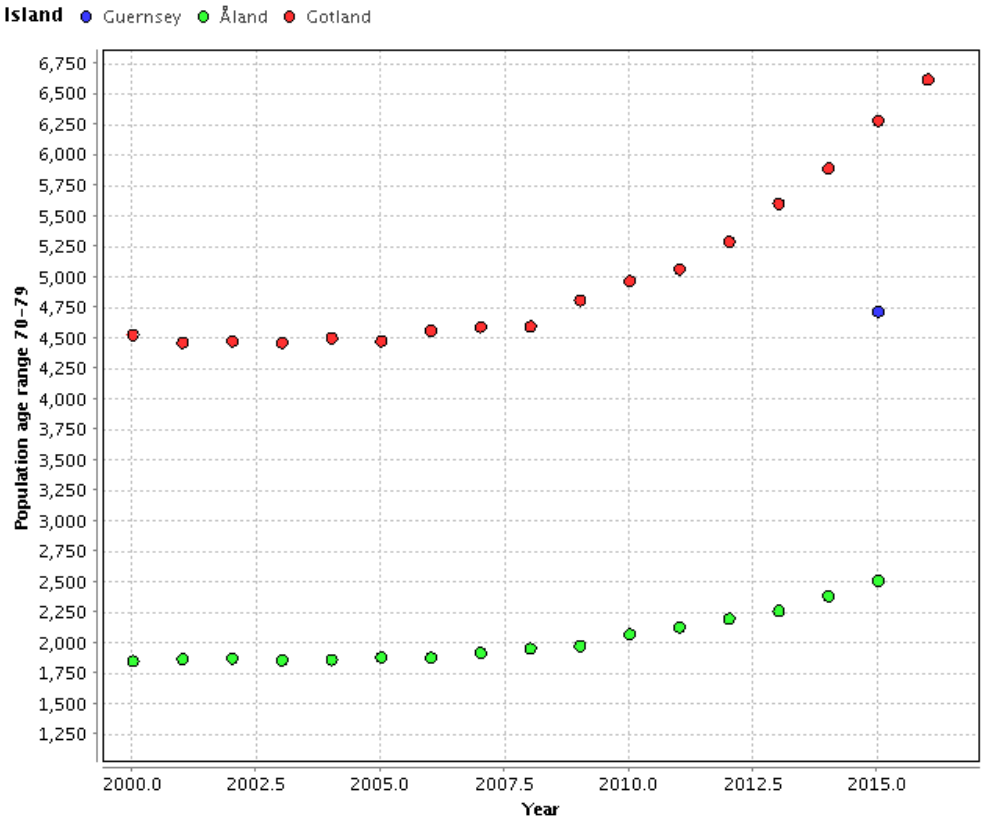

Figure 15. Population level between 70 to 79 years.

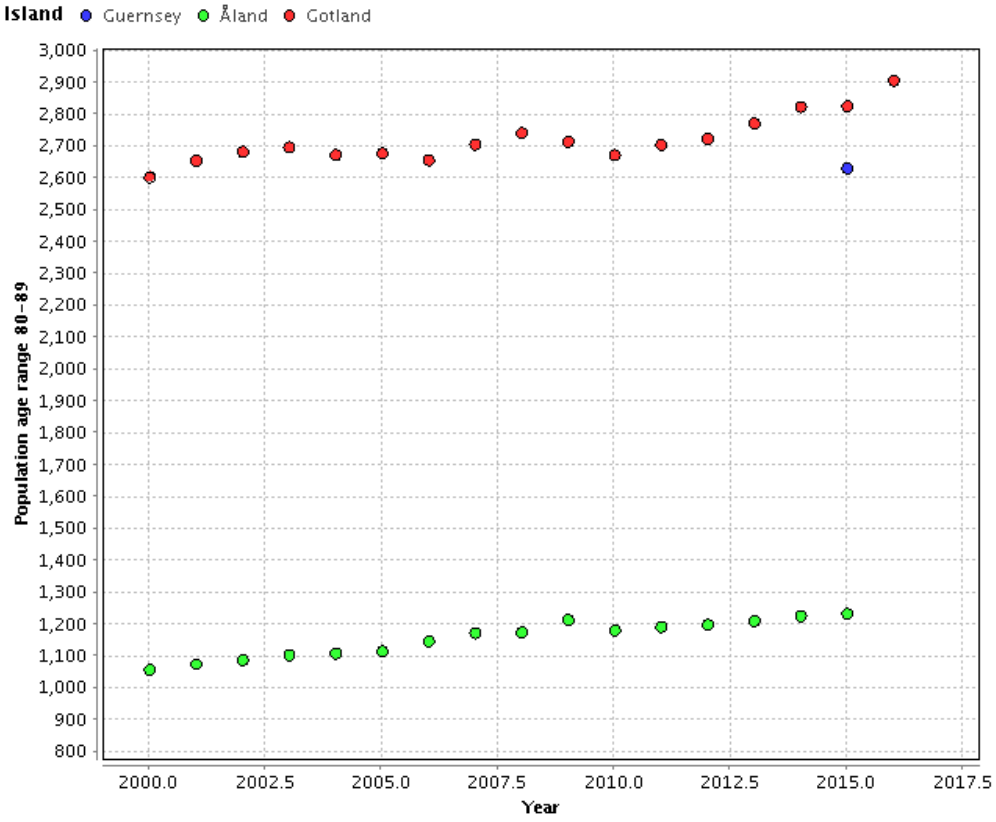

Figure 16. Population level between 80 to 89 years.

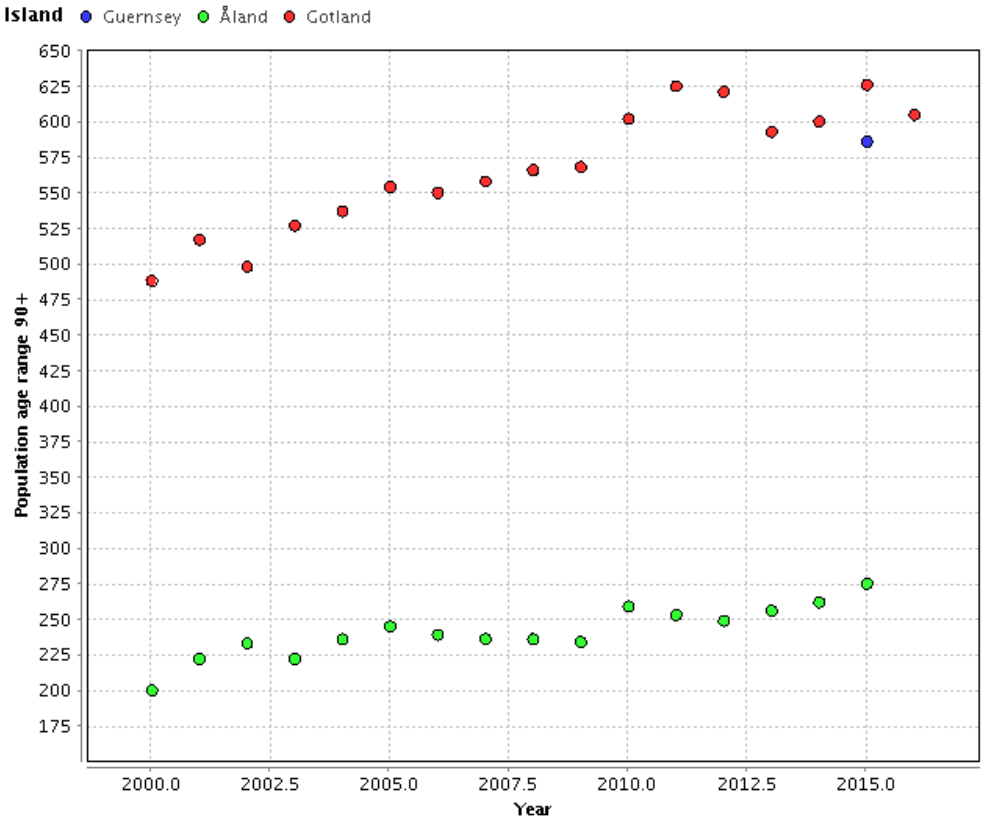

Figure 17. Population level of 90 years and above.

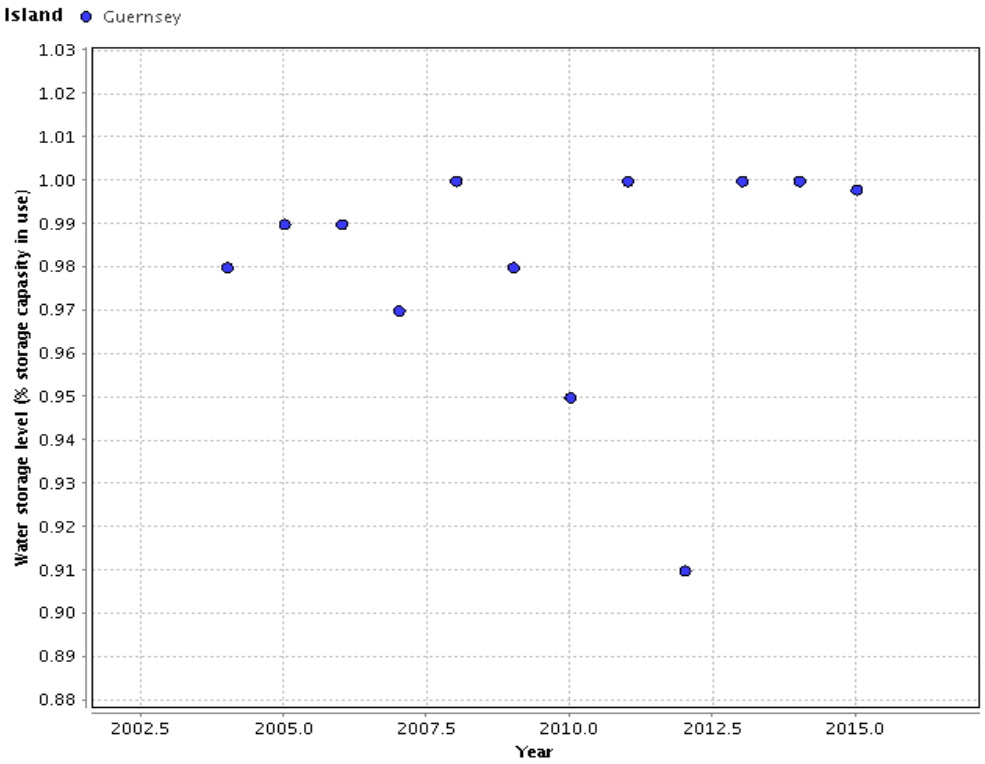

Figure 18. Illustration of water capacity level in use on Guernsey between the years 2004 and 2015.

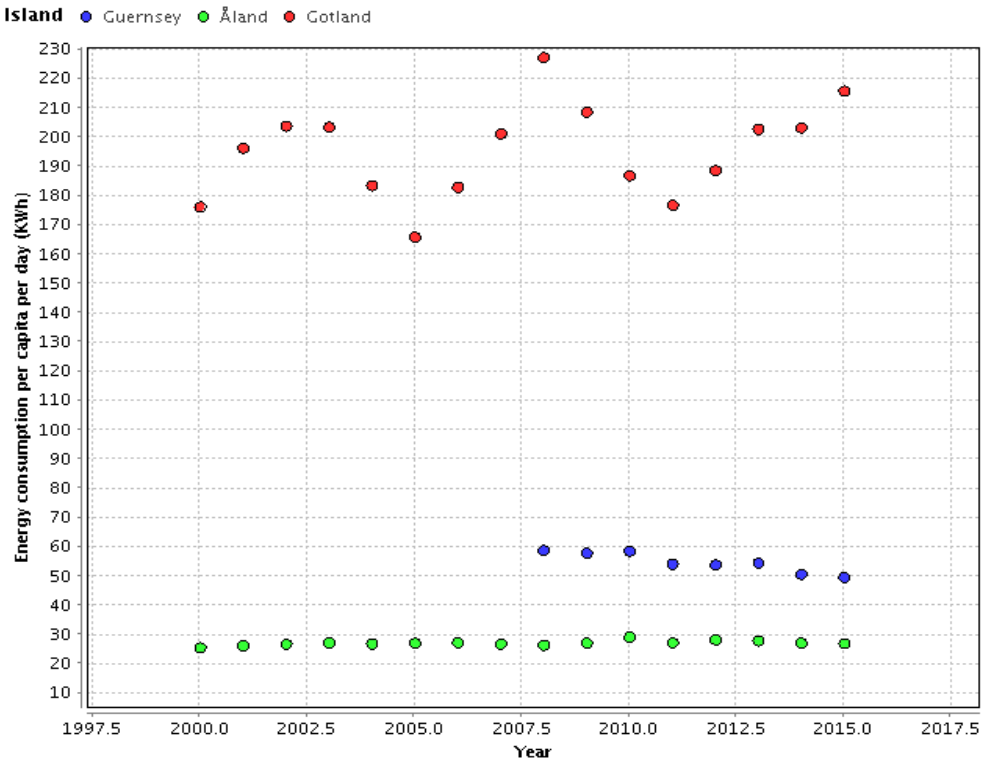

Figure 19. Illustration of islands energy consumption per capita between the years of 2000 and 2015.

4.8. Analysis

When analysing the result it becomes apparently that the three islands are quite different in many ways. However, Gotland and Guernsey have a higher similarity to one another than Aland. This is verified by the partitioning of the three islands into two different clusters, illustrated in Figure 5. A more visible illustration of the clusters and assigned islands can be seen in Figure 6, with the applied jitter. Applying a jitter function to the result is a way to spread the data points with the intent of producing a more comprehensible visualization of the result. In this case applying a jitter function visualize the data points belonging to Gotland. Additionally, analysing the results we can see in Figure 7 that the population level on Gotland and Guernsey have not had a major increase during the past ten years. Guernsey had in 2006 a total population level of 61029 people, and in 2015 the population had increased to 62571, which is an increase of approximately 2.5%. In similarity, Gotland had an population level of 57297 in 2006, which increased to 57391 in 2015, resulting in an increase of 0.2%. However, dissimilar to Guernsey and Gotland, Aland have had an increase of 7.7% from 26923 in 2006 to 28983 in 2015. Continuing analyzing the population level, see Figure 8 to Figure 17, the results clearly shows an alarming development for, especially, Gotland. The population level of people between 0 - 40 years is decreasing and the population level of people 50 years, and above, is increasing. When adding the fact that Gotland's population level overall does not increase, the economical perspective becomes problematic. The results indicate that the majority of the workforce on Gotland is decreasing, while there are and will be an increase of pensioners. This may pose a huge economical problem for the society on Gotland, as a result of the decrease and increase of people working and people retiring.

Continuing analysing the results it becomes worth to highlight the water storage capacity levels on Guernsey that are in use, illustrated in Figure 18. In 2004, the island was using approximately 98% of the total storage capacity, and exempt from 2012 they have been using nearly 100% of the islands storage capacity. Performing a comprehensive overview it is notable that there has been a small increase in usage between the years of 2004 and 2015, which could indicate a rising usage and need of water.

Analysing Figure 19, illustrating the respectively island's energy consumption per capita, it becomes apparently that there is a strong divergence between Gotland and the other two islands. Most eminent is the fact that on Gotland people uses more than twice the amount of energy per day compared to Guernsey and Aland. The secondly distinguished difference is that during the past ten years the energy usage on Gotland has had a high fluctuation in comparison to Guernsey and Aland, which both are showing much more regular energy consumption.

4.9. Discussion

It cannot be neglected that the size of the data set suffers from unsatisfied quantity of data points. This naturally affects the results and outcome of the data mining analysis. This can most evidently be explained by reviewing the number of emerged clusters in the results, explicitly that only two clusters were found. When performing data mining analyses it is commonly known that in order to reach compelling results the analysis is required to be performed on a substantial amount of data. However, in this case, even though the data set is limited, we can observe a clear partition between one of the researched islands. Aland has been assigned to a separate cluster, indicating that the island has a greater dissimilarity towards Gotland and Guernsey. It is not necessary that the division can only be explained through Aland's dissimilarity to the other islands. Another explanation of the result is that Gotland and Guernsey have a higher degree of similarity to each other, than towards Aland, producing the partition. Nevertheless, the result will be the same, Aland belonging to one cluster and Gotland and Guernsey belonging to the other cluster. Reviewing the result and analysis of the water storage and usage, and the energy consumption there are some interesting challenges within. For example, if there exists a water storage and usage issue on Guernsey, there is an opportunity using the possessing knowledge on Gotland towards solving the issues more efficiently. This type of consultation exchange could generate economic value for Gotland. Furthermore, capital and knowledge can be exchanges in various types of contexts and be beneficial for all parties included.

Though the cluster analysis only resulted in two clusters, the collected data provided interesting results and raises intriguing questions. For example, how can the energy consumption on Gotland be more than twice the amount used on Aland respectively Guernsey? Is Guernsey suffering from freshwater shortage in a similar way as Gotland? How come Aland has had their population level increased by nearly 8%, while Gotland has had an increase of only 0.2%? How will Gotland managing the potential economic problem with decreasing workforce and increasing pensioners?

These questions could act as outset factors to be discussed within a collaboration between not only Gotland, Aland and Guernsey but also the rest of the participating islands of the NatWest Island Games. Additionally, through such a collaboration a more substantial data set could be composed, enabling furthermore sizeable and valuable analyses.

5. The environmental dimension of Sustainable development

5.1. Background

This part of the study concerns a collaboration between small islands to encourage sustainable development, and has focused on environmental challenges small islands can experience. Small islands are vulnerable when it comes to richness in natural resources, such as freshwater for example. The case focuses on the freshwater shortage of the island of Gotland and how the authorities have handled it.

The island of Gotland is suffering from a shortage of natural resources, especially freshwater. During the winter and spring of 2016 the municipality of Gotland saw alarmingly low levels of water in their freshwater supplies. Low levels were recorded particularly in their second largest supply, the lake "Tingstäde träsk", see Figure 20. To gain more knowledge of the freshwater shortage on the island the municipality and other authorities are seeking help by experts in the area. In this case study, a "water balance study" was performed for Tingstäde träsk, including a prognosis of the lake's conditions in the future, considering climate change.

Figure 20. Northern Gotland, with a marker around Tingstäde träsk.

5.2. The theoretical perspective

5.2.1. Freshwater

Freshwater is water with a low salt content, lower than 0.05 % (IOC et al., 2010), that is unpolluted from biological and chemical substances (Falkland and Custodio, 1991a). Freshwater occurs naturally or is provided by artificial treatments. All natural freshwater originates from precipitation but can be divided into three groups: precipitation water, surface water and groundwater. Precipitation water is freshwater collected directly in containers or from a surface when the precipitation occurs. Precipitation becomes surface water when found in rivers, streams, lakes, swamps or other type of natural reservoirs of water at the surface of the Earth. Groundwater is precipitation or surface water that has infiltrated the ground and has accumulated in aquifers in the soil and in the bedrock (Falkland and Custodio, 1991a; Dahlqvist, 2015). To find bedrock aquifers a high knowledge of the bedrock structure, potential fractures and the general geology in the area is required (Dahlqvist, 2015). Almost all naturally occurring freshwater, surface and groundwater, are in need of some treatment before being seen as potable (Falkland and Custodio, 1991b).

Freshwater can be made available by treating saline water or used water in several ways. Desalination reduces the salinity in saline water and makes drinking water of seawater or brackish water. Desalination plants can be constructed in different ways but a common denominator for these processes is separating the water into two streams: one containing freshwater with low concentration of dissolved salts and one with a concentrated brine stream. All processes require energy to perform the separation which is the major cause for the high costs (Khawaji et al., 2008).

Used freshwater is called wastewater and includes sewage effluent, industrial discharge and stormwater. Because of the importance to protect the natural environment from wastewater pollution several different methods have developed over the years, where the majority of the treatment plants are treating water to a level that is safe for the environment (rivers, lakes) but is not potable for humans. The reason why most wastewater plants are not making it into pure freshwater is mainly economic (Falkland and Custodio, 1991a).

5.2.3. Water conditions on Gotland

The island of Gotland has suffered from freshwater shortage for a long time. But during the last few years the shortage has become more severe with the summer of 2016 being one of the hardest (Pettersson et al., 2017). The huge increase of visitors and inhabitants during the summer months is a major reason for the shortage. Besides being a popular tourist destination during the summer Gotland is a large agricultural community with 70% of the total land area cultivated (for agriculture and

forestry) and it has around 400 000 farming animals (cows, chickens, sheep and pigs) (Region Gotland, 2015a), that are in need of a large amount of water. The largest industries on Gotland are, except agriculture, quarrying industry and food processing industry. These industries stand for around 35% of the total workplaces on Gotland (Region Gotland, 2015a) and all three have a high demand of freshwater in their operation. This puts the freshwater supplies under a lot of pressure (Dahlqvist, 2015).

Groundwater is, together with surface water, the most commonly used freshwater supplier on Gotland. Approximately a fourth of the total land area on Gotland has no or a very thin soil cover above the bedrock, which has a large influence on the amount of water that infiltrates. This results in a major problem with the groundwater aquifers on Gotland, the recharge rate is very low. The structure and composition of the bedrock is also a contributing factor. The top layer of the bedrock can be categorized in two main categories; limestone and marlstone, or the two mixed. This top layer is between 250 and 800 m thick (Dahlqvist, 2015). Due to the highly fractured nature of the limestone the storage capacity is low and because of the thin soil cover an essential part of the precipitation will contribute to surface runoff and quickly be discharged to the surrounding Baltic sea (Dahlqvist, 2015).

In areas with solid limestone, karst is commonly occurring. Karst is a phenomenon that is created by chemical erosion inside the bedrock and forms large voids (a karst) from a small void or a regular crack. Soil pits is a form of karst structure and is also commonly occurring on Gotland. All types of karst structures have a large effect on the flow of groundwater since the majority of the flow in the bedrock occurs in voids. To gain knowledge of how the groundwater flows and where to find groundwater aquifers it is therefore necessary to know how the karst structure looks like in the area (Dahlqvist, 2015).

During the summer, there is almost no groundwater recharge because of high evaporation rate and vegetation uptake. If the precipitation is low the groundwater recharge becomes even less. This reduces the time for possible recharge to the colder half of the year. Another large problem with the groundwater is that many of the encountered groundwater aquifers have a salinity that is too high to be used as freshwater or they are polluted (Dahlqvist, 2015). The high salinity problem has various reasons. Two of them are seawater intruding into aquifers, and rapid spreading of saline solutions due to the fracture formations in the bedrock that contribute to the spreading of compounds such as boron, which should not be present at high concentrations in groundwater (Pettersson et al., 2017).

5.2.4. Treating water shortage on Gotland

The shortage of freshwater is not a recently discovered problem on Gotland and the inhabitants of Gotland have lived with this issue for decades or even centuries (Pettersson et al., 2017). The shortage has its origins in the composition of the bedrock that is badly crafted for reservoirs (Dahlqvist, 2015) and a history of draining naturally occurring wetlands. Farmers back in the 19th century drained their land in order to increase the value of the land and the amount of land to farm animals and grow crops. The wetlands were nature's way of slowly infiltrating the water at a rate the calcium-rich bedrock could handle and the drainage of them has resulted in a lower recharge rate of groundwater to the bedrock (Pettersson et al., 2017).

The freshwater shortage has culminated the last five years with the year 2016 being the worst. During the previous winter (2015-2016) the precipitation rate was unusually low which caused these low water levels in the water supplies. The municipality of Gotland is responsible for the availability of freshwater for every citizen connected to the local conduit, around half the population, and the summer of 2016 was a challenge for them (Pettersson et al., 2017). The water supply of Visby consists of groundwater from four different sources. During the summer these groundwater sources are not enough and freshwater is also taken from the lake Tingstäde träsk. Tingsträde träsk is the second largest freshwater supply on Gotland after Bästeträsk, and is providing northern parts of the island with freshwater. From a legal decision in year 1967 there are restrictions on minimum water levels in Tingsträde träsk and during the summer of 2016 the levels in the lake were alarmingly close to the restriction levels (Sundström et al., 2017). The municipality's first action was to introduce an irrigation prohibition for all land owners on Gotland by the first of April. The first of June a prohibition for everyone on Gotland was introduced followed by a decrease in pressure head in the freshwater conduit (Pettersson et al., 2017). The decrease in pressure head compared to the normal pressure was approximately 10% but varied because of the natural occurring differences in head. Residences located on high elevation had a naturally lower head in their water pipes and for them the decline in the water table resulted in non-functioning showers and water taps (Pettersson et al., 2017).

To save water an information campaign about the freshwater shortage and how to "save water" was spread to the public, the campaign was named "Saving Water" ("Spara Vatten" in Swedish). The purpose of the campaign was to inform the public and tourists about the shortage of freshwater and raise ten simple ways to decrease the use of water in a regular household. For example, shut the water tap when you brush your teeth and shower instead of bathing in your bathtub. The content and framing of the campaign were developed during a study visit to Brisbane, Australia, and had shown to have a positive impact (Pettersson et al., 2017). The campaign and the decrease in pressure head in the pipeline were spread through all newspapers, on information boards for everyone traveling with ferry

or airplane and as radio messages. The municipality provided all the media place for free or to an affordable price (Pettersson et al., 2017).

The municipal is working further with their information campaign and for the spring of 2017 they have developed an information/education campaign for schoolchildren on Gotland called "Vilda Vatten" ("Wild Water") with an educative movie of the hydrological water cycle on Gotland and experiments with water (Pettersson et al., 2017). The expectation of this campaign for children is to educate and show behaviour to not overuse water and by that hopefully see a long term difference in the future generations, or possibly even in a closer future as they can affect their family and friends to follow their behaviour. At the end of 2016 and into the beginning of 2017 the figures started to show a decreased usage of freshwater for the municipality. It was a decrease by around 14% for the highest peak in the average daily freshwater usage (in the area Visby, Vibble and Väskinde) for the year of 2016 compared to the same numbers for the last five years (Pettersson et al., 2017), see Figure 2**Error! Reference source not found.**. This could be seen as a behavioural change for the citizen of Gotland after the impact of the information campaign and digression of head in the conduit.

Figure 211. The average daily use of freshwater in m^3 for 2016 compared to the same average for 2011-2015 in the area of Visby, Vibble and Väskinde (Region Gotland, 2017).

The municipality has prepared a water and sewerage plan for the years 2016-2022 in order to ensure the access to freshwater the next coming years. The plan describes strategies to develop new solutions for freshwater supplies, for example desalination plants to treat saline water into drinkable freshwater (Gotlands kommun, 2005). One desalination plant on eastern Gotland was introduced in 2016 and they are now constructing a new plant in Visby with a capacity of 5000m^3/day (Pettersson et al., 2017). They mix the desalinated water with groundwater in order to make it healthier and taste better (Pettersson et al., 2017). They also have an on-going consulting project that investigates the possibilities to filter wastewater and infiltrate it into the ground to increase the groundwater recharge and another project to gain more knowledge of the existing and potential groundwater aquifers on Gotland (Pettersson et al., 2017). The municipality and local government also cooperate and give economic support to landowners that recreate wetlands for irrigation or in some other way decrease their freshwater usage (Pettersson et al., 2017).

5.2.5. Water balance study

A water balance study provides knowledge of the hydrological characteristics of a catchment and is an essential part of our understanding of the system (Shams et al., 2013). A water balance study is an estimation of the incoming and outgoing water in a defined area, for example a catchment. A defined area in water contexts is often referred to as a system. Incoming water in a catchment-based system is precipitation and outputs are natural outflows from the system and evapotranspiration. Water can also be stored in the catchment. An explanation of these terms can be found further on in this chapter. A general water balance equation can be written as follows:

$$Incoming\ water = Outgoing\ water + Change\ in\ water\ storage \quad (1)$$

The change in water storage can be either positive or negative. In a water balance study, the outgoing water flow cannot be larger than the available amount of water in the system, either in the form of incoming water or stored water. To avoid the complication of outgoing water being dependent on incoming water, the term potential evapotranspiration has been introduced. The potential evapotranspiration is the amount of water that potentially could leave the system through evapotranspiration, with the assumption that the surfaces are water saturated. For a lake, the potential evapotranspiration equals the actual evapotranspiration, but for soils the potential evapotranspiration does not take the existing amount of water in consideration and will therefore be misleading (Shams et al., 2013). Further is the general water balance equation:

5.2.5.1. Incoming water

By limiting the system to only contain a lake the water balance becomes more simplified. Incoming water to a lake system is surface runoff, river discharge to the lake, precipitation on the lake, and

groundwater seepage. Surface runoff depends on the precipitation on the surface and what sort of surface the land is. Every surface has a runoff coefficient and the coefficient indicates how much of the precipitation that will become surface runoff after losses through evaporation, infiltration and absorption by vegetation. A surface that is almost impermeable, like a rooftop, will have a runoff coefficient close to 1. For a surface with a high permeability rate, like a flat meadow with grass, the runoff coefficient will be close to 0 (Svenskt Vatten, 2004). Some of the water that does not contribute to runoff will infiltrate and contribute to the recharge of groundwater. It is hard to tell exactly how much because it depends on several different variables, some of them are composition of ground and bedrock, fracture formations, ground temperature and more (Shams et al., 2013). A common way to estimate the incoming water in a system is by using something called Specific Runoff, which is runoff per surface unit. Specific runoff is usually estimated by calculation models that calculate the amount of outgoing water from a catchment (SMHI, 2011). Specific runoff, therefore, includes surface runoff, river discharge and groundwater seepage to the lake.

5.2.5.2. Outgoing water

Outgoing water in a system of a lake is evaporation and naturally occurring outflows through streams and groundwater. Evaporation occurs when water changes state from liquid to gas and it can happen from all kind of surfaces. Water evaporates from the ground, lakes and vegetation and from the transpiration of the vegetation. These two parts are together called evapotranspiration. The phase transformation from water to vapour requires heat and evaporation increases with the temperature of the evaporating surface. The evaporation is therefore higher during summer than winter. The evaporation from lakes differs from the evaporation from land and is higher during the autumn and lower during spring. The reason for that is that it takes longer time to heat a lake and then the heat energy is stored in the lake making the evaporation during autumn more intense (SMHI, 2017a).

5.2.6. Future climate

5.2.6.1. Climate models

To be able to describe the future climate, statistics of the past is not enough and calculations of future climate condition are needed. Climate models are used to describe the future climate and in many ways the models are similar to weather models. Climate models consist of 3-dimensional mathematical descriptions of the atmosphere, land, sea, lakes and ices. The atmosphere is divided into a 3-dimensional grid. For every volume in the grid the development of meteorological, hydrological and climatological variables such as temperature and precipitation are calculated. (SMHI, 2017b).

Since the climate is global, the climate models need to consider global processes in the atmosphere. There are global climate models with a sparser grid to save computer power and there are also

regional climate models with a higher resolution. The regional climate models are more detailed and can still include the global processes (SMHI, 2017b).

5.2.6.2. RCP

Even though some climate variables can be calculated we need to do assumptions to be able to predict the future. It is impossible to tell the exact amounts of greenhouse gases and aerosols in the atmosphere in the future because it depends on the burning of fossil fuels and emissions which in turn depends on politics, availability etc. The Intergovernmental panel on climate change (IPCC) has developed representative concentration pathways (RCP) to describe different possible scenarios for the future climate. The different RCP-scenarios are based on assumptions about the atmospheric composition in the future. The purpose with the scenarios is not to predict the future climate, but to concretize the climate development driven by greenhouse gases. RCP2.6 is the most optimistic scenario in terms of reducing greenhouse gas emissions. It requires huge international measures and hard restrictions on the burning of fossil fuels from now on. RCP8,5 is the most pessimistic scenario with an increasing amount of greenhouse gas emissions and no international climate politic at all. In between is RCP4.5 and RCP6 with culminating carbon dioxide emissions around year 2040 for RCP4.5 and year 2060 for RCP6 (SMHI, 2017c) .

RCP2.6 is characterized by culminating carbon dioxide emissions around year 2020, rough climate politics and a population size of less than 9 billion people in the end of the century. RCP8.5 is characterized by an increase in the combustion of fossil fuels, no international climate politics and a population size of 12 billion people in the end of the century. Exactly how the climate will change depends on many factors, for example population increase, politics, amount of greenhouse gases in the atmosphere and future energy sources (SMHI, 2017c).

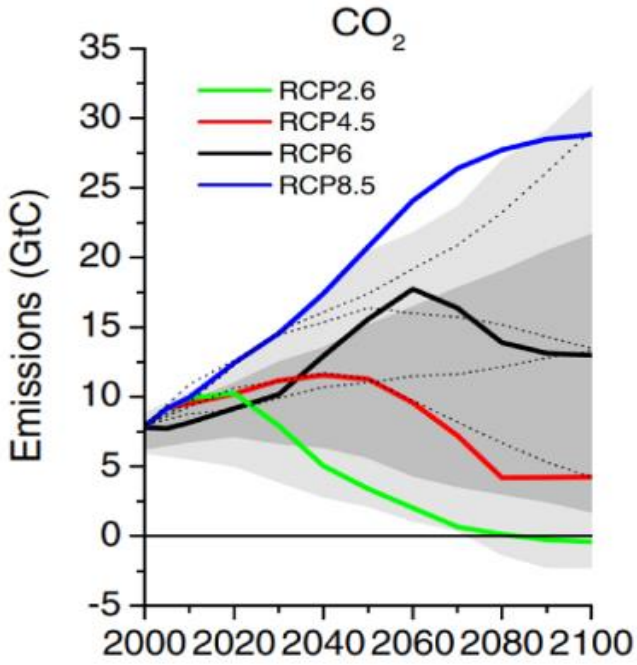

Figure 22. Example of possible development of CO2 in the atmosphere with the different RCP scenarios.(van Vuuren et. Al, 2011, with permission)(SMHI, 2017c).

5.2.6.3. Future climate on Gotland

SMHI has made a report (Persson et al., 2015) describing the future climate in Gotland County based on observations and climate modelling. The report presents the expected climate in the region during this century based on two different scenarios, RCP4.5 and RCP8.5. The study shows that for both scenarios the temperature and precipitation will increase significantly until the end of the century, with more extreme changes for the RCP8.5. The vegetation period will increase and eventually become up to 11 months of the year with RCP8.5 or 9 months with RCP4.5 (Persson et al., 2015).

The total yearly average runoff will probably increase by about 20% (Persson et al., 2015), and most of the runoff will occur during the winter season. The runoff during spring and summer will decrease because of the increasing evaporation and longer vegetation period as a consequence of rising temperatures. The precipitation during the winter period will be crucial for the groundwater recharge and the runoff contributing to surface water (Persson et al., 2015).

5.3. Data and procedure for water balance study

5.3.1. Water balance study

In order to gain more knowledge of the freshwater supplies on Gotland, a water balance study of the lake "Tingstäde träsk" was made. The land area around the lake has only low elevation differences, as for Gotland in general, and the land is mainly used for forestry, agriculture or roads and houses.

To calculate the water balance in Tingstäde träsk we used the following equation:

$\Delta S = P - E + Q_{in} - Q_{out}$ (2)

$\Delta S =$ water storage in the lake

$P =$ precipitation in the lake

$E =$ evaporation from the lake

$Q_{out} =$ discharge from the lake

$Q_{in} =$ runoff to the lake from the catchment

5.3.1.1. Incoming water

The incoming water into a system is, as said in the theory about Water balance study, surface and subsurface (groundwater) runoff from the catchment, precipitation directly into the lake and water pumped from areas outside the catchment. Further down are explanations of where the data for all parameters comes from.

Precipitation

The precipitation data used in the water balance study were from one of the Swedish Meteorological and Hydrological Institute's (SMHI) monitoring stations, the station "Hejnum" located three km from Tingstäde träsk. The precipitation data were in form of mm per month and mm per year. The precipitation amount was multiplied with the area of the lake to find the volume of incoming water from precipitation into the lake.

Specific runoff

Specific runoff is the runoff per surface unit.

SMHI (2011) has developed a hydraulic model called S-HYPE to calculate the specific runoff in a catchment, which are the data used in the calculation model for the catchment of Tingstäde träsk. The specific runoff includes groundwater seepage and surface runoff. The surface runoff were studied more closely by stating a model of the catchment of Tingstäde and its land use in ArcGIS, see a detailed review in Appendix A.2. From the model, areas of the specific land use in the catchment were produced. These areas were multiplied with its corresponding runoff coefficient, see Table 1. From these areas and coefficients a merged runoff coefficient was calculated for the whole land area in the catchment based on the proportion of the different land use, see Table 2 (in the Result). The merged runoff coefficient was multiplied with the total land area in the catchment and the precipitation for a specific year and month to form the volume of incoming water per month from runoff.

Table 2. Runoff coefficients (Svenskt Vatten, 2004).

Land use	Runoff coefficient
Meadows, Grass and Fields	0.1
Asphalt	0.8
Gravel and Sand	0.2
Roofs	0.9
Forest	0.1

Pumping incoming water from ditch

The municipality has since early in the 1900's pumped water from the ditch Hejnum, which lies outside of the catchment, to Tingstäde träsk. The amount of incoming water from the ditch in the calculations are from the municipality's numbers of how much the electric pump was used during a month and multiplied with its capacity. This gives the amount of pumped water per month.

5.3.1.2. Outgoing water

The outgoing water includes evaporation and discharge. The discharge from Tingstäde Träsk are the outtake to drinking water and the outflow to Ireån.

Outtake

The outtake from Tingstäde träsk is directly dependent on how much water the municipality needs to take to supply the people on Gotland with freshwater. The municipality monitors their amount of outtake of water per week, which are the data used in the calculation model.

Outflow

Ireån is a natural outflow from Tingstäde Träsk flowing to the north western coast of Gotland where it ends in the Baltic sea. The data used for calculations are modelled data on the monthly outflow to Ireån from the modelling tool "Vattenwebb" from (SMHI, 2013a), the data used were the total flow of stream water in the catchment 3070.

Evaporation

The potential evaporation has been calculated using a formula based on the empirical correlation between air temperature and the potential evaporation as calculated by Penman formula, taking seasonal variations into account (Rodhe et al. 2007).

$$E_{pot} = B(t) * T \ \ för\ T > 0 \qquad (3)$$

$$E_{pot} = 0\ för\ T \leq 0$$

E_{pot} = potential evapotranspiration according to Penman formula (mm/day)
B(t) is a proportionality factor depending of season and location in Sweden
t = time (day number of the year)
T = air temperature (°C)

$$B(t) = \left(1 + A * \sin\left(2\pi \frac{t+\psi}{365} - \frac{\pi}{2}\right)\right) * C_e \qquad (4)$$

A, ψ and C_e are empirical factors.

The proportionality factor B(t) has a sinusoidal variation over the year with the highest values during summer. When the temperature is 0°C or below, the potential evaporation E_{pot} is assumed to be 0. A is the amplitude, ψ is the phase shift (days), C_e is the evaporation parameter (mm d^{-1} °C^{-1}) and t is the day number of the year.

Parameter values from Rodhe et al. (2007) were used. The amplitude A is 0.56, the phase shift ψ is 45 days and the evaporation parameter C_e is 0.17. Temperature data were taken from the SMHI´s monitoring station "Visby flygplats" located on Gotland 25 kilometres from Tingstäde träsk. In order to get a monthly average of the potential evaporation the day number of the year, t, was set to the middle day of each month, for example 15 for January.

5.3.1.3 Calculation model

A calculation model for the water balance equation in Tingstäde träsk was created in Microsoft Excel and with this model a simplified prognosis of the future of the lake could be made. In the model the data of the incoming and outgoing water were inserted according to equation (2) described earlier. All data were recalculated in the unit cubic meters per month and then added to or subtracted from the assumed cumulated sum. Calculations were made for year 2014, 2015 and 2016, but presented in hydrological years in the results further in this study. The initial water volume, in December 2013, was assumed to be 300,000 cubic meters. This volume can be called representative since the monthly water volume in the magazine during the winter months (November till February), according to the calculated sum, usually lays between 160,000 and 440,000 cubic meters. With the data from the parameters described in *5.3.1.1 Incoming water* and *5.3.1.2 Outgoing water*, in unit cubic meters per month, the water balance was calculated. The sum of the "incoming water" terms added to the initial water volume, with the sum of the "outgoing water" terms subtracted from that amount, became the cumulative sum. In this way the water volume in the lake was estimated over time. This cumulative sum was compared with the observed water levels in Tingstäde träsk, measured every week for many years by the municipality at the water station in the lake. The tables of the calculation model are

presented in Appendix A.3 and the calculated cumulative sum and the observed water levels are shown in Figure 23 and Figure 24 in Results.

5.3.2. Climate study

For the simplified prognosis of the future of Tingstäde träsk only some of the flows have been taken into consideration: the precipitation, the potential evaporation and the specific runoff. Water discharge from Tingstäde träsk is not considered as the relationship between water level in Tingstäde träsk and water discharge is unknown for future scenarios. The specific runoff is the parameter from the developed calculation model but with precipitation and evaporation values from SMHI's future climate data. The values are data from the scenario RCP4.5 for the area of Gotland. With these values calculations were made for the period of 2020-2099 and a yearly temperature and precipitation average for each decade was calculated in order to get as representative result as possible. The first decade is a yearly average from 2020-2029 and the last is from 2090-2099. The data show the change in temperature and precipitation compared to the reference period of year 1961-1990. For that period the yearly average temperature was 6.8 ºC and 634 mm precipitation per year. Instead of calculating the terms in cubic meter per month, they were converted to cubic meter per year since there are no monthly scenario data for the future.

$$\Delta S_f = P_f - E_f - R_f \qquad (5)$$

$R_f =$ future runoff

$P_f =$ future precipitation

$E_f =$ future potential evaporation

$\Delta S_f =$ Change in water storage excluding lake discharge

To be able to calculate the incoming water in the future some assumptions have been made. We assumed that the area of the lake and the catchment will remain constant and also that the catchment area will contain the same kind of soil as it does today. The potential evaporation was calculated using the model based on Penman formula described in the theory. First a constant B was calculated using the potential evaporation and average temperature of year 2016.

$$B * T = E_{pot}$$

Year 2016 the average temperature was 9.02°C and the potential evaporation was 585 mm. The average temperature and potential evaporation for each month was used to calculate an average B. The average B during year 2016 becomes B=64.87. To calculate the future E_{pot} average temperature of each decade investigated in the future was used. To calculate the future specific runoff, a quotient α between the surface runoff and the groundwater runoff was used and α was found by calculating the

average of that quotient for the years 2014-2016, leading to α being 0.325, assuming α will remain the same in the future. The incoming water to the lake depends on the precipitation, the specific runoff and the potential evaporation. The precipitation and temperature (which affects the potential evaporation) is taken from SMHI:s future climate calculations and the future specific runoff was calculated by using α. With all these parameters calculated together the incoming water to the lake could be estimated for the future decades.

5.4. Results

The results from the water balance study of Tingstäde träsk will be presented first and after that the results from calculated effects of the future climate on Tingstäde träsk.

5.4.1. The Water balance study

From the modelling in ArcGIS a catchment for Tingstäde träsk was accessed. From this map together with the data from the map service GET the land use in the catchment was determined, see Figure 22. The land use was calculated into areas and can be seen in Table 2 together with the percentage of the total area.

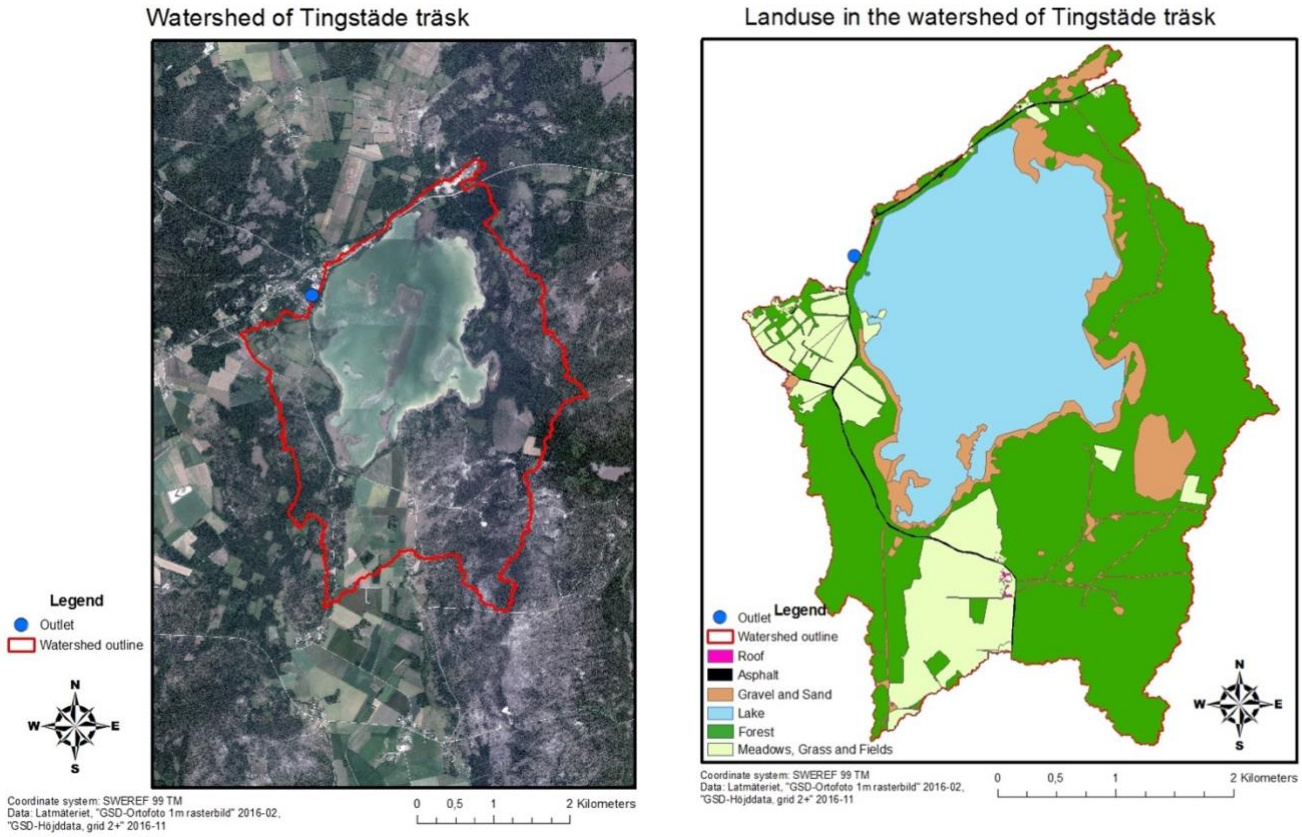

Figure 22. Tingstäde träsk catchment from the modelling in ArcGIS (left) and the land use in the same catchment (right).

Table 3. The land use in square meters and percentage of total area.

Landuse	m2	%
Meadows, Grass and Fields	1845848	17.70
Asphalt	62116	0.60
Gravel and Sand	1108916	10.63
Roofs	13096	0.13
Forest	7397120	70.94
Total land area	**10427096**	**100**

The calculations from the water balance study of Tingstäde träsk are shown in Figure 23 and Figure 24. These results show the calculated amount of the incoming and outgoing water in a cumulative sum for the hydrological year of 2014-2015 and 2015-2016. The initial water volume in December 2013 was assumed to be 300,000 m^3. The results also show the measured water levels, multiplied with the area of the lake, to gain the water volume in Tingstäde träsk for the same period for comparison with the calculated water balance.

Figure 23. The water balance for Tingstäde träsk for the hydrological year of 2014 - 2015.

Figure 24. The water balance for Tingstäde träsk for the hydrological year of 2015 - 2016..

5.4.2. Future climate

The result from the future climate study shows how change in storage excluding lake discharge to the lake will change during the century. The result shows a decrease.

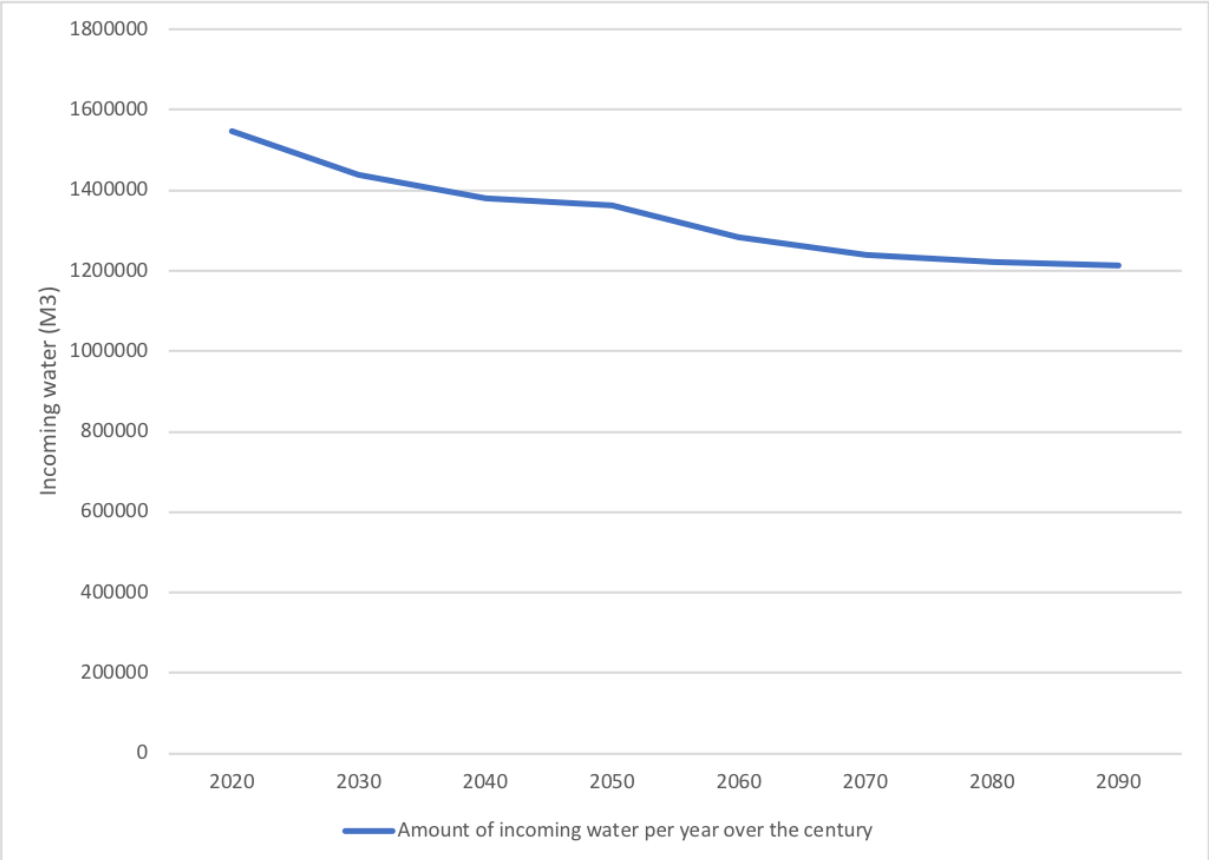

Figure 25. Predicted amount of incoming water (precipitation minus potential evaporation and runoff) per year to Tingstäde träsk year 2020 – 2090.

5.5. Discussion

The cumulative sum of the water balance study for Tingstäde träsk follows the measured differences of water level in the lake with a considerable deviation. That suggests that the calculation of the water balance study is not accurate but gives an approximate estimation of the situation. That indicates that this calculation model can be used to get a rough idea of the future water balance in Tingstäde träsk. To get a better estimation a more accurate model with more parameters has to be used.

There are uncertainties to be aware of, for example the evaporation seems to be overestimated and abnormally high. Several evaporations formulas were tested with approximately the same result.

The results from the future climate study show that the incoming water to Tingstäde träsk will decrease during the century. The precipitation and temperature will increase and it will affect the water amount in Tingstäde träsk. Even though the total amount of precipitation will increase, it doesn't mean that the groundwater levels also will increase. The vegetation period will be extended and the winter will be shortened because of the rising temperatures. More precipitation will come as rain instead of snow during the winter season which results in a faster movement of the water and probably more surface runoff. A longer summer period will result in larger water uptake by the vegetation. Longer vegetation periods will also result in longer agriculture and tourism seasons which requires more water. Since the calculations are considering the future climate, there are several uncertain parameters, for example the values of precipitation and temperature from SMHI.

As described earlier in the chapter the municipality of Gotland is introducing new ways of providing freshwater. It is obvious that this will be needed in the future if Gotland does not want to import freshwater from mainland.

Most of the ecotourism destinations implicate a sustainable method by having few tourists, that do not demand that much resources. But could it be possible to increase the number of ecotourists with better technical solutions in the local society, for example by good functioning desalination plants and a modern water conduct system? Probably yes, but it might require high investment costs.

The municipality of Gotland is responsible for available freshwater for every citizen on Gotland that are connected to local freshwater conduit. As described in chapter 5.2.6. the municipality has managed to form a behavioural change for their users with the information campaign “Saving Water”, irrigation prohibition and decreases of pressure head in the water conduit. Could this behavioural change be permanent and could similar behavioural changes for other natural resources usage be

possible? We believe that behavioural changes for everyone are possible if there is a desire to change, if you have the knowledge to see what the changes are capable to do.

6. Comparative analysis

Reviewing our questionnaire, data mining analysis and study of freshwater shortage it becomes evidently apparent that islands within the IIGA are suffering from both similar and different challenges. These challenges are related to the business, environmental or social sector. Additionally, from our questionnaires we can analyse that the majority of the participating islands within the NatWest Island Games all have great challenges regarding the business sector and specifically concerning tourism. Strengthening this statement, when looking at our data mining analysis, we can see that for example Gotland has almost twice the amount of water usage per capita per day than similar islands like Åland and Guernsey. This could be explained by the spike in tourism on Gotland during the summer season, and this in turn makes storage and supply of freshwater one of Gotlands most prioritized challenges. Furthermore, still reviewing the data mining analysis, we can see that Guernsey has had almost all of their freshwater reservoirs in use since 2004. This is similar to Gotland which is also using nearly all of its storage capacity and the island is having huge problems regarding water supply. Taking into consideration that Guernsey has not answered our questionnaire and thus we do not know if their primary challenges are environmental challenges such as for example freshwater storage. However, we can conclude from this data that they probably would benefit from establishing a water management strategy in similarity with for example, the one already established on Gotland, before the problem becomes critical. Additionally, an alarming movement within the population age distribution on Gotland was found in the results of the data mining analysis. Displaying potential negative influences on the economy of Gotland. Furthermore, as described in chapter *4.8*, exchanges of capital and knowledge could contribute and be beneficial for all involved parties, and thus positively contribute to the overall economic dimension.

Another challenge for islands that was found is within the social sector and primarily regarding emigration. We found that some of the islands have trouble engaging people to move to the island, and as a result their population level remains stagnant. This challenge is something many island are facing but to a more or less extent depending on its priority. From the data mining analysis we can see that neither Guernsey nor Gotland have had a population increase of more than two percent during the last ten years in total. This could pose great future challenges for these and similar islands, and strategies for managing this will become greatly anticipated.

As explained in the beginning it is not hard to understand that islands are facing different challenges. However, understanding that islands are facing similar challenges, and defining these challenges is not quite as easy. From our analysis we have found some such challenges that span both internationally and globally, and furthermore even possible solutions. Communicating these solutions and discussing new ways to managing the already existing challenges could be done through an

international collaboration between the participating islands of NatWest Island Games. Additionally, we have found that some of the member island strongly desire such an international collaboration.

To reach sustainability it is necessary to have a business development, and preferably business development within the boundaries of sustainability. Because of the system of society is so complex it is very difficult to set these boundaries. Individual citizens as well as companies need to realize that our resources on earth are limited and that we have to change our lifestyle and way of consumption to make future generations able to live on the planet. Even if the sustainable development goals are not legally binding, they are good examples of how the pressure on governments is increasing. In order to reach the goals, the environmental laws will most likely become much stricter in the near future and it will have a direct effect on businesses using resources in some extension. Companies that realize this early and start the sustainability conversion will get advantages over competitors in the future. Another incitement for the companies to become more sustainable is that the customers are getting more environmental conscious and the demand for sustainable products is increasing. In most cases the companies can make profit on becoming more sustainable, at least in the long term. With more effective processes, less energy consumption and by saving resources, money will be saved in the long run. The problem of today is that many companies think, plan and act in the short-term, as if the resources on earth was unlimited and that kind of approach might be temporarily profitable. But with the overall goal of sustainable development being to create a long-term stability of both the economy and environment, the availability of natural resources will be more valuable than anything. Without the necessary resources the value of businesses or even money itself will be non-existent.

On small islands, the limited resources are more obvious than in other regions. Citizens need to make a living to survive and that requires companies and workplaces. There are limited resources on an island, and even if the communications and transportation to mainland is good, the islanders need to relate to these limitations. On Gotland, for example, the freshwater shortage is a big issue that affects all parts of the society. The residents are affected in their everyday life and during the summer many households have problems to shower because of the decrease in pressure head in the conduit. Also the companies are affected by the water shortage which makes it more problematic for some companies to maintain or establish their business on the island. Agriculture and other industries require huge amounts of water on a daily basis. The water shortage is also affecting the tourism sector, for example the water park “Kneippbyn” that has to adapt to the water shortage and the irrigation prohibition set up by the municipality. They are now investigating the possibility to use seawater instead of freshwater.

A challenge that is more obvious on small islands is emigration. To attract possible citizens there is a need of attractive workplaces where people can develop and make a career. Today many people feel

that the career opportunities are too small on Gotland and that is a major reason for not moving there. Able-bodied inhabitants leave the island for better work or education opportunities in other parts of Sweden, or internationally, without the intention to return. Meanwhile is the proportion of the elderly population are growing and are now the largest portion of the population on Gotland. Companies are looking for competent employers that can be hard to find on an island with limited career opportunities. It easily becomes a vicious circle where either companies or people can find attractive workplaces or competent labour force.

The sustainable development is, as explained in the chapter about CSR, not only an issue for nations, governments and municipality's but also for companies. On Gotland there are several companies that take responsibility and work with social and environmental issues. There are companies with a business plan about improving and affecting the social and environmental aspects both locally and globally. In some issues, small islands share more challenges with other islands than they do with their respective mainland. That companies are taking a larger responsibility towards environmental and social sustainability is an effect of the growing demand of sustainable development, not only within social and environmental sectors but within the business sector as well. In the same context, the collaboration and knowledge transformation between these three spheres are discussed within the Triple Helix concept. Additionally, the Triple Helix models could be applied to form a sustainable synergy between business, environmental and social development. The fundamental point is to create a collaborative relationship between these three spheres that can, for example, discuss the issues of how wealth generation, organizational knowledge and normative control can function coherently, as mentioned within the Triple Helix. This collaboration is not regulated to only be established domestically or within a local region. We mean that such a collaboration is highly plausible to function internationally and not to be limited by geographical borders. From the Triple Helix, we know that through advanced collaboration between university, industry and government, knowledge-based economy contributes to the overall economy. This is realised by enhancing the development of new innovations that are ensured to be integrated back into society. However, can a collaboration of this kind function internationally? Well, yes. We believe that through solving an international common problem together, all the participating parties would gain value. Innovations created by solving global problems within similar settings could be applied internationally, for example how to manage environmental resources or how to attract businesses to small regions. Thus these solutions will not be limited to geographical borders. In fact, it could even be possible that they already have a functioning solution to a typical "island" problem on one island.

There already is a network between small islands spread all over the world. IIGA is a well-functioning network arranging the sport event Island Games every second year. Their communication structure with single-point of communication has worked very well during its 30 years of existence. Because

good contact between these islands already is established there is a major potential in developing this relationship. As described in chapter *2.9,* sport events are traditionally perfect occasions to meet, discuss and exchange experiences also in other sectors. In conjunction with earlier games initiatives have been taken to develop the collaboration by also inviting business people from the islands, but in order to create a lasting cooperation more efforts need to be done.

From the results of the questionnaire it is perceived that some of the member islands share the same challenges and that they also believe other islands suffer from the same problems as their own island does. Many islands have the same issues regarding emigration from the island and how to extend the tourism season. A few islands also experience challenges with natural resources and above all freshwater management. With a deeper cooperation Gotland could help other islands and contribute with a water management strategy for example. Probably other islands could bring their knowledge and experience for Gotland to learn from. The enhanced cooperation does not have to be limited by the business sector but could also cover the universities and for example provide the opportunity for exchange studies between the islands.

As previously explained in the Partnership model, collaboration can develop from relationships into stronger more sustainable partnerships. By using the Partnership model we can apply the same concept upon the already established relationship between the member islands of the IIGA, in order to form a partnership. From the model we know that the most critical element in forming such a partnership is the *Drivers*, or more explicitly the fundamental reasons why the members should create a partnership. Through our study we have found that these compelling reasons could be challenges within problem settings regarding for example sustainable tourism industry, environmental resource management and social development. What we mean is that we have found that islands within the Island Games network are confronted with the same type of challenges and that each island's strife to finding solutions to these challenges are potential Drivers. Additionally, as previously described in the model, the stronger these Drivers are the more likely it is for the partnership to function and prosper. Substantially, we have found that both Gotland and Menorca are suffering from seasonal tourism, meaning that both islands have trouble attracting tourists during the winter season. Furthermore, Saaremaa, Western Isles and Sark all suffers from social issues regarding emigration, and they all have trouble attracting people to move to the islands.

Following the model the next step is measuring factors of how well the potential partners can collaborate. The model described these factors as *Facilitators*, and these factors increase the probability of successfully creating a partnership. Two examples described in the model are the compatibility of corporate cultures and the degree of symmetry and mutuality between partners. Considering the Island Games network, the member islands do have dissimilarities regarding culture

and climate which could present a negative effect on a partnership. However, based on the similarities between islands concerning their geographical boundaries, one could argue that there exists a culture amongst islanders that spans globally and displaces the cultural differences regarding nationality. This could be seen as a means of compatibility and mutuality, which increases the probability of a successful partnership. Consequently following the model the third step would be establishing the joint operations and activities within the partnership. These activities are manageable and, as described in the chapter *2.5,* could include methods of planning and communications. How these operations and activities should be formed must be established between the parties within the partnership. The collaboration is highly depended upon the implementations of these components. From the implementation the resulting products, or as defined in the model the *outcomes*, is a reflection of the performance of the partnership. This could be reduced cost, improved service or profit, within a partnership. Outcomes could also include knowledge exchange.

Looking at The Tourism Partnership Model described in chapter *2.6*, there is similarities in the two partnership models but also some differences. For example The Tourism Partnership Model has five phases, *Antecedents, Problem-setting, Direction-setting, Structuring* and *Outcomes*, compared to The Partnership model's four stages. The first phase, with the motivations for the actors collaborate, are much the same as *Drivers* in The Partnership Model. The second stage in The Partnership Model, *Facilitators*, on the other hand does not have an equivalent in The Tourism Partnership Model. In the Facilitators-stage the model treats the compatibility and similarities in the structure of the potential partners to state the probability of a successful collaboration. Regarding that The Partnership Model was developed within supply chain management it is questionable if the model is a compatible model for collaboration between small islands. The Tourism Partnership Model was developed in the field of environmental resources and has been used in developing collaborations for sustainable tourism (Graci, 2013). The Tourism Partnership Model continues with the *Direction-setting* phase and the *Structure* phase, including setting goals and assigning roles for partners in the collaboration. If the plan for the collaboration is that it should discuss tourism, it might be better with a working structure more as The Tourism Partnership Model describes. A possibility is to combining the two models and their stages since they are not contradictory. Both of the models have *Outcomes* as their last phase and are of cyclical shape to give feedback back to the beginning of the cycle. For the construction of the potential collaboration between small islands, it is important to keep in mind that a collaboration is an emerging process rather than a rigid organization and that the methods must be tailored for the unique demands of the situation.

For a collaboration described as above the foundation should lie in the sustainability of the solutions to which the collaboration contributes. They should be sustainable in an ecological, economic and social way as the concept of sustainability itself. Baldacchino (2006) observed the differences in

tourism industry between islands in warm versus cold climates. For many warm water islands the tourism industry is mainly developed without taking sustainability for the industry into consideration which has resulted in failing infrastructure, insufficient waste management, foreign investors not contributing to the society and natives living in a parallel, non-cooperative, society. For the development of the tourism industry on cold water islands, the experiences for the warm water islands should be taken into consideration to not end up in the same situation.

With a collaboration discussing the challenges on small island and their experiences, of limited natural resources, an insufficient business sector and lack of right competence on their islands etc., solutions specific for small islands are more likely to emergence. A domestic system developed on mainland, without consideration of the noticeable limitations on a small island, may not be best alternative for islands. Finding solutions used in other isolated areas could be much more suitable. With a collaboration between islands, every island may not need their own experienced department handling challenges, just connections to the experts in the centralized network.

7. Conclusions

Summarizing the study, we now can answer the overall question of how a business collaboration between Gotland and the other member islands, originated from the IIGA, could contribute to the island's business sector. The result could be achievable through the creation of a collaboration between the islands, in which incentive challenges as how to manage natural resources, attracting new residents and maintain a sustainable tourism industry can be communicated and discussed. Through exchange of retained knowledge and experience, the participating islands can attain new knowledge and take part of already possessed experiences. Furthermore, solutions to some island's challenges may already be invented and can in this way be shared to avoid reinvention of the same solution. By applying this concept of collaboration different aspects such as freshwater management or the experience of theme packages for tourists on Gotland, can contribute to the business sectors on other islands. In similar ways other island's knowledge and experiences can contribute to the business sector of Gotland.

8. References

Ahlemeyer-Stubbe, A., 2014. A practical guide to data mining for business and industry. Wiley, Chichester, West Sussex, United Kingdom.

Ammenberg, J., 2012. Miljömanagement: miljö- och hållbarhetsarbete i företag och andra organisationer. Studentlitteratur, Lund.

Baker, S., 2016. Sustainable development, Second edition. ed, Routledge introductions to environment series. Routledge, Taylor & Francis Group, London ; New York.

Baldacchino, G., 2006. Warm versus Cold Water Island Tourism: A Review of Policy Implications. Isl. Stud. J. 1, 183–200.

Berresford, J., 2004. Tourism in the Region (Regional Review Hearing Report).

Brace, I., 2008. Questionnaire design: how to plan, structure and write survey material for effective market research, 2nd ed. ed, Market research in practice series. Kogan Page, London ; Philadelphia.

Bradburn, N.M., Sudman, S., Wansink, B., 2004. Asking questions: the definitive guide to questionnaire design-- for market research, political polls, and social and health questionnaires, Revised edition. ed. Jossey-Bass, San Francisco, CA.

Brown, M., 2012. Data mining techniques. IBM.

Brundtland, G.H., 1987. Report of the World Commission on Environment and Development: Our Common Future. UN.

Bryman, A., Bell, E., 2011. Business research methods, 3rd ed. ed. Oxford University Press, Cambridge ; New York, NY.

Butterfield, A., Ngondi, G.E. (Eds.), 2016. A dictionary of computer science, Seventh edition. ed, Oxford quick reference. Oxford University Press, Oxford, United Kingdom ; New York, NY, United States of America.

C. Brennan, M., J. Cotgrave, A., 2014. Sustainable development: A qualitative inquiry into the current state of the UK construction industry. Struct. Surv. 32, 315–330. https://doi.org/10.1108/SS-02-2014-0010

Carbone, M., 2005. Sustainable Tourism in Developing Countries: Poverty Alleviation, Participatory Planning, and Ethical Issues. Eur. J. Dev. Res. 17, 559–565. https://doi.org/10.1080/09578810500209841

Chisholm, A., 2013. Exploring Data with RapidMiner: explore, understand, and prepare real data using RapidMiner's practical tips and tricks, Community experience distilled. Packt Publ, Burmingham.

Dahlqvist, P., 2015. SkyTEM-undersökningar på Gotland. Sveriges geologiska undersökning, Uppsala.

Dwyer, F.R., Schurr, P.H., Oh, S., 1987. Developing Buyer-Seller Relationships. J. Mark. 51, 11. https://doi.org/10.2307/1251126

Enlund, M., 2017. Inspiration Gotland.

Etzkowitz, H., Leydesdorff, L., 1995. THE TRIPLE HELIX---UNIVERSITY-INDUSTRY-GOVERNMENT RELATIONS: A LABORATORY FOR KNOWLEDGE BASED ECONOMIC DEVELOPMENT. Amsterdam/New York.

Falkland, A., Custodio, E., 1991a. Hydrology and water resources of small islands: a practical guide: a contribution to the International Hydrological Programme, IHP-III, Project 4.6, Studies and reports in hydrology. Unesco, Paris.

Falkland, A., Custodio, E., 1991b. Hydrology and water resources of small islands: a practical guide: a contribution to the International Hydrological Programme, IHP-III, Project 4.6, Studies and reports in hydrology. Unesco, Paris.

Foggin, T., Munster, D.O., 2003. Finding the middle ground between communities and tourism. Afr. Insight 33, 18–22.
Glynn, M.A., 2008. Configuring the Field of Play: How Hosting the Olympic Games Impacts Civic Community. J. Manag. Stud. 45, 1117–1146. https://doi.org/10.1111/j.1467-6486.2008.00785.x
Gössling, S., Hultman, J. (Eds.), 2006. Ecotourism in Scandinavia: lessons in theory and practice, Ecotourism book series. CABI Pub, Wallingford, UK ; Cambridge, MA.
Gotlands kommun, 2005. Vattenplan för Gotlands kommun. Gotlands kommun, Gotland.
Graci, S., 2013. Collaboration and Partnership Development for Sustainable Tourism. Tour. Geogr. 15, 25–42. https://doi.org/10.1080/14616688.2012.675513
Gray, B., 1989. Collaborating.
Gray, B., 1985. Conditions Facilitating Interorganizational Collaboration. Hum. Relat. 38, 911–936. https://doi.org/10.1177/001872678503801001
Gupta, C., 2014. Sustainability, self-reliance and aloha aina : the case of Molokai, Hawai'i. Int. J. Sustain. Dev. World Ecol. 21, 389–397. https://doi.org/10.1080/13504509.2014.880163
Håkansson, H., Snehota, I. (Eds.), 1995. Developing relationships in business networks. Routledge, London ; New York.
Hallén, L. (Ed.), 1989. Networks of relationships in international industrial marketing, Advances in international marketing. Jai Press Inc, Greenwich, Conn.
Han, J., Kamber, M., 2011. Data mining: concepts and techniques, 3rd ed. ed. Elsevier, Burlington, MA.
Heesen, B., 2016. Effective strategy execution: improving performance with business intelligence, 2nd ed. ed, Management for professionals. Springer, Berlin.
Hofmann, M., Klinkenberg, R., Taylor & Francis, CRC Press, 2014. RapidMiner data mining use cases and business analytics applications.
IIGA, 2017. Official webpage of International Island Games Association [WWW Document]. URL http://iiga.org (accessed 2.5.17).
IOC, SCOR, IAPSO, 2010. The international thermodynamic equation of seawater (No. 56), Manuals and Guides. Intergovernmental Oceanographic Commission.
Isaksson, R., Garvare, R., 2003. Measuring sustainable development using process models. Manag. Audit. J. 18, 649–656. https://doi.org/10.1108/02686900310495142
Isaksson, R., Steimle, U., 2009. What does GRI-reporting tell us about corporate sustainability? TQM J. 21, 168–181. https://doi.org/10.1108/17542730910938155
Jamal, T., Stronza, A., 2009. Collaboration theory and tourism practice in protected areas: stakeholders, structuring and sustainability. J. Sustain. Tour. 17, 169–189. https://doi.org/10.1080/09669580802495741
Khawaji, A.D., Kutubkhanah, I.K., Wie, J.-M., 2008. Advances in seawater desalination technologies. Desalination 221, 47–69. https://doi.org/10.1016/j.desal.2007.01.067
Kim, K., Burnett, K., Ghimire, J., 2015. Assessing the potential for food and energy self-sufficiency on the island of Kauai, Hawaii. Food Policy 54, 44–51. https://doi.org/10.1016/j.foodpol.2015.04.009
Lambert, D.M., Knemeyer, A.M., Gardner, J.T., 2010. Building high performance business relationships. Supply Chain Management Institute, Sarasota, Florida.
Lashley, J., 2013. "Saving for a rainy day": Coping with extreme weather events in small island developing states, Journal of Eastern Caribbean Studies. Sir Arthur Lewis Institute of Social and Economic Studies, Barbados.
Lawton Smith, H., Leydesdorff, L., 2014. The Triple Helix in the context of global change: dynamics and challenges. Prometheus 32, 321–336. https://doi.org/10.1080/08109028.2014.972135
Linoff, G.S., Berry, M.J.A., 2011. Data mining techniques: for marketing, sales, and customer relationship management, 3rd ed. ed. Wiley Pub, Indianapolis, IN.

Liu, Z., 2003. Sustainable Tourism Development: A Critique. J. Sustain. Tour. 11, 459–475. https://doi.org/10.1080/09669580308667216
Loshin, D., 2013. Business intelligence: the savvy manager's guide, 2nd ed. ed. Morgan Kaufmann, Waltham, MA.
Louis Columbus, 2016. Roundup Of Analytics, Big Data & BI Forecasts And Market Estimates. Forbes.
Mackellar, J., 2015. Determinants of business engagement with regional sport events. Eur. Sport Manag. Q. 15, 7–26. https://doi.org/10.1080/16184742.2015.1007882
McCann, J.E., 1983. Design Guidelines for Social Problem-Solving Interventions. J. Appl. Behav. Sci. 19, 177–189. https://doi.org/10.1177/002188638301900213
McElroy, J.L., 2003. Tourism Development in Small Islands Across the World. Geogr. Ann. Ser. B Hum. Geogr. 85, 231–242. https://doi.org/10.1111/j.0435-3684.2003.00145.x
Orsborn, K., 2016. Intoduction to Data Mining II.
Pawłowski, A., 2008. How many dimensions does sustainable development have? Sustain. Dev. 16, 81–90. https://doi.org/10.1002/sd.339
Persson, G., Asp, M., Berggren-Clausen, S., Berglöv, G., Björck, E., Axén Mårtensson, J., Nylén, L., Ohlsson, A., Persson, H., Sjökvist, E., 2015. Framtidsklimat i Gotlands län - enligt RCP-scenarier (No. 31), Klimatologi. SMHI, Norrköping.
Pettersson, S., Westerlund, L., Hoas, R., 2017. Water shortage on Gotland.
Plummer, R., Telfer, D., Hashimoto, A., 2006. The rise and fall of the Waterloo.Wellington Ale Trail: A study of collaboration within the tourism industry. Curr. Issues Tour. 9, 191–205.
Pollack, S., 2012. What, Exactly, Is Business Development? Forbs.
Preuss, H., 2004. Calculating the regional economic impact of the olympic games. Eur. Sport Manag. Q. 4, 234–253. https://doi.org/10.1080/16184740408737479
Region Gotland, 2017. Data of water usages in Visby, Vibble and Väskine for the years of 2011-2016.
Region Gotland, 2015a. Gotland i siffror. Gotland.
Region Gotland, 2015b. Tillväxtprogram för Gotland 2016-2020 (No. RS 2015/831). Gotland.
Rodhe, A., Lindström, G., Dahnée, J., 2007. Grundvattennivårer i ett förändrat klimat (No. 60-1642/2007). Institutionen för Geovetenskaper, Uppsala universitet. SMHI.
Selene Xia, B., Gong, P., 2014. Review of business intelligence through data analysis. Benchmarking Int. J. 21, 300–311. https://doi.org/10.1108/BIJ-08-2012-0050
Selin, S., Chevez, D., 1995. Developing a collaborative model for environmental planning and management. Environ. Manage. 19, 189–195. https://doi.org/10.1007/BF02471990
Shams, S., Chen, D., Arevalo, J., Leone, A., Carmona Moreno, European Commission, Joint Research Centre, Institute for Environment and Sustainability, 2013. Water balance study: training manual. Publications Office, Luxembourg.
SMHI, 2017a. Avdunstning [WWW Document]. URL https://www.smhi.se/kunskapsbanken/hydrologi/avdunstning-1.30720 (accessed 4.25.17).
SMHI, 2017b. Hur fungerar en klimatmodell? [WWW Document]. URL https://www.smhi.se/kunskapsbanken/klimat/hur-fungerar-en-klimatmodell-1.470 (accessed 4.25.17).
SMHI, 2017c. Vad är RCP? [WWW Document]. URL https://www.smhi.se/klimat/framtidens-klimat/vagledning-klimatscenarier/vad-ar-rcp-1.80271 (accessed 4.25.17).
SMHI, 2013a. Vattenwebb.
SMHI, 2013b. Vattenweb [WWW Document]. URL http://vattenweb.smhi.se/modelarea/ (accessed 3.20.17).
SMHI, 2011. Specifik avrinning [WWW Document]. URL https://www.smhi.se/klimatdata/hydrologi/vattenforing/avrinningskartor (accessed 6.5.17).
Sundström, M., Sandberg, A., Urberg, C., Götbrink, E., 2017. Tingstäde träsk MKB (MKB), Sweco.

Svenskt Vatten, 2004. Dimensionering av allmänna avloppsanläggningar (No. P90), Publikation.
Waddock, S.A., 1989. Understanding Social Partnerships: An Evolutionary Model of Partnership Organizations. Adm. Soc. 21, 78–100. https://doi.org/10.1177/009539978902100105
Walker, K., Wan, F., 2012. The Harm of Symbolic Actions and Green-Washing: Corporate Actions and Communications on Environmental Performance and Their Financial Implications. J. Bus. Ethics 109, 227–242. https://doi.org/10.1007/s10551-011-1122-4

A. Appendix

A.1. All answers from the questionnaire

A.1.1. Saaremaa

F1: **Which island are you representing in Island Games?**

Saaremaa

F2: **How many years have you been active/engaged in Island Games?**

How many years?	5 <

F3: **How many years have you been working with Island Games?**

12

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	Finance manager

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	Low
industry and commerce (for example absence of businesses or issues related to tourism)?	Moderate
emigration (people leaving the island)?	High

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	High

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

emigration, lack of jobs in island

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

No

F9: **Is your island active in other international collaborations similar to Island Games?**

Yes (please specify in what areas)	B7 islands- different co-operation

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

75

A.1.2. Western Isles

F1: **Which island are you representing in Island Games?**

Western Isles

F2: **How many years have you been active/engaged in Island Games?**

How many years?	5 <

F3: **How many years have you been working with Island Games?**

8 years

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	Sports Development Services Manager (Local Authority)

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	Low
industry and commerce (for example absence of businesses or issues related to tourism)?	High
emigration (people leaving the island)?	Very high

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	High

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

Young people leaving for FE and not returning.
Predicted fall in population.
increasing swing to ageing population.
Lack of well paid jobs.
Government cutbacks - austerity.

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

Yes (please specify)	Pursuing introduction of windfarms but removal of Government grants and lack of undersea cable have stalled progress. There are initiatives such as "Our Islands, Our Future" and multi agency conferences to tackle current and future issues.

F9: **Is your island active in other international collaborations similar to Island Games?**

No

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

70

A.1.3. Aland

F1: **Which island are you representing in Island Games?**

Aland

F2: **How many years have you been active/engaged in Island Games?**

How many years?	5 <

F3: **How many years have you been working with Island Games?**

26

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	Teacher

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	Moderate
industry and commerce (for example absence of businesses or issues related to tourism)?	Moderate
emigration (people leaving the island)?	Moderate

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	Moderate

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

Financial stability towards the Finnish government

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

No

F9: **Is your island active in other international collaborations similar to Island Games?**

Yes (please specify in what areas)	Baltic region collaboration and the Nordic Council

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

53

A.1.4. Jersey

F1: **Which island are you representing in Island Games?**

Jersey

F2: **How many years have you been active/engaged in Island Games?**

How many years?	5 <

F3: **How many years have you been working with Island Games?**

18

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	Not employed by IIGA . Retired engineer

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	Low
industry and commerce (for example absence of businesses or issues related to tourism)?	Moderate
emigration (people leaving the island)?	Low

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	High

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

Tourism

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

No

F9: **Is your island active in other international collaborations similar to Island Games?**

Yes (please specify in what areas)	Finance commerce

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

56

A.1.5. Sark

F1: **Which island are you representing in Island Games?**

Sark

F2: **How many years have you been active/engaged in Island Games?**

How many years?	5 <

F3: **How many years have you been working with Island Games?**

15 years

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	Builder

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	None at all
industry and commerce (for example absence of businesses or issues related to tourism)?	Very high
emigration (people leaving the island)?	Moderate

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	Moderate

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

Bringing new families into the Island

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

No

F9: **Is your island active in other international collaborations similar to Island Games?**

No

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

0

A.1.6. Hitra

F1: **Which island are you representing in Island Games?**

Hitra

F2: **How many years have you been active/engaged in Island Games?**

How many years?	5 <

F3: **How many years have you been working with Island Games?**

10 years

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	I am a headmaster at a school

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	None at all
industry and commerce (for example absence of businesses or issues related to tourism)?	None at all
emigration (people leaving the island)?	Low

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	Don't know

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

My island doesnt have major challenges at the moment. We have good econmy, low unemployment and high wellfare amongst our islanders

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

Yes (please specify)	There are always things that we can learn from each others systems

F9: **Is your island active in other international collaborations similar to Island Games?**

No

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

51

A.1.7. Cayman Islands

F1: **Which island are you representing in Island Games?**

Cayman Islands

F2: **How many years have you been active/engaged in Island Games?**

How many years?	3-5

F3: **How many years have you been working with Island Games?**

6

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	I am the CFO of an Insurance Company for over 30 year but I have been volunteering my services to the Island Games Association due to my overall interest in sports

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	None at all
industry and commerce (for example absence of businesses or issues related to tourism)?	Low
emigration (people leaving the island)?	Low

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	High

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

Cayman economy is build on Tourism and the Financial sector. Both are doing well currently so we not facing the challenges some islands are currently facing with the decline in the economy. Our main challenge currently in managing the global changes affecting offshore jurisdictions especially in the financial sector.

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

Yes (please specify)	They are working with various countries to establish treaties for information sharing in a controlled manner

F9: **Is your island active in other international collaborations similar to Island Games?**

No

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

75

A.1.8. Isle of Wight

F1: Which island are you representing in Island Games?

Isle of Wight

F2: How many years have you been active/engaged in Island Games?

How many years?	5 <

F3: How many years have you been working with Island Games?

10

F4: Is your commitment in Island Games your primary employment or do you have another occupation?

No (please describe your other occupation)	Retired, part time leisure centre worker

F5: What is the general opinion in following question? To what degree is your island suffering from challenges in:

environmental resources (for example freshwater shortage)?	None at all
industry and commerce (for example absence of businesses or issues related to tourism)?	Moderate
emigration (people leaving the island)?	High

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	High

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

Investment in industry and business to bring employment opportunity

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

Yes (please specify)	Not known

F9: **Is your island active in other international collaborations similar to Island Games?**

No

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

3

A.1.9. Orkney

F1: **Which island are you representing in Island Games?**

Orkney

F2: **How many years have you been active/engaged in Island Games?**

How many years?	5 <

F3: **How many years have you been working with Island Games?**

14

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	Media reporter

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	None at all
industry and commerce (for example absence of businesses or issues related to tourism)?	Moderate
emigration (people leaving the island)?	Very high

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	Moderate

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

Affordable transport

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

No

F9: **Is your island active in other international collaborations similar to Island Games?**

No

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

71

A.1.10. Greenland

F1: **Which island are you representing in Island Games?**

Greenland

F2: **How many years have you been active/engaged in Island Games?**

How many years?	< 1

F3: **How many years have you been working with Island Games?**

8 month

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	Organization consultant, arctic winter games, courses

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	None at all
industry and commerce (for example absence of businesses or issues related to tourism)?	Don't know
emigration (people leaving the island)?	None at all

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	Don't know

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

Social issues

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

No

F9: **Is your island active in other international collaborations similar to Island Games?**

Yes (please specify in what areas)	Arctic winter games

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

50

A.1.11. Menorca

F1: **Which island are you representing in Island Games?**

Menorca

F2: **How many years have you been active/engaged in Island Games?**

How many years?	5 <

F3: **How many years have you been working with Island Games?**

10

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

Yes (Island Games is my primary employment)

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	Moderate
industry and commerce (for example absence of businesses or issues related to tourism)?	Moderate
emigration (people leaving the island)?	High

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	High

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

The main business in Menorca is summer tourism, but Menorca would like to get another kinds of business such as sport tourist in winter.

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

Yes (please specify)	No, but I think we need to find out more and sure I will find it us!

F9: **Is your island active in other international collaborations similar to Island Games?**

Yes (please specify in what areas)	We have a Tourisme Assosiation named "Fundació del FOment del Turisme de Menorca"

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

100

A.1.12. Faroe Islands

F1: **Which island are you representing in Island Games?**

Faroe Islands

F2: **How many years have you been active/engaged in Island Games?**

How many years?	5 <

F3: **How many years have you been working with Island Games?**

6 years

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	Iam a sports advisor at the sports confeteration

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	None at all
industry and commerce (for example absence of businesses or issues related to tourism)?	Low
emigration (people leaving the island)?	None at all

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	Moderate

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

We need sportsfacilitis. Bad flightconnections.

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

No

F9: **Is your island active in other international collaborations similar to Island Games?**

No

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

46

A.1.13. Rhodes

F1: **Which island are you representing in Island Games?**

Rhodes

F2: **How many years have you been active/engaged in Island Games?**

How many years?	5 <

F3: **How many years have you been working with Island Games?**

Snce 1996

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	Iam the Rhodes Island Games coordinator, volundier work

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	High
industry and commerce (for example absence of businesses or issues related to tourism)?	Moderate
emigration (people leaving the island)?	High

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	Moderate

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

Invairement, water, energy, trafic.

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

Yes (please specify)	Invarement,

F9: **Is your island active in other international collaborations similar to Island Games?**

No

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

66

A.1.14. Alderney

F1: **Which island are you representing in Island Games?**

Alderney

F2: **How many years have you been active/engaged in Island Games?**

How many years?	3-5

F3: **How many years have you been working with Island Games?**

7 years

F4: **Is your commitment in Island Games your primary employment or do you have another occupation?**

No (please describe your other occupation)	Counter assistant in local post office and newsagents

F5: **What is the general opinion in following question? To what degree is your island suffering from challenges in:**

environmental resources (for example freshwater shortage)?	None at all
industry and commerce (for example absence of businesses or issues related to tourism)?	High
emigration (people leaving the island)?	Moderate

F6: **What is the general opinion in following question? To what degree are other islands suffering from the same or similar challenges as described in previous question?**

Do islands faces similar challenges?	Moderate

F7: **What is the general opinion in following question? What is your island's primary challenge at this moment?**

Travel to and from the island

F8: **Have your island observed potential solutions or interesting solutions to your challenges on other islands?**

No

F9: **Is your island active in other international collaborations similar to Island Games?**

Yes (please specify in what areas)	Arts & Literature festivals

F10: **What is the general opinion in following question? To what degree would your island be interested in a joint collaboration, working towards solving these challenges?**

50

A.2. Modelling the watershed of Tingstäde träsk in ArcGIS

The watershed of Tingstäde träsk were created with the programs ArcMap and ArcCatalog with data from Lantmäteriet. The data that was used were “Höjddata 2m raster”(elevation data), “Ortofoto raster”, “Översiktskartan raster” and “Terrängkartan raster” from the SLU Geodata Extraction Tool (GET), with data from four Swedish agencies: Lantmäteriet, SCB, SGU and Sjöfartsverket. All these rasters have the coordinate system “SWEREF99 TM”.

The data were put in a folder in ArcCatalog and a shapefile called “avrinningsomrade.shp” with the coordinate system ”SWEREF99 TM” was created in the same folder. All files were added to a blank map in ArcMap and a rough outline of the watershed for Tingstäde träsk was drawn with the shapefile created earlier. As a guide for the drawn outline information about watersheds from (SMHI, 2013b) was used. This polygon is then the outline of the extracted elevation data in the watershed. Finding a watershed in ArcMap can be complicated if the algorithm encounters closed low points in the elevation data, by using the tool “Fill” in the Spatial Analyst toolset on the elevation data it prevents this from happening.
After using the Fill-tool on the elevation data the next thing is to decide the flow direction of all the surface water and where it accumulates. The Flow Direction-tool was used with the elevation data as input to find the flow direction and the Flow Accumulation-tool with the raster from the flow direction-tool as input to find out where the water accumulated. Next up a point shapefile was created in ArcCatalog and imported into the map in ArcMap, this pointfile received the same coordinate system as the others. The point was used as the outlet point of the watershed, even this time the watershed information from (SMHI, 2013b) was used as a guide to the location, together with the information were the flow accumulated.

Following the watershed for Tingstäde träsk was produced with the tool “Watershed” and converted to a polygonfile to just be an outline, see the result in figure X together with a comparison of the watershed from (SMHI, 2013b).
To calculate the amount of water contributed by surface run off the landuse in the watershed have to be evaluated. From the data “Ortofoto raster” an evaluation of the landuse was made which generated to split the land in six different sections, every section with a specific run off coefficient, see table X for the different sections and coefficients.