DALARNA UNIVERSITY

Degree Project

Master

Sports venues' effect on social welfare

Cost-Benefit analysis of infrastructure investments within Lugnet area in Falun.

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Abstract:

Economic analysis and evaluation of sport events and sports infrastructure is a widely researched topic, especially when it comes to mega-sports events. As many of major and mega events require large amount of resources, governments and municipalities worldwide have to make decisions regarding support for the events. To determine whether and to what extent events should be subsidised with public resources, a thorough analysis of potential impacts of the event has to be conducted. Most of the studies within this field choose Economic Impact Analysis as a method, while many researchers point out a need for cost-benefit analysis, as only a comprehensive analysis of costs and benefits for society can justify public subsidies for sport events and sports infrastructure. This paper presents a cost-benefit approach of sports venue evaluation. A cost-benefit analysis made in this paper, on the case of Swedish outdoor area of Lugnet, Falun, presents possible effects of sports infrastructure investments on social welfare. Analysis was aimed towards investments made prior to hosting 2015 FIS Nordic World Ski Championships in Falun. Presenting results for three alternative scenarios, this study compares different effects on social benefit. This research paper highlights areas that need to be investigated to ensure the better quality of the results, thus it can be beneficial for further studies of the topic. Results presented in this paper can also be beneficial for policy makers, as many of the potential welfare effects were described.

Keywords: Social welfare, Economic efficiency, Cost-Benefit Analysis, FIS Nordic World Ski Championships 2015, Falun, Skid-VM.

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1. Introduction

From welfare economics point of view, it is highly interesting to investigate various public policies and their impacts on social welfare. Comprehensive analysis of potential costs and benefits of planned actions is a base for efficient policy making within the public sector. With support for hosting major and mega-sports events becoming more common for governments and municipalities, evaluation of sports infrastructure and legitimacy of public subsidies in such investments has become more important. Some claim that with this type of support becoming more popular, evaluation of such investments should treat them as regular public policies and apply same standards as for investments in other public sectors. (Coates and Humphreys, 2008; Dwyer and Forsyth, 2009; Késenne, 2005) Thus, sports infrastructure should be evaluated using same principles as for other types of infrastructure subsidised with public resources. Through analysis of costs and benefits associated with infrastructure investments for the sports event, rather than only analysing event's impact, will provide better understanding of long-run effects on social welfare. (Barget and Gouguet, 2010; Dwyer and Forsyth, 2009; Késenne, 2005; Matheson, 2006; Mules and Dwyer, 2005; Preuss, 2006; Solberg and Preuss, 2007)

As stated by Késenne (2005), there is an overwhelming advantage of impact analyses versus cost-benefit analyses in field of sport events and sports infrastructure evaluation. His paper also points out a need for broader use of cost-benefit analysis in field of sports infrastructure evaluation. This paper attempts to evaluate the effect of investments in sports infrastructure on local residents in the case of a Swedish outdoor area of Lugnet in Falun. Using method of cost-benefit analysis, this paper will investigate positive and negative impacts that infrastructure investments in Lugnet area may have over 25-year period, between 2015 and 2040. A hypothetical alternative of no investments was set up as control scenario. It puts cost-benefit analysis of main scenario in perspective and allows for comparison of results of both analyses.

The purpose of this paper is to investigate the impact investments in sports infrastructure may have on social welfare. Analysis conducted in this research could help policy makers in the evaluation of investments in sports infrastructure from welfare economics point of view. This paper presents a cost-benefit analysis of sports infrastructure in Lugnet area, Falun. These investments were made prior to hosting FIS Nordic World Ski

Championships in 2015 and has been an object of political argument since decision about bidding for the games was made. With about 227 million SEK spent on building or renovating sports venues and surrounding infrastructure, it is important to thoroughly analyse the effects of this investment on the society.

Remainder of the paper will be organised in following manner: literature review, theoretical framework, empirical analysis, discussion and conclusions. Chapter regarding literature review will present relevant approach within the field of sports event and sports venue evaluation, where previous research relevant for this paper will be presented. Further, chapter with theoretical framework will address relevant economic theories and point out importance of this type of evaluation with respect to welfare economics as well as present procedures of conducting a cost-benefit analysis. Later, those procedures will be applied on data obtained from Falun municipality and thoroughly analysed using theoretical framework and guidelines from previous studies presented in preceding chapters. Lastly, in Chapter 5 the results of the research will be critically discussed, making recommendations for further studies.

2. Literature review

Public support for sport events, and events in general, often raises arguments about legitimacy of spending public money that way. There are different views regarding what public resources should be spent on and which investments should be prioritised. It is a difficult job for a government or municipality to decide whether to support organisation of events and to what extent. There is a risk of losing potential profit by being too restrictive with involvement in organising events. On the other hand, decision makers have to take into account exaggerated potential positive impacts often claimed by organisers, otherwise they will run the risk of supporting unbeneficial events. (Késenne, 2005; Solberg and Preuss, 2007)

Regardless which point of view people may have on public support of events, it is common for governments and municipalities to invest in organisation of various sports events around the world. Many countries strive to be in bidding races for sports mega-events and are willing to invest large amount of money to ensure hosting of such events. (Barget and Gouguet, 2010) Therefore, it is important to identify and measure the effects of sporting events on local or national economy to evaluate whether public support for these types of investments is justifiable. Many authors point out the need for further development within the field of sports event evaluation. (Késenne, 2005; Solberg and Preuss, 2007; Porter et al., 1999) Some even suggest that investments or support in sport events should be treated as ordinary public policy and evaluated using the same criteria. (Coates and Humphreys, 2008; Dwyer and Forsyth, 2009; Késenne, 2005; Solberg and Preuss, 2007)

Over the years there have been a number of different attempts within sports event evaluation, with majority of them using two methods – Economic Impact Analysis and Cost-Benefit Analysis. (Késenne, 2005; Dwyer and Forsyth, 2009)

2.1 Studies using Economic Impact Analysis (EIA)

One method used to measure event's effect on society is Economic Impact Analysis. EIA is usually uses input-output modelling to conduct a multiplier analysis. Using multiplier, it converts the total additional expenditure in the city hosting the event to a net income generated within the host city adjusted for leakages. The input-output based EIA is often criticised for inappropriate and overinflated multipliers and ignoring negative effects

(Késenne, 2005; Dwyer and Forsyth, 2009). In his paper, Késenne (2005) also brings up the role that event's size has on evaluation. Input-output model may be appropriate for smaller events as overestimations are not that likely. Same applies for overlooked negative impacts, as small event will probably not have any major negative effects on other parts of regional and national economy, contrary to a mega-sports events. (Késenne, 2005)

In the field of sports economics, many economic impact studies have been made regarding events and investments in sports venues. Many of the studies of economic impact have been made due to interest from national or regional decision makers and further used to justify the public support for these types of investments. (Késenne 2005; Dwyer and Forsyth, 2009)

EIA approach is a popular choice of researchers within the field of sports event evaluation. De Nooij, Van Den Berg and Koopmans (2013) study on social impact of hypothetical organisation of FIFA World Cup in Netherlands and Belgium in 2018 tried to estimate the effect an event of that magnitude may have on the economy and whether it is beneficial for Netherlands to host said event. Martin Müllers (2014) study on impacts of Winter Olympic Games in Sochi 2014 presented immediate financial effects of hosting the event. Including overall costs of building venues and additional operating costs his paper draws conclusions about the value of benefits needed to pay off the investment. No direct calculations of actual benefits of the event or infrastructure investments has been done. A study by Solberg and Preuss (2007) has thoroughly analysed impacts a major sport event may have on tourism. Their study looked at the problem from various angles including many factors that influence the tourism growth.

Regarding more relatable EIA's of sport events for this research, the Swedish Agency for Public Management (2005) has conducted an extensive study at the request of Swedish government on potential impacts of hosting 2014 Winter Olympics in Östersund and Åre. It involved a general cost analysis of infrastructure investments in regards to International Olympic Committee's requirements, analysis of tourism effects of Olympic Games and regional economic analysis of local community. (Swedish Agency for Public Management, 2005)

Similar study has been made on hypothetical 2014 Winter Olympics in Tromsö, where possible regional effects of the event where investigated. (Johansen et al., 2004)

2.2 Studies using Cost-Benefit Analysis (CBA)

CBA is based on principles of welfare economics. It studies which of the money flows in EIA form costs and benefits for the local community. CBA requires extensive data, therefore, not many studies have applied this method for sports events evaluation. (Késenne, 2005) Regarding evaluation of purely infrastructure investments for an event through CBA, none prior studies in the field has been found.

An *ex ante* cost-benefit analysis of Winter Olympics in Vancouver 2010 (Shaffer et al., 2003) has investigated event's impact on the region of British Columbia through analysis of five accounts: government financial account – where the net return or cost to taxpayers was investigated; resident/consumer account – analysis of net benefit to British Columbians as consumers of the event; environmental account – where event's effects on the environment where studied; economic development account – regarding income and employment effects; and social account – considering community and social impacts. (Shaffer et al., 2003)

Generally, majority of researches within the field are *ex ante* studies on the request from event organisers used to support application for hosting major events. (Kasimati, 2003) There is a lack of *ex post* studies that compares before and after effects of events in general. (Kasimati, 2003; Késenne, 2005; Swedish Agency for Public Management, 2005)

As for researches that would specifically evaluate investments into sporting venues and their impact on social welfare in a long run, such study has not been conducted prior to this paper, although many authors point out a need for such evaluation (Davies, 2011; Matheson, 2006; Mules and Dwyer, 2005; Müller, 2012; Preuss, 2006; Solberg and Preuss, 2007).

Regarding the chosen method of evaluating the event's impact, a cost-benefit analysis allows for a more accurate and realistic results, given that correct data is obtained (Barget and Gouguet, 2010; Késenne, 2005; Mules and Dwyer, 2005).

Due to the nature of cost-benefit analysis and resources required to conduct one, application of this method has not gained support of researchers within this field, even though

only assessment of costs and benefits and comprehensive analysis can justify and support governmental funding of a project. (see, Davidson and Schaffer, 1980; Baade and Dye, 1990; Crompton, 1995; Noll and Zimbalist, 1997; Késenne, 1998; Porter et al., 1999; Preuss, 2006; Siegfried and Zimbalist, 2000; Dwyer and Forsyth, 2009)

In their study of the impact of sports venues on area development, Baade and Dye (1990) pointed out the need for analysis of public subsidies for sports venues. Their study highlights direct and indirect economic impacts of major sports stadiums in United States with respect to development of the areas surrounding the venues. In their study, Baade and Dye emphasised imperfections of impact studies and pointed out the necessity for long-run cost and benefit studies. (Baade and Dye, 1990)

Crompton (1995), in his article regarding Economic Impact Analysis of sports facilities and events summarized misapplications and imperfections associated with EIA models. He stated that wide use of multipliers often leads to exaggerated economic benefits, which in turn encourages government to unwisely invest public resources. Through misuses of EIA presented in his article, he points out analysis of costs and benefits as more appropriate to justify public subsidies into sports venues. (Crompton, 1995)

Similar recommendations were made by Siegfried and Zimbalist (2000) in their study analysing public subsidies for major sports venues in United States. In their paper, Siegfried and Zimbalist argue upon motives for public support of sport infrastructure and point out a need for extensive analysis of these types of investments. They also point out possible impacts, both positive and negative, a new venue may have on local economy, as well as people involved in professional sports like players, managers, owners and sponsors. (Siegfried and Zimbalist, 2000)

Critique of impact analysis and importance of cost-benefit analysis with respect to sports infrastructure has also been highlighted in Dwyer and Forsyth's (2009) article ¨Public Sector Support for Special Events¨. Their study presented challenges regarding both methods, along with common misapplications. The article compared results of both methods used to evaluate the impact of Formula One Grand Prix in Melbourne, Australia. Results of their study pointed out the over exaggerated results of the impact study versus cost-benefit analysis. Commenting on the outcome of their analysis, Dwyer and Forsyth recommend to

use both types of analysis simultaneously, as some of the factors calculated through impact analysis form important components of cost-benefit analysis, e.g. business and labour surpluses.

3. Theoretical Framework

This chapter presents the economic theories relevant for this paper. Firstly, an explanation of welfare economics is presented, further an explanation of welfare efficiency is followed by an explanation of public goods. Lastly, procedures for CBA, cultural evaluation and Monte Carlo simulation are presented.

3.1 Welfare economics

In economics an individual's consumption is limited by his or hers budget constraint. Therefore, it is necessary to make choice between different alternatives and strive for most effective allocation of said budget. In welfare economics, same principle applies to societies where scarce resources of labour, capital, natural resources etc. have to be used in the most efficient way possible. (Just et al., 2004) At any given point in time the amount of resources can be considered as fixed, inferring the fact that trade-offs must be made. To gain something, we have to give something up. (Johansson, 1991) Welfare economics set up the criteria for evaluating consequences of various policies, e.g. imposing a new tax, and guidelines for evaluation of policy's impact on society. (Johansson, 1991; Just et al., 2004)

Rational decision-making in public sector implies an understanding of the costs and benefits associated with proposed policies. A tool enabling thorough analysis of social impact of a project is cost-benefit analysis. This approach is characterised by measuring in monetary unit the effects of a project on social welfare. By including not only direct costs and benefits of a project, but also considering underlying effects on other areas gives a better understanding of projects' impact on society's welfare. The goal of social cost-benefit analysis is to identify and include all effects and express the unobservable change in welfare into observable monetary units. (Johansson, 1991) These effects may be both negative and positive and affect society in different ways depending on the nature of the project. By neglecting some factors in analyses, major impacts on social welfare are overlooked, thus emphasis on importance of cost-benefit analysis in the context of social welfare maximisation. (Just et al., 2004)

As governmental or municipal fund are limited, not every project can be undertaken. Hence, investigating net social benefits of policies allows decision makers to choose a set of projects that maximises social welfare, subject to funding constraint. Given the proper

empirical base of said analysis, welfare economics provide guidelines on above mentioned issues. (Hultkrantz and Nilsson, 2004) Due to limitations of cost-benefit analysis, it often cannot be the only source of information in decision-making. Typically, the policy-maker takes project's private profitability, impact on governmental or municipal budget, political consequences etc. into consideration. (Johansson, 1991; Just et al., 2004)

Ultimately, a project or a policy should result in a positive net present value of social benefits to be considered. Out of all possible projects the government or municipality should choose a set of projects that maximises the total social welfare. (Johansson, 1991; Bohm, 1996; Hultkrantz and Nilsson, 2004; Just et al., 2004)

3.2 Efficiency and externalities

Welfare economics and economics in general are characterised by scarce resources. That implies that there is a need for efficient allocation of these resources. A goal to pursue in welfare economics is finding an allocation that maximises welfare through maximising each individual's utility. That state is described as Pareto-efficient. (Johansson, 1991, p.10-21; Bohm, 1996, p.19-25; Just et al., 2004, p.15)

Pareto efficiency defines a situation where no alternative allocation of resources can benefit an individual without making someone else worse of. Although there is an exception in Pareto theory called Kaldor-Hicks criteria, which allows for an alternative allocation of resources that would benefit some parties and leave other worse off if, hypothetically, ¨winners¨ can compensate ¨losers¨ and still be better off than before. (Johansson, 1991, p.22-23; Just et al., 2004, p.32-33)

Above mentioned theories do not take externalities into consideration. Externalities are positive or negative effects a certain good or service may have on non-consumers. They are a by-product of consumption or production that affects markets that they are not traded on. An example of a negative externality may be pollution caused by a factory. A positive externality may be e.g. an increase in value of nearby properties due to newly built shopping mall. Externalities may cause so called ¨missing markets¨ as, e.g. a water or air pollution of a factory affects the environment but is not considered nor compensated for by the factory

owner, resulting in market failure. (Johansson, 1991, p.120-121; Bohm, 1996, p.45-65; Just et al., 2004, p.527)

3.3 Public goods and services

A public good is a term in economics used to describe goods or services that are both non-rivalrous and non-excludable. Rivalry refers to a situation when one consumers' consumption restrains or prevents others consumption. An example of that is gold mining or timber stock. Scarcity of those resources and limited access to them prevents unlimited consumption of these goods. In regards to excludability it describes a good or a service which consumption can be restrained and limited solely to people who have paid for it limiting free-riding. (Bohm, 1996, p.66; Frank and Bernanke, 2009, p.398-399)

In case of the investments in Lugnet area, these are, in some sense, public goods, as they are not rival, but some can be excludable to some extent. *Id est* funicular tickets exclude free riders from enjoying panorama view of Falun from ski jumping tower. As for non-rivalrous and non-excludable good a case of cross-country skiing tracks is an example. Given there are no competitions or ongoing preparations for upcoming events, cross-country tracks are available for the general public for free. (Lugnet i Falun AB, 2016c)

3.4 Cost-Benefit Analysis

Cost-benefit analysis is an evaluation method widely used by the governments, as well as private businesses, to evaluate desirability of a policy. Many infrastructure projects like dams, highways, railroads are subject of CBA ordered by governments. Through analysis of the present value of expected future benefits and costs, it determines whether a policy or a project would be efficient from welfare economics point of view. Comparison with status quo or alternative projects determines whether it should be undertaken or not. Depending on the chosen approach, it takes into account various financial and non-fiscal effects of the investigated project. The biggest challenge associated with CBA is monetisation of non-market effects of a policy or a project, both negative and positive. Comprehensive cost-benefit analysis is both time and resource consuming and it strongly relies on the quality of provided data. (Boardman et. al, 2014; Layard and Glaister, 1994)

According to Boardman et al. (2014) there are nine steps one should take while conducting a CBA. These steps were presented in detail below and form a base on which this study is grounded on.

- **Specifying possible scenarios**

To start of one has to identify what are the possible outcomes or projects that can be undertaken. In case of this study, three scenarios were investigated. Details regarding these are thoroughly presented in section 4.2.

- **Identifying cost and benefits of a project**

Firstly, one has to choose an angle to approach evaluation. It is crucial to be able to identify cost and benefits and allocate them properly. In case of this study, evaluation will be conducted from municipality and its residents' standpoint. All of the costs and benefits regarding this will be described thoroughly in Chapter 4.

- **Identifying the impacts and select measurement indicators**

This step requires an analysis of all costs and benefits and finding a right measurement indicator for these. This paper will use Swedish krona (SEK) as a currency. Methods for monetising some of the impacts will be described in empirical part of this paper.

- **Predict the impacts over the life of the project**

Further, one has to decide for how long will the costs and benefits last. This paper analysed the investments in Lugnet area over 25-year period between 2015 and 2040 for all scenarios.

- **Monetising the impacts**

Fifth step requires attaching a monetary value to all costs and benefits used in evaluation. As stated above, this research will use 2015 Swedish krona (SEK) as a currency to monetise all the impacts.

- **Discount costs and benefits to present values**

In the sixth step it necessary to bring costs and benefits to present values using a discount rate. Formulas for discounting costs and benefits are listed below, where PV(B) is present value of benefits, PV(C) is present value of costs, n=lifetime of the project, t=year that is being discounted and s=discount rate (see equation 1 and 2).

$$PV(B) = \sum_{t=0}^{n} \frac{B_t}{(1+s)^t} \quad (1)$$

$$PV(C) = \sum_{t=0}^{n} \frac{C_t}{(1+s)^t} \quad (2)$$

- **Compute the net present value of a project**

Next step in the model is to calculate a Net Present Value (NPV) for a project (see equation 3). This has to be done in order to be able to compare different projects. As for *ex ante* evaluation, we hope for NPV to have a positive value. To get a Net Present Value, one has to subtract present value of costs from present value of benefits. It is calculated using following formula:

$$PV(B) - PV(C) = NPV \quad (3)$$

- **Perform sensitivity analysis**

After obtaining Net Present Values, a sensitivity analysis is conducted to check how sensitive these values are to changes in parameters. This can be done with focus on e.g. discount rate, inflation or exchange rate. In case of this research, sensitivity analysis will

utilise Monte Carlo simulation further described in section 3.5. Details regarding simulated parameters will be described in section 4.5.

- **Reach a conclusion**

Finally, a conclusion must be drawn and suitable recommendation should be made, regarding which project to choose. As this research is dealing with *ex ante* evaluation, conclusion chapter of this research will point out potential room for improvement for organisers.
(Boardman et al. 2014, p. 6-15)

3.5 Valuation of non-market goods

One of the core components of comprehensive cost-benefit analysis is putting a price tag on non-monetary benefits or costs. Estimation of these types of effects uses methods common in non-market goods valuation. Non market goods are commodities that have positive or negative impact on an individual's utility, but are not traded on any market. Examples of such goods are water pollution, visibility, noise, view from apartment window etc. (Bockstael and McConnell, 1993)

As stated by Choi et al. (2014) evaluation of non-market goods can be divided into two parts: stated preferences and revealed preferences. Stated preferences is a questionnaire based research that aims to find out possible future behaviour of consumers on specific markets. Using stated preferences one can create a hypothetical market there the item in question can be bought. Questions are aiming to research consumers' willingness to pay. (Choi et al., 2014)

For revealed preferences, an estimation of willingness to pay is made based on observed consumer's behaviour. It assumes that consumers' preferences can be revealed by their purchasing habits, e.g. if a consumer buys bundle of goods X instead of bundle of goods Y, given that both bundles are affordable, it is revealed that the consumer directly prefers X over Y. It is also assumed that preferences are constant over the observed period of time, meaning that consumer will not change their preference regarding X and Y. (Samuelson, 1948)

As Lugnet area has been a host for many sports events in the past and has been a part, if not the main one, of Falun's trademark, it certainly possesses some cultural and historical value. Due to limited time and resources, this kind of evaluation has not been done. It would be highly interesting and relevant for research presented in this paper to have access to this type of data.

Same approach of valuation could be applied to other non-market goods that were identified in this paper, like value of local pride, value of medal success, value of media exposure, along with other factors described in section 4.3.3

Ideally, this types of researches would be conducted in advance to ensure the quality of the results. As no such research has been made, it is important to assess the results, having in mind the omitted value of media exposure.

3.6 Monte-Carlo Simulation

Monte-Carlo Simulation method is extensively used in many quantitative researches in the field of operational research, statistics and nuclear physics, where problem's variety requires resources beyond ones provided by theoretical mathematics. This method is sporadically used in other fields of science as chemistry, biology and medicine. It introduces element of randomness into the analysed data allowing to account for risk factors. It can also be used as a scenario analysis with respect to different assumptions made. (Hammersley, 2013)

As for this research paper, it was used to conduct sensitivity analysis on uncertain factors, e.g. cultural value, impact of future events hosted in Lugnet area, tax revenue from additional consumption etc. The value of parameter is obtained using equation 4. Following equation includes γ which randomly takes values between 0 and 1, α being higher and β lower limits for tested parameter.

$$CV_1 = (\gamma \times (\alpha - \beta)) + \beta \qquad (4)$$

Using equation 4, one can test the impact of changes in assumed cultural value on results. By setting up a range of values one can include the results of the equation into the calculations over multiple trials and analyse statistical characteristics of final results. In case of this

research, many unknown parameters were tested simultaneously over 1000 trials, all using equation 4. The variable γ has continuous uniform distribution with probability density function as follows:

$$f(x) = f(x) = \begin{cases} \frac{1}{b-a}, & for\ a \leq x < b \\ 0, & for\ x < a\ or\ x > b \end{cases} \quad (5)$$

All parameters used in simulation and their ranges are thoroughly described in section 4.5

4. Data and empirical analysis

This chapter will briefly present the case of Lugnet area, define investigated alternatives and described costs and benefits associated with all scenarios. Finally, results of analysis will be presented and commented on along with results of the sensitivity analysis.

4.1 Case of Lugnet area

Lugnet area is a central spot of sports activities in Falun. Sports infrastructure consists of 2 ski jumping hills, nearly 30 km of cross-country tracks, a bandy arena, 2 outdoor and 1 indoor ice hockey rinks, a curling hall, an athletics arena with football field, a floorball arena, outdoor and indoor pool, 2 outdoor tennis courts and an indoor tennis facility. All located in the close neighbourhood of Lugnet high school, University Dalarna, Scandic Hotel and Dala Sports Academy, Sweden's biggest and the most advanced research centre for sports. All of those facilities are regularly used by over 50 sports clubs. (Lugnet, 2016a)

Up to date, Lugnet area has been hosting FIS Nordic World Ski Championships four times, in 1954, 1974, 1993 and 2015 (Falun Municipality, 2016). Last years' championships are of particular interest for both researchers and public, as large investments, in terms of amount of money spent, have been made. To thoroughly analyse the effects of an event itself and investments surrounding it had on local community could help decision makers with future allocation of public resources.

Regarding the investments made for World Ski Championships 2015, the most resource-intensive of them were ski jumping hills, which consumed almost 70% of total money invested. Both hills were built in 1973 for World Ski Championships that took place one year later and have not had a major renovation since then, which explains the need of modernising them. The investments were primarily made into ski hills in-run tower, out runs, referee and coaches' stands as well as funicular that takes athletes to the top of the hill and on the days off serves as a tourist attraction. (Lugnet i Falun AB, 2016c)

Spectator stand for ski jumping competition was outdated and needed an investment as well. No seats, steep, uneven path leading to stands were the issues that had to be addressed. Nearly entire area surrounding supporter, referee, coaches' stands and out-run of hills were renewed and modernised to meet current standards. Cross-country part of Lugnet

area also received a facelift with new waxing cabins, new run-up and finish with additional service facilities as well as a tunnel for supporters and a new entrance. (Lugnet i Falun AB, 2016c)

Above mentioned investments were absolutely crucial to be able to host FIS Nordic World Ski Championships in 2015, but the thought process behind investments was a long-run vision that would allow the city of Falun to be in the bidding races for multiple future championships, with 2026 championships as the next event of interest. (Reutherborg, M., Development Manager in Falun Municipality, personal communication, 14 April 2016) (Ingeström, C., J., CEO of Visit Dalarna, personal communication, 6 April 2016).

4.2 Definition of alternatives

Proper cost-benefit analysis requires comparison of results across alternatives to draw conclusions about project's efficiency. In the case of this study main scenario is the current status quo, later referred to as Scenario 1, after the FIS Nordic World Ski Championships 2015, including all benefits and costs associated with it. Scenario 2 takes into account possibility of hosting future championship event. It was assumed that the city of Falun will be a host of FIS Nordic World Ski Championships in 2026. That assumption was made based on expressed desire from people involved in Falun Municipality. (Reutherborg, M., Development Manager in Falun Municipality, personal communication, 14 April 2016) (Ingeström, C., J., CEO of Visit Dalarna, personal communication, 6 April 2016). Third alternative is a hypothetical scenario if none investments were made, which implies that events in 2015 and 2026 would never take place in Falun, further denoted Scenario 3.

The main difference between scenarios involves FIS Nordic World Ski Championships. Scenario 1 hosted the event only in 2015, Scenario 2 in both 2015 and 2026. In the case of Scenario 3, no such event would take place over the analysed period. As for the Cross-Country World Cup events, all three scenarios are assumed to host these events annually. Benefit from the event was assumed to be constant over time. Further, distinctions between alternatives are described in detail in following chapters of this paper.

4.3 Data

This chapter presents the data used in analysis and assumptions made due to incomplete or missing data. Costs and benefits used in analysis were presented, as well as possible effects that have not been monetise, thus not included in analysis, were discussed.

4.3.1 Costs

Data regarding initial investment into building new infrastructure or revitalising existing one was gathered directly from LUFAB (Lugnet i Falun AB, 2016b), a public company that owns facilities in Lugnet area and is responsible for cost and revenue streams occurring within the area. The total cost of infrastructure investments summed up to roughly 227 million SEK. The major part of these costs has been depreciated over 30 years with some even up to 60 years. For more detailed information about renewed or built infrastructure see appendix. (Appendix, Table A1).

As this paper conducts an analysis over 25 years, remaining costs after that period formed a residual value attributed to year 25.

Cost of the investments prior to hosting future FIS Nordic World Ski Championship in 2026 used in Scenario 2 was assumed to be 40 million SEK, based on rough estimations, and will be a subject of sensitivity analysis where its value is going to range from 20 to 80 million SEK. (Reutherborg, M., Development Manager in Falun Municipality, personal communication, 14 April 2016) This value represents additional investments that may be required to meet FIS criteria and takes into account renovation costs as well as cost for setting up temporary infrastructure needed for the event.

Regarding maintenance costs for Scenarios 1 and 2, facilities that has been renewed prior to 2015 have different warranties depending on the facility, thus any issues with major construction renovation needed, will be covered by companies responsible. (Lugnet i Falun AB, 2016c) Budget for maintenance of facilities for year 2016 allocates 16 million SEK of total maintenance cost. As it also consists of salaries for people involved in maintenance operations, it was assumed that 10 out of 16 million SEK forms a cost to society. It has assumed to be constant over time, although LUFAB (2016c) believes that some of the costs may increase after 10 to 15 years. Ideally an alternative cost of resources used for

maintenance of facilities should be included, however, limited access to this data restricted this part of analysis. Therefore, above described method of approximation was used to estimate the opportunity cost of mentioned resources.

As for Scenario 3, it was assumed that operating costs would increase by 5% every 5 years. That assumption was made based on discussion with Development Manager in Falun Municipality, who stated that it is highly likely to expect that if none investments were made prior to FIS Nordic World Ski Championships, the operating costs, including renovations, would increase over time, to preserve Lugnet area's condition prior to made investments. (Reutherborg, M., Development Manager in Falun Municipality, personal communication, 14 April 2016)

As alternative policies that could have been subsidised using public money are unknown, it is difficult to estimate opportunity cost for resources invested in Lugnet area. Opportunity cost refers to the value of the best alternative not taken when a decision to spend public resources is made. (Archer, 1977, p. 46)

Therefore, it has been assumed that the opportunity cost is equal with the actual cost of investments. Further long-run analysis could show the alternative use of mentioned resources that would benefit society in some way, thus the value of costs used in future studies should take opportunity costs into account.

4.3.2 Benefits

Primal benefits come from the spectators attending annual Cross-Country World Cup competitions hosted in Falun. In a research by Heldt and Olofsson (2012), they have estimated the regional economic impact of 25 000 visitors at 10 million SEK. This was calculated based on the questionnaire study on visitor spending. That number represents additional revenue due to the event taking place. It was assumed that the benefit from that will measure to 5 million SEK per year and is constant over time. As for the 2015 FIS Nordic World Ski Championships, based on Ipsos' (2015) calculations on tourist consumption, the total consumption in the Falun region due to the event was reported to be around 150 million SEK. An assumption has been made that half of that amount forms a benefit for the local community, and will also be a subject to sensitivity analysis.

Facilities located in the Lugnet area are rented by various sports clubs over the year and generate an income for the municipality. (Lugnet i Falun AB, 2016c) As no actual reports of the revenue streams from Lugnet facilities could have been accessed, an assumption of its value had to be made. It was assumed that the benefit towards local community from revenue generated by facilities is 5 million SEK a year. Additional assumption was made in regards to this value being constant over the period of analysis. This value represents both benefit generated towards local community through visitor spending within the Lugnet area over the year, as well as the benefit for all athletes, coaches, supporters, sponsors from activities taking place in facilities within Lugnet area over the year.

There are plans from people involved in organisation of the FIS Nordic World Ski Championships 2015 to bid on an event in 2026. (Ingeström, C., J., CEO of Visit Dalarna, personal communication, 6 April 2016) Scenario 2 takes possibility of hosting future championship event into account, therefore costs and benefits associated with that has to be included. It has been assumed that Falun will host FIS Nordic World Ski Championships one more time over this period, in 2026. Estimated benefits of that event were assumed to be identical to ones from 2015.

Additional benefit included in the analysis is tax revenue due to the event. It was estimated that event in 2015 gave an additional revenue from tax by 20 million SEK (Ipsos, 2015). This value was also applied to year 2026 in Scenario 2.

As no studies regarding the actual cultural or historical value of Lugnet has been made, it had to be estimated. In following calculations, a value of 5 million SEK was assumed and it will be subject of sensitivity analysis. That value forms a benefit in all scenarios, as regardless of the investments, Lugnet area would have a value, cultural or historical, for the local community. Estimation was based on previous studies regarding willingness to pay (WTP) for football stadiums in Germany and Poland. In case study made on Germans WTP for arenas hosting 2006 World Cup, an average value of €10,07 per capita was found. (Heyne et al., 2007) Similar study made in Poland regarding venues hosting 2012 European Championships exhibited the value of WTP for having a venue in the city of Gdańsk of €17.61 per capita. (Zawadzki, 2015) The cultural value of 5 million SEK for Lugnet implies a per capita WTP of 87,49 SEK given 57 151 residents of Falun county

(Statistics Sweden, 2016). As the value used in the calculations is only an assumption, actual calculations of WTP for Lugnet area are needed to ensure to quality of the results.

4.3.3 Non-monetised effects

Extensive cost-benefit analysis requires a lot of time and resources that this research unfortunately lacks. Due to that fact, some of the effects could not be monetised and included in calculations.

One of such effects is a value of media exposure that city of Falun received while hosting the event. It has been found that around 500 million people watched the event live on TV (Falun Municipality, 2016). It is really difficult to monetise the effect of reaching that group, as no methods have been developed to set a price tag on media exposure of that calibre. Possible solution to that question would be to estimate the cost of reaching same number of people with advertisement, although it would not be very efficient in terms of providing a realistic value of that benefit. (Kee and Hassan, 2006, p.50)

In addition to media exposure, a possible change in public perception of the city of Falun may have occurred. There is an evidence in case of Olympic Games hosts that recorded positive impacts on tourism and tourism investment due to the legacy of being former host cities to an event of that magnitude. (Ritchie and Smith, 1992)

Another effect that was not monetised in this paper is the effect event and investments had on labour market. In Ipsos' research (2015), it was estimated that the tourists' consumption during championships lead to around 200 new full-time man-years. As there is no information regarding the industries that benefited with those newly created job opportunities, there is no way of monetising them. Further research into this subject could show the impact event had on unemployment. Without having access to said data, such effect was not monetised and will not appear in further calculations.

Similar estimation was done in regards to construction market, where estimated effect on labour market was 50 full-time man-years per year over 3 years of construction work prior to the event. As this research focuses on years 2015-2040, this was not included in the analysis.

Apart from investments within the Lugnet area, the city of Falun modernised travel centre (railway station, bus station and connecting roads) prior to the event. It was one of the requirements of International Ski Federation (FIS) and was also stated in the proposal while bidding for the event. (Ingeström, C. J., CEO of Visit Dalarna, personal communication, 6 April 2016) As this investment was in municipality plans regardless of hosting the event, it was not included in the analysis. On the other side, organising the event advanced the investment in travel centre, that otherwise could have been stalled for years (Reutherborg, M., Development Manager in Falun Municipality, personal communication, 14 April 2016). Therefore, a possible factor that could have been included in this study is the potential benefit for the Falun residents of having a renewed travel centre sooner. Due to lack of research in this field, that effect was also not included.

Popularisation of cross-country skiing and ski jumping due to hosting the championships and boosting the number of participants in those disciplines was not measured and is not present in further analysis. As magnitude of this effect and the benefits or costs associated with the increased number of athletes occur under long period of time, it is hard to estimate and monetise its impact. Further studies within this field are required to include those effects in calculations.

Another long term effects of the investments and events hosted at Lugnet may be positive externalities on the ski equipment market, health care, overall tourism sector and the local labour market. Ski equipment market could experience an upward shift of the demand curve due to more participants within the cross-country skiing. Same effect could impact the tourism sector due to the increased number of tourists. As for the local labour market, attractiveness of the city of Falun for investors and new companies could have increased due to the media exposure which could lead to more businesses opening on the local market, leading to higher demand for employees (Ipsos, 2015). Above mentioned effects are in nature long-run effects therefore could not be included nor estimated due to the uncertainties surrounding them.

Due to the lack of data regarding environmental impacts of investments or events taking place in the Lugnet area, some assumptions had to be made. It was assumed that renewed or newly built infrastructure did not have any impact, positive or negative, on the environment. This assumption was made based on the fact that most of the infrastructure was

already in place prior to made investments. There may have been some side effects of the construction work or materials used in the process. Possible positive impacts due to investments made in the water, electricity and heating supply infrastructure may also be the case. Nature of environmental is case-specific and hard to estimate without in-depth investigation of those issues (Schaffer et al., 2003), therefore could not have been included in this paper.

It is important to mention the intangible effects in terms of local pride from purely hosting the World Championship event or value of medal success at the home venue. Humphreys' et al. (2011) paper estimated the value of medal success at 2010 Winter Olympic Games to Canadians. Their study showed that hosting the event resulted in increased willingness to pay (WTP) for medal success and increased pride from athletic performance during Olympic Games. (Humphreys et al., 2011). Kavetsos' (2012) empirical study investigated national pride associated with 2000 UEFA European Championships. It indicated that individuals from host and winning nations report higher levels of national pride in the period following the event, supporting the theory of events' positive impacts on individual satisfaction. (Kavetsos, 2012) Results of studies, similar to ones above, made on Falun residents would be highly interesting and relevant for analysis presented in this paper. Unfortunately such study has not yet been made.

Investments made in Lugnet area may have had an impact on Lugnet's cultural or historical value. This impact may be positive or negative, depending on individual preferences. Some may argue that modernisation of the facilities increased their value, while others may state that the area was more attractive prior to the investments. Without extensive studies in this field prior to this paper, such effects could not have been included in this analysis. However, it would be beneficial for the future studies to consider including this effect.

4.4 Empirical Analysis

Using CBA guidelines revised in Chapter 3, an analysis of scenarios described in section 4.2 was conducted, using data presented in section 4.3. In this chapter the differences between scenarios' costs and benefits were thoroughly described and explained.

For Scenario 1, cost portion of the analysis per year consists of following factors: Renovation and construction costs, prior to event in 2015, based on LUFAB's accounting calculations (Lugnet i Falun AB, 2016b), plus 10 million SEK of operating costs per year for maintenance of facilities. Costs in year 25 of the project consist of residual renovation costs depreciated and accounted for in years after 2040. Costs in year 2026 include estimate of hypothetical investments for hosting FIS Nordic World Ski Championships in 2026.

On the benefit side, tax revenue and the profit from visitors' consumption during cross-country world cup is included in values of 2 and 5 million SEK respectively. In addition, a 5 million SEK operating benefit from regular use of Lugnet facilities has been included. For year 2015, hosting the FIS Nordic World Ski Championships, assumed 75 million SEK benefit from tourist consumption and 20 million SEK tax revenue (Ipsos, 2015) has been included. Operating benefit from Lugnet facilities is also included for these years.

To allow for better understanding of distinctions between the scenarios, a summary of effects included in the analysis is presented in Table 1.

Table 1. Summary of analysed effects

Scenario 1	**Scenario 1**	**Scenario 3**
+ Benefits from 2015 FIS Nordic Ski Championships + Benefits from cross-country World Cup events + Cultural/historical value + Operational benefits from facilities + Additional tax revenue - Cost of infrastructure investments - Operational costs for facilities	+ Benefits from 2015 and 2026 FIS Nordic Ski Championships + Benefits from cross-country World Cup events + Cultural/historical value + Operational benefits from facilities + Additional tax revenue - Cost of infrastructure investments - Operational costs for facilities - Cost of investments for 2026 event	+ Benefits from cross-country World Cup + Cultural/historical value + Operational benefits from facilities + Additional tax revenue - Operational costs

Including effects listed in Table 1, cost-benefit analysis for each scenario was conducted. Results of analysis for each scenario will be presented and discussed separately, followed by sensitivity analysis for all three scenarios.

Using data described in section 4.3, adequate costs and benefits for Scenario 1 were identified and monetised. Table 2 presents a summary of costs and benefits.

Table 2. Cost-benefit summary Scenario 1

Calendar year	Project year	Costs	PV of Costs	Benefits	PV of Benefits
2015[1]	0	16 903 812	16 903 812	105 000 000	105 000 000
2016	1	16 903 812	16 253 665	12 000 000	11 538 462
2017	2	16 903 812	15 628 524	12 000 000	11 094 675
2018	3	16 903 812	15 027 427	12 000 000	10 667 956
2019	4	16 903 812	14 449 449	12 000 000	10 257 650
2020	5	16 903 812	13 893 701	12 000 000	9 863 125
2021	6	16 903 812	13 359 328	12 000 000	9 483 774
2022	7	16 903 812	12 845 508	12 000 000	9 119 014
2023	8	16 903 812	12 351 450	12 000 000	8 768 282
2024	9	16 903 812	11 876 394	12 000 000	8 431 041
2025	10	16 903 812	11 419 610	12 000 000	8 106 770
2026	11	16 903 812	10 980 394	12 000 000	7 794 971
2027	12	16 903 812	10 558 071	12 000 000	7 495 165
2028	13	16 903 812	10 141 991	12 000 000	7 206 889
2029	14	16 903 812	9 761 530	12 000 000	6 929 701
2030	15	16 903 812	9 123 682	12 000 000	6 663 174
2031	16	16 431 236	8 772 771	12 000 000	6 406 898
2032	17	16 431 236	8 435 357	12 000 000	6 160 479
2033	18	16 431 236	8 110 920	12 000 000	5 923 537
2034	19	16 431 236	7 798 962	12 000 000	5 695 709
2035	20	15 234 680	6 952 909	12 000 000	5 476 643
2036	21	15 234 680	6 685 490	12 000 000	5 266 003
2037	22	15 234 680	6 428 355	12 000 000	5 063 465
2038	23	15 234 680	6 181 111	12 000 000	4 868 716
2039	24	15 234 680	5 943 376	12 000 000	4 681 458
2040	25	74 325 430	27 880 718	12 000 000	4 501 402

(1) Year hosting FIS Nordic World Ski Championships

Calculations of Net Present Values shown in Table 2 were made using 4% discount rate, proposed by the Swedish Transport Administration (2005). In order to determine whether Scenario 1 is efficient in terms of welfare economics, Present Values of cost and benefits were summed up and, using equation 3, a value of Net Present Benefit was calculated. Result of this calculation is presented in Table 3.

Table 3. Results of CBA of Scenario 1 in SEK

Total Costs	PV of Costs	Total Benefits	PV of Benefits	Net Present Benefit[(1)]
486,2 million	297,7 million	405 million	292,4 million	-5,3 million

[(1)] Calculated using equation 3.

As shown above, analysis of Scenario 1 resulted in negative value of Net Present Benefit., implying that the project is not efficient from welfare economics point of view and would have a negative impact on residents of Falun. As Present Value of Costs is greater than Present Value of Benefits, implying that over 25 year period, local residents would experience a loss in welfare of 5,3 million SEK due to made investments. Depending on the accuracy of made assumptions and estimations, true effects may differ from one showed above, therefore a need for sensitivity analysis. Also, some effects that, most likely would increase the value of Net Present Benefit, i.e. the value of media exposure, effects on labour market, local pride etc., could not been included in due to lack of data.

To be able to assess results shown above, an analysis of control scenarios has to be made. Following analysis of Scenario 2, including the costs and benefits of hosting future FIS Nordic World Ski Championships, was made based on data listed in chapter 4.3. As described previously, only difference between scenarios 1 and 2 is taking into account possibility of hosting future championships in the analysis. All of the remaining components on both cost and benefit side remain the same. Summary of values for costs and benefits included in analysis of Scenario 2 is represented in Table 4.

Table 4. Cost-benefit summary Scenario 2

Calendar year	Project year	Costs	PV of Costs	Benefits	PV of Benefits
2015[1]	0	16 903 812	16 903 812	105 000 000	105 000 000
2016	1	16 903 812	16 253 665	12 000 000	11 538 462
2017	2	16 903 812	15 628 524	12 000 000	11 094 675
2018	3	16 903 812	15 027 427	12 000 000	10 667 956
2019	4	16 903 812	14 449 449	12 000 000	10 257 650
2020	5	16 903 812	13 893 701	12 000 000	9 863 125
2021	6	16 903 812	13 359 328	12 000 000	9 483 774
2022	7	16 903 812	12 845 508	12 000 000	9 119 014
2023	8	16 903 812	12 351 450	12 000 000	8 768 282
2024	9	16 903 812	11 876 394	12 000 000	8 431 041
2025	10	16 903 812	11 419 610	12 000 000	8 106 770
2026[1]	11	56 903 812	36 963 631	100 000 000	64 958 093
2027	12	16 903 812	10 558 071	12 000 000	7 495 165
2028	13	16 903 812	10 141 991	12 000 000	7 206 889
2029	14	16 903 812	9 761 530	12 000 000	6 929 701
2030	15	16 903 812	9 123 682	12 000 000	6 663 174
2031	16	16 431 236	8 772 771	12 000 000	6 406 898
2032	17	16 431 236	8 435 357	12 000 000	6 160 479
2033	18	16 431 236	8 110 920	12 000 000	5 923 537
2034	19	16 431 236	7 798 962	12 000 000	5 695 709
2035	20	15 234 680	6 952 909	12 000 000	5 476 643
2036	21	15 234 680	6 685 490	12 000 000	5 266 003
2037	22	15 234 680	6 428 355	12 000 000	5 063 465
2038	23	15 234 680	6 181 111	12 000 000	4 868 716
2039	24	15 234 680	5 943 376	12 000 000	4 681 458
2040	25	74 325 430	27 880 718	12 000 000	4 501 402

(2) Years hosting FIS Nordic World Ski Championships

Calculations of Net Present Values shown in Table 4 were made using 4% discount rate, same as for Scenario 1. Using equation 3, a value of Net Present Benefit for Scenario 2 was calculated and is presented in Table 5.

Table 5. Results of CBA of Scenario 2 in SEK

Total Costs	PV of Costs	Total Benefits	PV of Benefits	Net Present Benefit[(1)]
526,2 million	323,7 million	493 million	349,6 million	25,8 million

(1) Calculated using equation 3.

As shown above, Scenario 2, resulted in a Net Present Benefit of 25,8 million SEK. As the value is positive, this result of the analysis implies that investments made within the Lugnet area, taking all the assumptions into consideration, will have a positive impact on the social welfare of Falun residents. Comparing to Scenario 1, positive Net Present Benefit heavily relies on the assumption that the city of Falun will host another FIS Nordic World Ski Championships within 25 year period.

As analysis showed, efficiency of the investments, in terms of welfare economics depend on hosting future championship event, due to negative value of Net Present Benefit for Scenario 1 and positive for Scenario 2. To be able to determine whether investments made within Lugnet area would improve social welfare of local residents, an analysis of Scenario 3, where no infrastructure investments were undertaken, was made. To begin with, a summary of costs and benefits for Scenario 3 is presented in Table 6.

Table 6. Cost-benefit summary Scenario 3

Calendar year	Project year	Costs	PV of Costs	Benefits	PV of Benefits
2015	0	10 000 000	10 000 000	17 000 000	17 000 000
2016	1	10 500 000	10 096 154	12 000 000	11 538 462
2017	2	10 500 000	9 707 840	12 000 000	11 094 675
2018	3	10 500 000	9 334 462	12 000 000	10 667 956
2019	4	10 500 000	8 975 444	12 000 000	10 257 650
2020	5	10 500 000	8 630 235	12 000 000	9 863 125
2021	6	11 025 000	8 713 218	12 000 000	9 483 774
2022	7	11 025 000	8 378 094	12 000 000	9 119 014
2023	8	11 025 000	8 055 860	12 000 000	8 768 282
2024	9	11 025 000	7 746 019	12 000 000	8 431 041
2025	10	11 025 000	7 448 095	12 000 000	8 106 770
2026	11	11 576 250	7 519 711	12 000 000	7 794 971
2027	12	11 576 250	7 230 492	12 000 000	7 495 165
2028	13	11 576 250	6 952 396	12 000 000	7 206 889
2029	14	11 576 250	6 684 996	12 000 000	6 929 701
2030	15	11 576 250	6 427 881	12 000 000	6 663 174
2031	16	12 155 063	6 489 881	12 000 000	6 406 898
2032	17	12 155 063	6 240 084	12 000 000	6 160 479
2033	18	12 155 063	6 000 081	12 000 000	5 923 537
2034	19	12 155 063	5 769 308	12 000 000	5 695 709
2035	20	12 155 063	5 547 412	12 000 000	5 476 643
2036	21	12 762 816	5 600 752	12 000 000	5 266 003
2037	22	12 762 816	5 385 339	12 000 000	5 063 465
2038	23	12 762 816	5 178 210	12 000 000	4 868 716
2039	24	12 762 816	4 979 048	12 000 000	4 681 458
2040	25	12 762 816	4 787 547	12 000 000	4 501 402

Present Values shown in Table 3 were calculated using discount rate of 4%, same as for Scenarios 1 and 2. To correctly compare outcomes of all scenarios, calculation of Net Present Benefit using equation 3 was made. Results for that operation are presented in Table 7.

Table 7. Results of CBA of Scenario 2 in SEK

Total Costs	PV of Costs	Total Benefits	PV of Benefits	Net Present Benefit[(1)]
300,1 million	187,9 million	317 million	204,5 million	16, 6 million

[(1)] Calculated using equation 3.

As shown above, Scenario 2 resulted in a Net Present Benefit of 16,6 million SEK. As the value for Scenario 2 is positive, this implies that it would be efficient from welfare economics point of view and would result in a positive impact on the social welfare of residents of Falun.

Results of analysis have shown that, based on made assumptions and estimations, Scenario 1 is not efficient from welfare economics point of view, as value of Net Present Benefit is negative. Comparing Scenario 1 and 3, local residents would be better off if no infrastructure investments were made, as shown by positive value of Net Present Benefit for Scenario 3. Although, Scenario 2 has a highest value of Net Present Benefit out of all alternatives, meaning that it is the most efficient, in terms of the welfare economics, of the scenarios. On the other hand, positive value associated with Scenario 2 is strongly dependent on hosting future FIS Nordic World Ski Championships. Whether the city of Falun will host such event in the future is surrounded with some uncertainty. Based on results of analysis, it is crucial for the city of Falun to host future FIS Nordic World Ski Championships to generate a benefit towards local community.

Out of three scenarios, only Scenario 2 and 3 are efficient from welfare economics point of view, as Net Present Benefit value is positive for both scenarios. On the other hand, scenarios 1 and 2 are excluding scenario 3, implying that a choice regarding the alternatives has to be made. Based on results of the analysis, Scenario 2 generates greater benefit for the society than Scenario 3. Therefore, subject to made assumptions, investments in infrastructure in Lugnet area would be beneficial in the long-run, in terms of welfare economics, conditional on hosting future FIS Nordic World Ski Championships. Nonetheless, it is important to summarize all possible effects that could not have been included in this analysis, but would have major impact on true total Net Present Benefit of the project. Table

8 presents all effects that could impact the society through investments in Lugnet area along with the nature of an effect (positive or negative). The effects included in the table refer solely to current status quo, i.e. Scenario 1.

Table 6. Overview of welfare effects

Costs	**Benefits**
- Investment costs	+ Benefits from hosted events
- Operational costs	+ Preserved cultural/historical value of Lugnet
- Opportunity cost of alternative allocations	+ Operational benefits
- Possible negative effects on the environment	+ Increase in employment
	+ Positive externalities on ski-equipment and tourism sector
	+ Value of media exposure
	+ Value of local pride
	+ Effects on health and welfare due to popularisation of cross-country skiing and ski jumping
	+ Increased foreign investment due to exposure
	+ Increased property value in areas surrounding Lugnet

As seen above, many of the relevant impacts could not have been included in this research, therefore a further analysis of the presented topic is required to determine the true magnitude of listed effects.

Even though analysis points out Scenario 2 as more efficient, it is important to critically assess the results. Due to lack of data regarding actual cultural value of Lugnet, precise operatioal costs and benefits from Lugnet facilities and uncertainties associated with future revenues, among other factors, a sensitivity analysis has to be made to understand how responsive the results are to changes in assumed values.

4.5 Sensitivity analysis

As previously mentioned, this paper used Monte Carlo Simulation as a method of conducting sensitivity analysis. Simulation was made for all three scenarios with varying parameters over 1000 trials. Probability was assumed to have uniform distribution, meaning that it is equally probable to observe any of the values within the set up range. Varying parameters and their ranges are given below.

- Profit from tourist consumption, as portion of revenue, which ranged between 20% and 50% of total revenue, for years hosting FIS Nordic World Ski Championships.
  For World Cup years, same range for profit proportion of total revenue was chosen, only with different total revenue as a base.

- Tax revenue for years with FIS Nordic World Ski Championships varied between 5 million SEK and 20 million SEK.
  For World Cup years it could take values between 1 million and 5 million SEK.

- Current historical value of Lugnet area ranged between 10 million SEK and 1 million SEK.

- Cost of investments for hosting future FIS Nordic World Ski Championships varied between 20 million SEK and 80 million SEK.

- Annual operating cost for Lugnet facilities varied between 5 and 15 million SEK for both scenarios.

- Annual operating benefit from Lugnet facilities ranged between 5 and 10 million SEK.

- Finally, discount rate varied between 2% and 6%.

The table below presents descriptive statistics of total Net Present Benefits for both scenarios after 1000 trials with above listed flexible parameters.

Table 7. Descriptive statistics of Monte Carlo Simulation

Variable	N	Mean	Std. Dev.	Min	Max
Scenario 1	1000	-4 919 070	16 294 948	-51 860 528	38 218 932
Scenario 2	1000	24 308 391	25 800 399	-48 193 650	97 168 614
Scenario 3	1000	16 896 849	14 854 890	-33 764 819	64 546 852

As shown in Table 7, results of simulations are consistent with the main analysis. Values obtained from the simulation are close to ones used in main analysis for all scenarios. It is important to point out, that, in the least favourable situation, all of the scenarios could result in negative value of Net Present Benefit.

Reason behind simulation was to show how sensitive results presented in chapter 4.4 are to the change in above listed flexible parameters. In other words, how different values of unknown parameters included in analysis could affect the results. As analysis of Scenario 2 consists of more unknown factors, when some assumptions were relaxed under simulation, it resulted in more varied results than Scenario 1 and 3. In general, results of simulation for all scenarios have large variation due to many unknown parameters and large ranges of values used in the simulation. Many of the uncertainties surrounding included parameters can be eliminated in the future, allowing for more accurate results. Large variation is also surrounded with probability distribution chosen while conducting the simulation. As most of the parameters were completely unknown and had to be estimated, they were assumed to have a uniform distribution, implying that it is equally probable to observe all values between set up ranges. That assumption was made due to high uncertainty surrounding the used data.

Access and more in-depth analysis of data regarding operational costs and revenues for Lugnet facilities would eliminate some of the uncertainties associated with analysis made in this study and improve the overall quality of the results. Access to data regarding other policies that were postponed or cancelled due to prioritising investments in Lugnet area would enable to include opportunity cost in analysis. Hence, allow a better assessment of true costs associated with made investments. On the benefit side, access to more accurate data regarding benefits from FIS Nordic World Ski Championships and World Cup evens would also improve the presented study. Further research within the topic of cultural and/or historical value of Lugnet area for local residents would provide data needed for further development of presented research topic.

5. Discussion and conclusions

As this study pointed out, there is a shortage of research that would purely evaluate sports infrastructure and its impact on the social welfare. Many studies have been made within the field of sports event evaluation, but not many authors investigated legitimacy of public support for sports infrastructure. Although, many have pointed a need for that type of evaluation.
(Barget and Gouguet, 2010; Davies, 2011; Késenne, 2005; Matheson, 2006; Mules and Dwyer, 2005; Müller, 2012; Preuss, 2006; Solberg and Preuss, 2007).

Cost-benefit analysis, used as a method in this paper, is based on premise of welfare efficiency being one of the goals of policies. Thus, results of positive value of Net Present Benefit imply that no individual in society would be worse off due to project being implemented. Critique associated with results of practical CBA are often misinterpreted as general critique towards approach of cost-benefit analysis, implying that it is irrelevant or invalid. That is incorrect as long as governments, municipalities, policy makers and public are interested in efficiency of implemented policies. (Bohm, 1996, p.217)

This paper was an attempt for addressing sports infrastructure evaluation by conducting a cost-benefit analysis of investments made in Lugnet area in Falun, prior to hosting FIS Nordic World Ski Championships in 2015. The aim of this paper was to investigate the impact investments in sports infrastructure may have on social welfare. Through study of costs and benefits associated with three scenarios – Scenario 1, after infrastructure investments, Scenario 2, taking into account potential future championships events, and Scenario 2, without any infrastructure investments, this paper showed, that in order to generate benefit toward local community, city of Falun has to host future FIS Nordic World Ski Championships. A comparison of results for both scenarios showed that investments in sports venues in Lugnet area solely for the event in 2015 would generate a negative value of Net Present Benefit of -5,3 million SEK. On the other hand, Scenario 2 resulted in a Net Present Benefit of 25,8 million SEK, compared to 16,6 million SEK for Scenario 3. As the infrastructure investments in Lugnet Area have already been made, the only real choice for the local policy makers is between Scenario 1 and 2. Given that only Scenario 2 resulted in the positive value of Net Present Benefit, it is fundamental to host

future FIS Nordic World Ski Championships in order to make investments made in Lugnet area efficient, from welfare economics point of view.

In an ideal universe evaluation of project's effect on welfare would be based on observing each household's utility levels prior and after the project and comparing the two values. Unfortunately, in the real world such evaluation is not possible. The closest alternative within the field of welfare economics is social cost-benefit analysis. As this study presented, this type of analysis can identify and monetise many, but not all, of the effects sports venues have on social welfare. It also pointed out challenges associated with monetising different effects and made recommendations on how some factors may be estimated. Cost-benefit analysis conducted in this paper showed that investments in sports venues in case of Lugnet area would not be beneficial for the society, unless future championship events would be hosted. Through comprehensive analysis of costs and benefits over 25-year period, this study estimated total Net Present Benefit of -5,3 million SEK resulting from infrastructure investments in Lugnet area, along with other, non-monetised effects presented in this paper. An alternative, Scenario 2, taking into account costs and benefits from hosting future FIS Nordic World Ski Championships resulted in a total value of Net Present Benefit of 25,8 million SEK. On the other hand, Scenario 3, without investments, resulted in a total value for Net Present Benefit of 16,6 million SEK, implying that if no future championship events will be hosted, local community would be worse off due to investments in Lugnet area.

Access to more data regarding alternative policies that were not subsidised, due to prioritising investments in Lugnet area, would give a better understanding of true social costs of the project. *Id est* if an alternative policy resulting in Net Present Benefit of 20 million SEK was postponed or cancelled due to lack of resources, that value would form a cost for this project. As it is unknown how the money would be used if not for investments in Lugnet area, it is extremely difficult to estimate opportunity cost of used resources.

Cost-benefit analysis strongly relies on accuracy of data and made assumptions, therefore it is important to properly test and comment the results. This paper conducted a sensitivity analysis using Monte Carlo Simulation for both scenarios. Simulations with flexible parameters thoroughly described in section 4.5 resulted in mean values for Net Present Benefit of -4,9, 24,3 and 16,8 million SEK for scenarios 1, 2 and 3 respectively.

Based on results of the simulation, the results of main analysis are correct on average, given the ranges chosen for flexible parameters. As mentioned before, access to better quality of data would eliminate many uncertainties related to the analysis.

Hence results of this study are associated with relatively high uncertainty, it is not suitable to draw any definite conclusions. Although, based on the used data and made assumptions, choice of bidding for FIS Nordic World Ski Championships, and investments made for that cause, will be beneficial for Falun's residents in the long-run, conditional on hosting at least one more championship event in the future. Still, further analysis of presented topic is recommended to investigate true impact on social welfare.

Future studies within the field of sports venue evaluation, or specifically evaluation of Lugnet's infrastructure, could benefit from research conducted in this paper. It pointed out which data could improve the overall results, as well as methods of collecting it. Further analysis of presented topic with respect to labour market, tourist consumption and value of media exposure would give more accurate results in terms of impacts on social welfare.

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Appendix

Table A1. Detailed information about infrastructure costs.

Type of Infrastructure	**Cost (in million SEK)**
Ski jumping hills (Total)	157,9
Infrastructure 1[(1)]	11
Infrastructure 2[(1)]	6,5
Tech station[(2)]	3,5
Service buildings and finish for cross-country	11,2
Tunnel for supporters	1,2
Referee tower and coaches stand	6,8
Funicular	14,9
Waxing cabins for teams	2,7
Renovation of supporter stand at ski jumping hill	7
Entrance	1,5
Ongoing/remaining investments in ski jumping hills	3,2
Total	227,4

(1) Infrastructure 1 and 2 refers to water, sewage, electricity and internet leads to all facilities, as well as temporary buildings set up for specific events, district heating and snow cannons.

(2) Tech station refers to a building with control systems for snow, electricity and internet leads.