

# **Charting Value Creation Opportunities with IoT for a Modern Competitive Sports Center**

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Abstract  <p>The era of the fourth industrial revolution is here, and it affects all of us. The widespread of the internet has enabled the networking of physical devices, the internet of things (IoT). Health and wellness are megatrends and valued more than physical goods by consumers.</p> <p>The aim of the study was to chart the value creation opportunities that exist for IoT in a modern competitive sports center environment. Another aim was to understand the success factors and challenges when applying IoT in the chosen environment. The qualitative research method with an exploratory and inductive approach was chosen for the study. The empirical data was collected through six semi-structured expert interviews.</p> <p>According to the results, the added value that the data gained by using IoT solutions can offer is vital. Utilizing the data by analysis and mining is crucial. IoT solutions should be offered as a service to obtain continuous cash flow and customer loyalty. Understanding the value that lies in the infrastructure of the sports center offers considerable money saving opportunities by energy optimization. In order to succeed in gaining added value, a customer centered approach and smooth processes between functions and operators should be in the core. If the customer needs are not clear, challenges occur, and IoT solution may end up dormant.</p> <p>The area of research is novel, emerging and of great current interest. Multidisciplinary research brings insight, practical implications and ideas for further research to various operators in business, technology, sports and health. The research helps to understand the added value opportunities, what it takes to succeed or what may cause challenges when applying IoT in the chosen or similar environment.</p>		
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<p>Tiivistelmä</p> <p>Meneillään oleva neljäs teollinen vallankumous vaikuttaa meihin kaikkiin. Internetin yleistymisen mahdollistaa fyysisten laitteiden verkottumisen, esineiden internetin (IoT). Terveys ja hyvinvointi ovat trendejä, joita kuluttajat arvostavat enemmän kuin fyysistä omaisuutta.</p> <p>Työn tavoite oli kartoittaa mitä arvonluontimahdollisuuksia IoT tarjoaa modernissa kilpaurheilukeskusympäristössä. Muut tavoitteet olivat ymmärtää menestystekijöitä ja haasteita liittyen IoT:n käyttöön valitussa ympäristössä. Laadullinen tutkimusmenetelmä kartoittavalla ja induktiivisella otteella valikoitui työn lähestymistavaksi. Tutkimuksen empiirinen tieto kerättiin teemahaastatteluiden kautta haastatellen kuutta asiantuntijaa.</p> <p>Tulosten perusteella IoT sovelluksista syntyvän datan luoma lisäarvo on erittäin tärkeää. Datan hyödyntäminen analysoinnin ja tiedonlouhinnan kautta on ratkaisevassa asemassa. IoT sovellus tulee tarjota palveluna, jotta taataan jatkuva kassavirta ja asiakasuskollisuus. Kilpaurheilukeskuksen tilojen arvo tulee ymmärtää, sillä ne tarjoavat merkittäviä taloudellisia säästömahdollisuuksia energiankulutuksen optimointiin liittyen.</p> <p>Menestyäkseen lisäarvon tuottamisessa avainasemassa ovat asiakaskeksisyys ja sujuvat prosessit toimintojen ja toimijoiden välillä. Asiakastarpeen epäselvyys aiheuttaa haasteita ja IoT sovellus voi jäädä kokonaan käyttämättä.</p> <p>Tutkimusaihe on uudentyyppinen, kasvava ja erittäin ajankohtainen. Monialainen tutkimus tarjoaa näkemyksiä, käytännön vaikutuksia ja ideoita lisätutkimukselle liiketoiminnan, teknologian, liikunnan ja terveyden alan toimijoille. Tutkimus auttaa ymmärtämään lisäarvomahdollisuuksia, menestystekijöitä sekä haasteiden aiheuttajia IoT:n hyödyntämiseen liittyen valitussa tai vastaavassa ympäristössä.</p>		
Avainsanat ( <a href="#">asiasanat</a> ) Teollinen internet, lisäarvo, kilpaurheilukeskus, älykäs kaupunki, teknologia		
Muut tiedot		

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# 1 Introduction

This study focuses on charting value creation opportunities with IoT for modern competitive sports centers. In addition, the study tries to find out what the main success factors and challenges are when applying IoT solutions in modern competitive sports centers. The subject of this research is multidisciplinary associated to the field of business, technology, sports and health. A modern competitive sport center in this research means a center for sports that provides professional training in competitive sports. In addition, the sport center provides regular exercise and free time sport activities for everyone. Typically, the venue also has a sport stadium/ stadiums depending on the type of the competitive sport. This means that the customers of the competitive sports center can be, for example, fans, children and adults doing sports or individual competing athletes, teams and coaches. The term IoT is explained in chapter 2.1.1 in dept.

In addition, it was decided that Hippos2020 would act as an example environment in this research. Hippos2020 is a project worth 220-250 million euros. The purpose is to develop a leading sports and wellness center for the Nordic countries in Jyväskylä (Central Finland) with a wide range of additional services. The schedules and design for the construction of the venue are public, and when ready, the environment will be a great example of a modern competitive sports center. Space of the current facilities at Hippos will triple and there will be a strong research center for sports, wellness and health promotion. Hippos2020 will not be only for top athletes, but for all people from all age groups. It is planned to become a sporty living room for the citizens that promotes well-being, international multidisciplinary research and product development, in other words, a “Silicon Valley” of sport, wellness, well-being and health promotion. A strong Big Data center will be built to the Hippos2020 area to collect, research and analyze sports, exercise and well-being. Users, researchers and product developers benefit from the Big Data information. The construction work of Hippos2020 is estimated to start in the year 2019. (Hippos2020 Faq n.d.)

## 1.1 Background

The fourth industrial revolution has lately received extensive publicity. The term was developed by Klaus Schwab, the founder and executive chairman of the World Economic Forum. The fourth industrial revolution that is seen to have started in the year 2000 describes a world where people move between digital domains and offline reality with the use of connected technology to enable and manage their lives.

(David, Kim & Xu 2018, 90.) Figure 1. Illustrates the four industrial revolutions as a series of events.

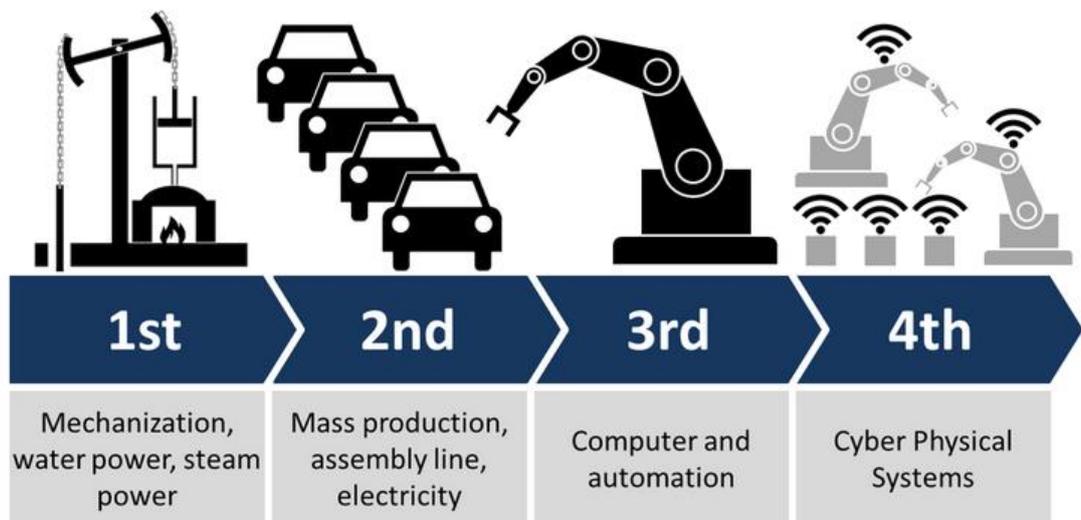


Figure 1. Industry 4.0 (By Christoph Roser at AllAboutLean.com under the free CC-BY-SA 4.0 license)

Each industrial revolution is often considered a separate event, but together they can be better understood as a series of events that build upon the innovations of the previous revolution and lead to more advanced forms of production (David et al.

2018, 90). David and colleagues (2018) have listed opportunities of the fourth industrial revolution, and one of them is the Internet of Things (IoT), the networking of physical devices. IoT is expected to offer advanced connectivity of devices, systems and services. The interconnection of these embedded devices is expected to lead to the automation of almost all fields and expand, for example, to areas such as smart cities. The advance of the internet enables the revolution of the connected life (David et al. 2018, 92.) It can be stated that IoT with other evolving technologies will most probably have a major role in our daily lives in the future, and as described above, it will also have a major role for the society we live in as well as a major economic impact.

Wellness is the new luxury. These days consumers value health and wellness more than material objects says Weinswig (2017). People value mental, physical and emotional health. Looking good, feeling good and participating in activities that promote well-being are considered more important than owning expensive goods. Eating healthy, exercising and monitoring health have become lifestyle choices. (Weinswig 2017.)

## 1.2 Motivation

The author has been working for the past nine years in a university of applied sciences. She is currently working in the R&D-team of the department of Social Services and Healthcare, being involved in several projects related to well-being. Hippos2020 became familiar to the author through the collaboration that the department of Social Services and Healthcare had done with the Hippos2020-project. Personally, the author is a highly motivated sport enthusiast interested in physical and overall well-being. Technology has also always been close to the author's heart and thus, she is, simultaneously with this research project, studying to become an engineer specialized in IoT and cyber security.

IoT and physical well-being are both phenomena of great current interest as explained in Chapter 1.1. Nowadays, people value experiences, such as participating in sports or attending sports events, more than tangible goods. On the other hand, physical technological objects provide information on one's personal health and progress through, for example, wearables, such as fitness trackers and smart watches. IoT has a major role in the fourth industrial revolution, and thus, it can be seen as a global, economically important subject for academic research as well as relevant for the future. Solutions that ease and encourage people to participate in wellness and health related activities also have relevance for public health and individuals' well-being; thus, this can be seen as a socially and globally valuable theme for research.

Peter Drucker, one of the most widely known and influential thinkers of management, identified already in 1974 that "What the customer buys and considers value is never a product. It is always utility – that is, what a product or service does for him or her." (Drucker 2011, 57.) He also added that it is anything but obvious what value for the customer is (Drucker 2011, 57). With this in mind, choosing to focus this research on the value creation opportunities or in other words **added value** that IoT can offer modern competitive sports centers, opens up an interesting and complex viewpoint for research. Although IoT and sports in general are areas of great interest and wide research, the added value that IoT solutions could offer competitive sports centers has received quite little research attention. It can be stated that this research offers novelty value to the subject at hand. Researching the added value offers relevant information for health, sport and technology field businesses about the benefits and sources of income that IoT can offer in the field of sports. The concept of added value is also crucial from the point of view of business. It is important to understand what added value something offers before making it part of the business in the field.

### 1.3 Research Questions

After the research topic is decided, the next phase of a research project is formulating the research problem. Each study should have a research problem that is answered using research methodologies and materials. To transform a research problem into a research question eases the process, since it is easier to answer a question than a problem. Both the research problem and research question direct the researcher and the progress of the research. The research problem will eventually be solved with the correct questions. There can be one or several research questions (Kananen 2015, 46–48.)

Research questions in qualitative research are often exploratory and descriptive. They describe a social phenomenon and their meanings to relevant actors (what questions) and explain and understand social patterns and processes (how questions). It is important to notice that in qualitative research there is a distinction between **what** and the **how** questions. The what questions focus on what is happening, what are people doing and what it means to them. The emphasis is on the meanings that exist, emerge from and are consequential for individuals and social settings. The aim is to describe reality in terms of what it naturally is. How questions, on the other hand, focus on how the meaning is produced. Research focuses on the everyday practices through which the meaningful realities of everyday life are formed and sustained. (Hesse-Biber & Leavy 2011, 39–40). In this research, the focus was on describing a phenomenon and its meanings to relevant factors, and thus, what questions were used in research questions.

Based on the literature review on previous research related to the subject at hand, the author observed that there was need for further research. Due to this scenario, the objective of this research was to find answers to the following research questions. The first one focused on the added value that IoT solutions can offer in a modern competitive sports center environment. The second question focused on a deeper view on the added value and factors that influence taking IoT solutions into

use in the specific environment in question. In addition, success factors and challenges needed to be identified as well.

Main research question:

What added value IoT can offer modern competitive sports centers?

Sub questions:

What are the main success factors when applying IoT solutions in modern competitive sports centers?

What are the main challenges when applying IoT solutions in modern competitive sports centers?

## 1.4 Structure of the Thesis

This thesis contains five main chapters:

The **Introduction** chapter introduces the reader to the subject and explains the background for the research. The chapter also reveals the motivation for the research from the personal, professional and academic points of view. The chapter also introduces the research questions and includes this chapter: The structure of the thesis.

The **literature review** chapter describes the different concepts that are relevant from the research question's point of view and presents how the ideas are linked through a summary of the theoretical framework. The two central themes for reviewing literature were technology in sport business and creating value with IoT and data analytics.

The **methodology** chapter introduces the objectives and methodological choices for the study, together with the research context. This chapter also includes information on the data collection, data analysis and ethical concerns of the research.

In the **results** chapter the author presents the findings of the empirical research process supplemented with quotes from the expert interviews and illustrations made based on the findings.

The **discussion** chapter includes the answers to the research questions. The theoretical implications reflect on the results based on the literature, and the practical implications present the impacts and benefits of the study in practice. In addition, the limitations of the study are presented as well as ideas for future research.

## 2 Literature Review

The literature review chapter describes the different concepts that are relevant from the research question's point of view and presents how the ideas are linked through a summary of the theoretical framework. The main sources of information for the literature review were international academic articles found through Google Scholar, Harvard Business Review and Janet Finna. Published books were also used. In addition, some company websites and company reports were reviewed since the field of research was quite novel and in an emerging state so there so that there was a relatively small amount of academic literature available.

The two central themes to review literature were: **technology in sport business** and **creating value with IoT and data analytics**. Within technology in sport business theme, two significant sub-themes were reviewed: the Internet of Things (IoT) – definition and appearance in sports and smart technology – definition and examples. In creating value with IoT and data analytics theme two sub-themes were also reviewed: value creation with IoT and data analytics in sports and IoT business models. Familiarizing these themes helped to clarify the research problem and set

the goals for the research project. These themes acted as the theoretical basis for the research.

## 2.1 Technology in Sport Business

In the introduction words of the International Conference on Technology and Innovation in Sports, Health and Well-being held in Portugal 2016 it was said that in the 21<sup>st</sup> century sports, health and well-being are areas that cannot work without technology and innovation. To live, people need to maintain a healthy life with regular sports habits, and that is the reason this area can be seen as one of the most important fields of research and work of our time. (2016 1<sup>st</sup> International Conference on Technology and Innovation in Sports, Health and Wellbeing (TISHW) 2016.) Hahn, James and Ringuet-Riot (2014) have discovered that technological innovation play a crucial role in elite sports, but that it is often proceeded in an ad hoc manner that emerges from the grass roots of sports and is not a strategically programmed activity. Some sports organizations are still unwilling to adopt new technologies and favor sporting traditions. Fortunately, many have discovered the potential and view sport science and improvements in on-field performance as a possibility for competitive advantage through innovation. (2-3.)

A concrete example of the significance of technology in sports nowadays comes from the biggest sport of all time –football. Memmert and Rein (2018) claim that in the field of match analysis, there has been a true revolution in the past few years. New ways to evaluate performance have been developed especially in commercial football. The drivers for this are novel development in sensor technology and a changing coverage of sports games in media. **Positional data** of individual players and the football allow a much more in-depth analysis of the games than analyses that depend on video material. (65.) Hanh and colleagues (2014, 3) also state that Information technology has had a transformative effect on sports performance,

especially in the communication between athletes and coaches and in **analyzing data** (for training, performance and competitor analysis).

The real-time instant feedback opportunities that the use of positional tracking data technologies offer has, according to researchers, the potential to completely transform how matches and training are organized in elite sports. However, presently the full potential of objective performance assessment through digital data is far from being achieved. Big Data based on positional data tracking methods will play a key part in supporting this field of research in the future. (Memmert and Rein 2018, 69.)

### 2.1.1 Internet of Things (IoT) – Definition and Appearance in Sports

“Welcome to the future. It’s spelled I-o-T.” states Kranz (2017a, 3). Industrial Internet, Industrial internet of Things (IIoT), industry 4.0., internet of things (IoT), internet of everything (IoE), Machine-to-machine-communications (M2M) and Cyber Physical Systems (CPS) (Collin & Saarelainen 2016, 29). There are many overlapping terms that, to some extent, mean the same but are not synonyms since they all have a specified meaning. To better understand the research, the term **Internet of Things** (further referred to as IoT) needs to be comprehensively understood. According to Collin and Saarelainen (2016), IoT means unspecified, heterogeneous objects or things that are connected to a global network. The common denominator of these objects is that they have a unique identifier, in practice an IP address. (30–31.)

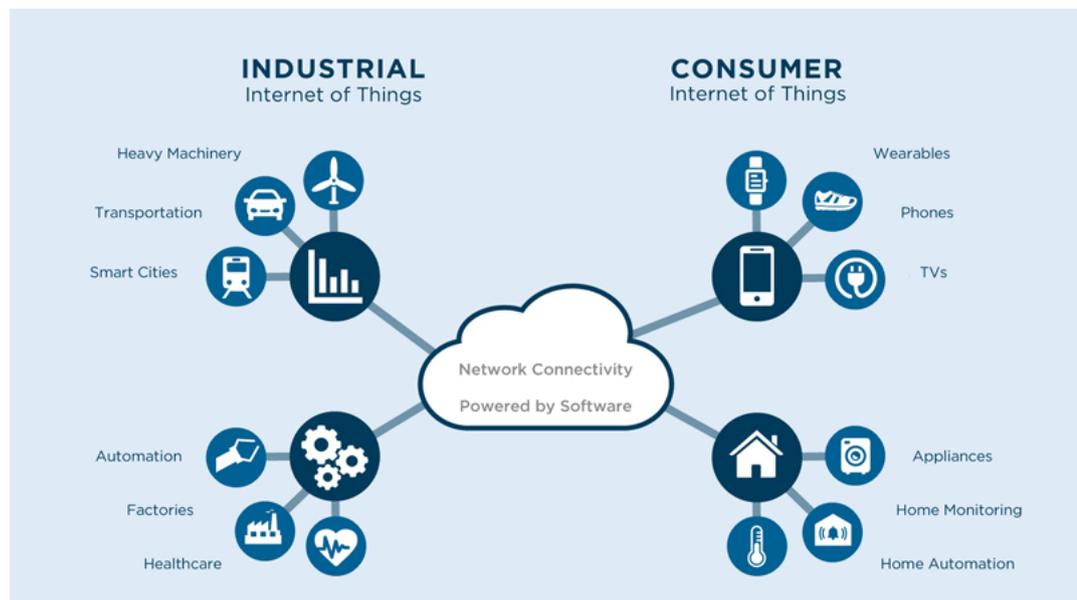


Figure 2. IIoT and IoT (mdestrian 2016)

IoT is sometimes divided into two: the industrial (IIoT) and consumer (IoT) internet of things (Figure 2). Although they have similarities, they are also very different regarding services, requirements and constraints. IIoT can be seen as more complex from the technical, functional and business point of view, whereas IoT could be seen as cheaper products focusing more on multimedia features and time to market. (mdestrian 2016.) Furthermore, IoT is a network of physical devices (for example vehicles, home appliances etc.) embedded with software, sensors, electronics and network connectivity. These enable the objects to collect data and exchange it. Each object is uniquely identifiable through its embedded computing system, but is able to operate in the existing Internet. This massive network of connected things and people share data about the way they are used and about the environment around them. (Chandrol, Chidar, Mahato, Shrivastava, Tiwary & Tripathi 2018, 23.)

To understand IoT more concretely, it is important to understand the elements that an IoT solution consists of. The essential components to build IoT objects are 1) hardware (for example sensors and actuators) 2) middleware components (for example database for storage and data analytical tools) 3) visualization through different kinds of applications. (Chandrol et al. 2018, 24.)

According to Chandrol and colleagues (2018, 24) it is estimated by experts that there will be about 30 billion IoT objects by the year 2020, and the global market will be worth 457 billion dollars (Columbus, 2017). Although this is an example of many future estimations, and no one knows the exact truth, we know we are dealing with a major technological breakthrough meaning that more and more daily used objects will be connected to the internet in the future and the market of IoT technology will expand rapidly. There has also been high expectations for IoT platforms in the Gartner hype cycle for emerging technologies for several years: 2015, 2016, 2017 and 2018 (Pemberton Levy 2015, Panetta 2016, Panetta 2017, Panetta 2018). In the Gartner Hype cycle for emerging technologies 2018, IoT platforms are placed on the peak of inflated expectations part, and it has been estimated that the plateau will be reached in 5 to 10 years. Gartner has also recognized 5 emerging trends from the emerging technologies hype cycle of 2018, and IoT platforms are placed in the emerging trend of digitalized ecosystems as seen in Figure 3. It is also estimated that in general the emerging technologies will need support from new technical platforms and ecosystems that are more dynamic. The ecosystems also need new business strategies and entirely new platform-based business models that form a bridge between humans and technology. (Panetta 2018.)



Figure 3. Emerging technology trends 2018 (Panetta 2018)

Eating healthy food, adoring fitness and doing sports are trends, and the markets have also discovered this opportunity. There are already plenty of implementations of **IoT in sports**. For a comprehensive view, some of the most significant ones are presented here. Ebling (2016) states that probably the most obvious uses of IoT in sports are appliances, such as fitness bracelets, for example FitBit. Similar technology can also be found in a field not so common, in sport wearables like clothing. An example is Hexoskin smart shirt that measures heart rate, heart rate variability, breathing rate and breathing volume as well as steps and pace. It also tracks sleep, measures heart rate, breathing and sleep positions throughout the night. (2.)

Sport equipment also start to have technological features, for example, the Adidas smart soccer ball called the miCoach smart ball. The ball has sensors inside it, which can detect the speed, spin, strike and flight path. This data can be sent back to a smart phone via the miCoach application. In golf, there are sensors and display technology used to provide feedback to golfers. These sensors can measure launch angles, spin rates, club speed and many other factors, and a video allows the golfer to observe his or her swing from many angles. (Ebling 2016, 2.)

Deloitte's publication states that presently IoT has a role in sports in three segments. **Player development**, in which coaches can easily process data to obtain metrics on player efficiency and performance as well as opponent weaknesses to be able to develop a better in-game strategy. **Player safety**, in which sports physicians, physical therapists and team doctors can use IoT solutions to obtain data that helps to reduce injuries, help players heal faster and raise player safety. **Fan engagement**, in which many organizations are investing massively in new stadiums to allow fans to engage with their favorite teams and athletes in a new way. (Internet of Things in sports. Bringing IoT to sports analytics, player safety, and fan engagement 2018, 4–6.)

IoT is an enabler of ubiquitous computing (Alam, Albeshri, Albogami, Katib & Mehmood 2017, 9533) and that is why it is essential to emphasize the meaning of **ubiquitous data**. Ubiquitous data can be defined as data that emerges in an asynchronous, decentralized way from many different, loosely interconnected and partly overlapping sources that are possibly contradicting. The characteristics of ubiquitous data are that the data is produced asynchronously in a highly decentralized way, and collecting such data in a central data warehouse can be expensive or even impossible. Usually, many different data types are involved to make up a whole. In sensor networks, different sensors can measure image data, sound, video, temperature, light, etc. to gain a complete picture of a situation and thus data processing becomes complex. In addition, in almost all the cases, the data emerges from a very **high number of partially overlapping, loosely connected sources**. Processing such data is much more challenging than processing data from a single source or a small number of sources, since contradictions and overlaps cannot

be resolved manually like in data warehouse systems. (Hotho, Pedersen & Wurst 2010, 62.)

IoT also generates **big data** for many reasons. The volume of the data attributable to IoT is remarkable. For example, RFID tags generate extensive amounts of data. The velocity of the data associated with IoT explodes since sensors can continuously collect data. As the types of sensors (and the quality of them) and the different sources of data expand, the variety of data associated with IoT also expands. RFID tags, for example, create much more reliable information now than a decade ago. High volumes of data, increasing velocity of data, along with increased variety of data illustrates how IoT generates Big Data. (O'Leary 2013.)

According to Abdalla Ahmed, Ahmed, Imran, Khan, Targio Hashem, Vasilakos and Yaqoob (2017) the massive increase in the number of devices connected to the Internet of Things and the exponential growth in data consumption reflect how the growth of Big Data overlaps with the growth of IoT. Collecting enormous amounts of data is not sufficient. In order to successfully benefit from IoT, companies must also create platforms where they can collect, manage and analyze big amounts of sensor data in a scalable and profitable way. Making use of a Big Data platform that is able to assist in consuming and reading versatile data sources and also accelerate the data integration process becomes vital. Companies can use data analytics tools to transform massive volumes of sensor-collected data into valuable insights and business opportunities. (1.) This process is illustrated in Figure 4.

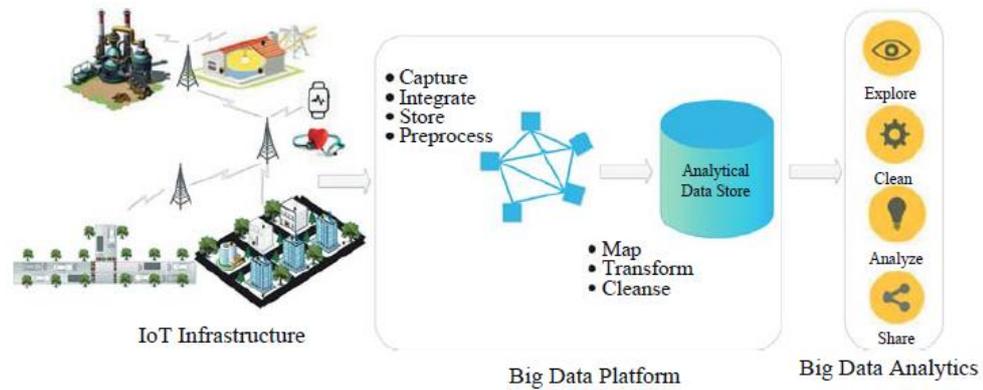


Figure 4. Big Data flow in IoT (Abdalla Ahmed et al. 2017, 2)

### 2.1.2 Smart Technology – Definition and Examples

When reading about the meaning of the term “smart” or “smart environment” or “smart city”, IoT is nearly always mentioned, and seems to belong together with smart technology. Still it is difficult for a researcher to find a solid definition to “smart” in the context of technology. It is not straightforward what smart technology consists of, but it is so closely related to IoT that it needs to be opened and understood.

Bullough, Haywood and Worden wrote in the year 2003 that a high technology product, which possesses awareness of its situation and is capable of reacting to it can be considered smart. The situation in this case means: the technology’s environment, as well as its condition or motion, for example. The product could know, for example, when it needs to be repaired or adapt its functions for a specific situation. (1.) This reminds us of the definition of IoT.

Fortino, Guerrieri, Russo, Savaglio (2014) describe IoT as a concept that describes a vision in which everyday objects will be connected to the internet. They can be identified and they can possibly communicate with other devices. These objects are typically referred to as **smart objects**, which can be defined as real objects enhanced

with computing, communication, sensing and storing functionalities. (1.) This could be understood so that IoT consists of a large number of smart objects. From this point of view, smart objects are part of the Internet of things.

A very similar idea is given by Fitton, Kawsar, Kortuem, G. and Sundramoorthy (2009) describing that the combination of the Internet and emerging technologies like nearfield communications, real-time localization and embedded sensors transform everyday objects into smart objects. These smart objects can understand and react to their environment; they are building blocks for the Internet of Things. (30.) It seems that when talking about smart solutions and devices it can be understood as a synonym for IoT solutions and devices.

An example of a smart environment is a **smart city**. Dameri (2013) refers that the concept of smart city is far from clear. Cities define themselves smart, although there is a lack of a systematic theoretical study about the phenomenon. (2544.) The conclusive definition that Dameri (2013) presents on the research article is:

*a smart city is a well defined geographical area, in which high technologies such as ICT, logistic, energy production, and so on, cooperate to create benefits for citizens in terms of well being, inclusion and participation, environmental quality, intelligent development; it is governed by a well defined pool of subjects, able to state the rules and policy for the city government and development (2549).*

Smart City – Research Highlights (2015) points out that there is no unique definition when it comes to defining a smart city. Different interest groups, stakeholders and regions interpret it differently. Sometimes by smart city is meant the same as with digital city and sometimes the same as with sustainable city. (6.) Smart City – Research Highlights (2015, 8) also points out that identifying, integrating and optimizing different energy, transport and data flows in planning and managing cities are crucial when creating sustainable smart environments.

Fan engagement leads us to **smart stadiums**, which are being built with numerous IoT solutions: restroom/ parking availability, in-seat concession ordering, seat

upgrades, stadium directions and replays (Internet of Things in sports. Bringing IoT to sports analytics, player safety, and fan engagement 2018, 9). What is interesting about smart stadiums is that they can be seen as part of a bigger picture. As Chakraborty, Fakhri, Little, Marsden, Mcdaniel, Mcguinness, Monaghan, O'Connor, Panchanathan and Tadayon (2017) point out, rapid urbanization has led cities to find out ways to reduce costs and complexity, provide better management and meet resource needs. At the same time, the cities need to ensure high quality of life for their citizens. (2.) Chakraborty and colleagues (2017) also propose to research the use of a smart stadium as a living laboratory platform to more easily evaluate IoT technologies and smart city solutions. The idea is to try the smart city solutions in a small enough environment for the research purpose, but large and complex enough to evaluate scalability and effectiveness. (2.) In the study, three fan enrichment projects were implemented: crowd understanding, athletic demonstration platform and wait time/ queue estimation. The preliminary results demonstrated the potential of the above mentioned technologies for smart cities. (Chakraborty et al. 2017, 30.)

An Intel report highlights that smart stadiums increase profitability, improve fan experience and increase the safety of the stadium. An example of increasing profitability is for example that the infrastructure of a smart stadium allows to control the heating, ventilation, air conditioning and lighting systems. To maintain operating costs low the systems can be automated to save energy and reduce the number of people that are needed to operate them. Fan experience on the other hand can be improved by a stadium app, which directs fans to the best place to park their car as they approach the stadium. Inside the stadium, it can lead them to their seats, offer upgrades and order food. The safety in crowded stadiums is of course a very important issue to consider as well. IoT also offers tools to improve the safety and security of the stadiums with for example surveillance cameras that monitor crowd behavior and detect unruly fans quickly. Facial recognition can be added to access sensitive areas. (Smart Stadiums Take the Lead in Profitability, Fan Experience, and Security 2016, 1–3.)

IBM claims, that IBM Watson IoT already offers many of the above mentioned IoT technologies for those who work with competitive sports and in sport venues. In

IBM's website, they market the solution with: improved player performance, possibility to create ultimate fan experience, success for the team and optimizing venue infrastructure. (*I can change the game for athletes and fans with IoT and sports analytics* n.d.)

Similarly as Deloitte and Intel, IBM is also picturing the future of fan engagement. In the IBM infographic from 2015 this is called: the anatomy of the ultimate fan experience. In the infographic, there are many similarities to Deloitte's and Intel's IoT solutions: in-seat food orders, in-stadium seat upgrades, interactive navigation, real time instant replay and intelligent security monitoring. In addition IBM has pictured IoT solutions for sharing selfies from the game, food and drink offers in or near venue, interactive trivia and games, retail discounts at local fan shop and public Wi-Fi for pregame/tailgating. (The anatomy of an Ultimate Fan Experience 2015.)

One must be critical when reading reports such as Deloitte's, Intel's and IBM's, since they are all global corporations that want to highlight and also limit their publications to be in line with their own product offerings. They are top players in the field of technology and thus have current data, but as global companies they represent the information with their own interest first. For this reason it should not be stated that these are the only evolving innovations in IoT in the field of sports, there are in addition many smaller companies and startups springing to the expanding market as well.

## 2.2 Creating Value with IoT and Data Analytics

In the beginning of this chapter, it is important to understand what is meant by the terms **value** and **added value**. Brandenburger and Harborne (1996) say that value creation is dependent on characteristics of all three categories of players in the chain: suppliers, firms, and buyers (of products and services of the firm). Next, there is a need to determine how value is divided up among these different players in the chain and what is "added value" to each of the players. Added value to each of the

players is defined as the value created by all the players in the vertical chain minus the value created by all the players except the one in question. A simple example on the value created by the vertical chain of players can be demonstrated with one supplier, one firm, and one buyer. It is important to note that there are also two ingredients involved “the willingness to pay” of the buyer and the “opportunity cost” of the supplier. The value created by the chain of players is the first minus the second: **value created = willingness to pay – opportunity cost**. Willingness to pay: the amount of money at which equivalence arises is the willingness to pay for the quantity of product in question. Opportunity cost: the amount of money that leads the supplier to evaluate the new situation (money minus resources). (5–9.) This clarification of creating value is good to keep in mind when we go further. The same clarification is visualized below (Figure 5).

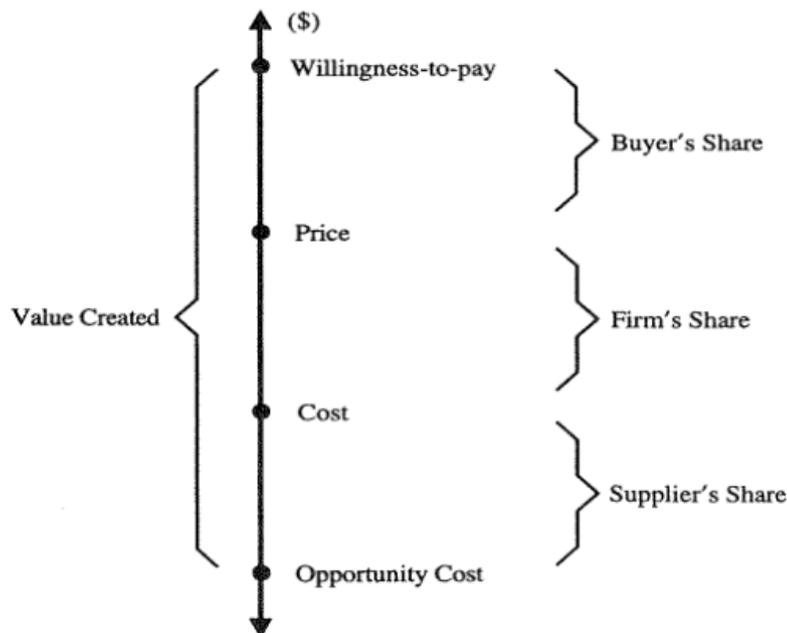


Figure 5. Creating value (Brandenburger & Harborne 1996, 10)

How is value created with IoT and data analytics? This is a very important issue to consider, as Kranz (2017a) claims that IoT will change your organization like nothing before. It will not only be the next big thing as security issues are strengthened and standards are adopted (which are already being worked on), it is the future: for your industry, for your organization and probably for you personally as well. (3.)

Connecting to the cloud with IoT solutions forces a new mindset around value capture in addition to value creation. In many product companies, value capture is as simple as setting the correct price to maximize profits from separate product sales. IoT requires a mindset shift when thinking of value creation and capture. (Hui 2014.)

#### THE INTERNET OF THINGS REQUIRES A MINDSET SHIFT

Because you'll create and capture value differently.

		TRADITIONAL PRODUCT MINDSET	INTERNET OF THINGS MINDSET
<b>VALUE CREATION</b>	Customer needs	Solve for existing needs and lifestyle in a reactive manner	Address real-time and emergent needs in a predictive manner
	Offering	Stand alone product that becomes obsolete over time	Product refreshes through over-the-air updates and has synergy value
	Role of data	Single point data is used for future product requirements	Information convergence creates the experience for current products and enables services
<b>VALUE CAPTURE</b>	Path to profit	Sell the next product or device	Enable recurring revenue
	Control points	Potentially includes commodity advantages, IP ownership, & brand	Adds personalization and context; network effects between products
	Capability development	Leverage core competencies, existing resources & processes	Understand how other ecosystem partners make money

SOURCE SMART DESIGN

HBR.ORG

Figure 6. Value creation and value capture mindset shift (Hui 2014)

Earning money is not limited to physical product sales, so after the initial product sale other revenue streams become possible. These other revenue streams can actually exceed easily the initial product price; they are for example services that add value to the product, subscriptions and applications. In IoT mindset (see Figure 6), enabling recurring revenue is an important part in capturing value with IoT. Options for control points also improve through IoT. Customers can remain hooked to the product because of personalization and context obtained through information that is received over time, also network effects between products increase as more products join the platform. Capability development changes focus to emphasize growing partnerships, since in the long-term success it is important to understand how others in the ecosystem earn money. (Hui 2014.) Kranz (2017b) also emphasizes the importance of partnerships. He notes that the essence of IoT is connections between customers, partners and suppliers. IoT is changing business structure from the mindset that one company needs to do everything to a working together approach. This leads to a need for open and flexible structures that enable partners to solve business problems together. There is no such company only making use of its own products and services that can capture IoT value alone. The speed required in today's digital market is too fast. (Kranz 2017b.)

In addition to partnerships, Kranz (2017b) emphasizes the importance of updating talent management strategies. New technical skills from data science and system architecture to cybersecurity are needed when dealing with IoT. There is also a need for technology experts who have business and people skills to be able to collaborate across different departments. IoT solutions generally reach different parts of the company: information technology (IT), operational technology (OT), and core business functions. (Kranz 2017b.)

Kranz (2017a) also points out that at the moment most of the IoT implementations are on the business-to-business (B2B) side, directed on improving the **efficiency** and **productivity of existing processes**. The real big thing happens, when existing processes that have a big labor / time component are automated and the related process is intensified. The results from this will be evolutionary and of course have great business impact. He recommends intensifying and improving the existing

processes first. This gives financial rewards and sets businesses on track towards new applications, business models and revenue streams. (4.)

Manufacturing industry is utilizing IoT globally at the moment. IoT-driven factory automation helps companies to merge their production and business systems and then bring everything online over only one network. This helps companies to adapt to changes by receiving **real-time information** concerning for example new product introductions. The real-time information reaches the whole company from the business department to the manufacturing plant and also links back to the whole supply chain. This saves plenty of time, allowing quick response and delivering real business value. (Kranz 2017a, 5.)

*These represent evolutionary improvements that together deliver real business value. Similar gains are being achieved in transportation utilities, agriculture, building automation, education, retail, health care, sports, and entertainment— even the military. Companies in these industries are taking first steps on their IoT journeys starting with low-hanging fruit. (Kranz 2017a, 5–6.)*

### 2.2.1 Value Creation with IoT and Data Analytics in Sports

Bukstein and Harrison (2017) give a good example of adding value with data driven decision making in sports. During basketball season 2014–2015 of NBA (national basketball association), Atlanta Hawks weekday home games started at 7:30 p.m. For the next season 2015–2016 they changed the starting time to 8:00 p.m. Steve Koonin, Atlanta Hawks chief executive officer said that the organization tries to make every decision data based. Collecting and analyzing data resulted the decision of delaying the starting of the match with 30 minutes. Atlanta Hawks analyzed data on the exact timing when fans arrived to the game and also analyzed the traffic patterns. The decision resulted in increasing the number of fans on the arena seats on tip-off time. (1–2.)

The main idea of **sport business analytics** is to transform raw data into significant, value adding information that helps sport business professionals in making strategic business decisions, resulting in company's finance and performance improvement and a measurable and sustainable competitive advantage (Bukstein & Harrison 2017, 3).

Core advantages of using analytics according to Bukstein and Harrison (2017) are

- saving decision-makers time;
- providing decision-makers with novel insight;
- resulting in gradually increased revenue;
- reducing costs;
- managing risk;
- more effective use of human resources;
- product and service development optimization;
- improving customer marketing and service (fan engagement) and
- strategic decision-making overall more informed.

(3.)

### 2.2.2 IoT Business Models

Value creation just covered in chapter 2.2.1. is according to Hui (2014) the heart of any business model, since it includes activities that increase the value of a company's offering and promotes customer's willingness to pay. Hui (2014) also points out that in IoT business models innovation is important, since established business models are not enough.

In addition to value creation, a survey made by Dijkman, Janssen, Peeters and Sprenkels (2015) indicates that the most important building block in IoT business models is the value proposition. Other important building blocks were discovered to be customer relationships and key partnerships. The most important things inside

value proposition building block were: convenience/ usability, performance, getting the job done, comfort and possibility for updates. The study used the Business Model Canvas as a starting point and applied the Business Model Canvas terminology, by naming the business model components as **building blocks**. (673–677.) The limitations on this research were that it lacks a more detailed approach, for example targeting a specific building block. In addition, the relatively low number of observations lacked the possibility of doing analysis on all discovered building blocks, which could have led to broad insight in finding patterns of various business models. The majority of the respondents were from the USA and the Netherlands, so the results should not be generalized to different cultures and economies. Although the study had limitations, the study was relevant from the perspective that it was the first study that widely maps, which building blocks are most important and what things within the building blocks in IoT business models are most important. (677–678.)

Krotov (2017) proposes two different approaches for creating business models when using IoT; the bottom-up or **sustaining approach** and the visionary or **disruptive approach**. The sustaining approach uses IoT to improve existing products or services. To use this approach, analyzing properties of existing products and designing new ways of improving existing processes are needed. The disruptive approach on the other hand requires vision of the future as a world where every object is part of a global pervasive network. One needs to think that if this vision becomes reality, what kind of new business models will be possible. (9–10.)

After choosing the approach for the business model, from the two options mentioned above and coming up with a value proposition, one needs to think how elements of IoT landscape will affect the business model. Both of the approaches can be an opportunity, threat or both to the company using it. Decisions concerning what hardware, software and networking technologies are needed and special attention needs to be given to the legal and privacy issues. (Krotov 2017, 10.)

Since the IoT is still emerging there is no clear and uniformed business model generated. In Figure 7 there are listed a few researchers' findings on trying to form a suitable business model for the IoT.

Author(s), Year	Business Model	Business category	Findings
Li & Xu (2013) [23]	MOP Model	None	The multidimensional structure composed of technology dimension, industry dimension, policy dimension, and strategy dimension
Sun et al. (2012) [19]	DNA Model	Smart Logistic	The basic visual structure and relationships between the DNA blocks – design, needs, and aspirations are the same at any level of the business model.
Qin & Yu (2015) [24]	Value Net Model	Tele-communication	The strategy of customer centered, information sharing, and resource integration
Leminen et al. (2012) [6]	2x2 matrix dimension	Automobile	B2C solutions through IOT technology in the automotive industry
Bucherer & Uckelmann (2011) [25]	Business model canvas	Information Systems	The importance of information as a major source for value creation and the value proposition
Chan (2015) [26]	None	None	Three-dimensional model (collaborators, networks, tactic, inputs, service/processing/packaging, benefits, strategy, content/information product)
Dijkman et al. (2015) [27]	Business model canvas	None	Building blocks that are relevant in the IoT and identifying the relative importance of these building blocks

Figure 7. Literature on IoT business models (Jae-Hyeon, Jaehyeon & Mi-Seon 2016, 884)

Some of the researchers developed IoT business models based on the business model canvas that consists of nine key components: key partners, key activities, key resources, value propositions, customer relationships, channels, customer segments, cost structure, and revenue streams. The key factors presented by these studies focused on specific business areas such as logistics. Other researchers created different business models like MOP model and Value Net model. These business models are too abstract for characterizing key factors of IoT services. (Jae-Hyeon et al. 2016, 885.)

Jae-Hyeon and colleagues (2016, 887) had interesting results based on literature analysis and interviews on what could be a suitable business model framework for IoT services (Figure 8).

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
<ul style="list-style-type: none"> <li>· Software Developer</li> <li>· Data Analytics Company</li> <li>· Device Manufacturer</li> </ul>	<ul style="list-style-type: none"> <li>· Product Development</li> <li>· Partner Management</li> <li>· Platform Integration</li> </ul>	<ul style="list-style-type: none"> <li>· Convenience</li> <li>· Performance</li> <li>· Customization</li> </ul>	<ul style="list-style-type: none"> <li>· Co-Creation</li> </ul>	<ul style="list-style-type: none"> <li>· General Customer Segment</li> <li>· Vertical Market</li> <li>· Global Market</li> </ul>
	<b>Key Resources</b> <ul style="list-style-type: none"> <li>· Sensors</li> <li>· Cloud Service (Software)</li> <li>· IoT Dedicated Network</li> <li>· Capability for Business Analytics</li> </ul>		<b>Channels</b> <ul style="list-style-type: none"> <li>· Internet</li> <li>· Mobile</li> </ul>	
<b>Cost Structure</b>		<b>Revenue Streams</b>		
<ul style="list-style-type: none"> <li>· IT Cost</li> <li>· Maintenance</li> </ul>		<ul style="list-style-type: none"> <li>· Profit sharing</li> <li>· Subscription fee</li> <li>· Product sales</li> </ul>		

Figure 8. Business model framework for IoT services (Jae-Hyeon et al. 2016, 887)

There are many important points in Figure 8 business model framework for IoT services. Software development is mentioned in key partners, cloud services in key resources, co-creation in customer relationships, internet and mobility in channels, maintenance and IT cost in cost structure and subscription fees in revenue streams. When thinking specifically of these important issues mentioned it is easy to agree with De Saulles' (2017) conception that in the world of IoT we are moving **from product to service innovation**. He continues that services become increasingly bundled with products. For example Delair-Tech, a French company manufacturing drones that are used by many industries to monitor assets that are hard to access, such as factory roofs and fields. The company sells associated services alongside the drones. The package includes the aircraft, embedded sensors, a ground control station, software and training for end users to manage their own systems. This particular company achieved a turnover of 3,2 million dollars in 2015 claiming to grow at a 200 % rate after four years in business. One other important issue is typical to IoT service business, Delair-Tech also offers an analytics service to help make

sense of the data embedded in the images that the drones have collected. It can for example help farmers to spot diseases in crops and predict yields. This phenomenon, where distinction between product and service is blurring is often described with a term **product-as-a-service (PaaS)**. It leads to the fact that the manufacturers are increasingly having to think how their customers use their products. A deeper relationship is created between producers and customers and it does not end the moment the product is sold, but continues throughout the lifecycle. In many IoT devices, it is the data generated by the hardware, which holds the value for users and which requires more services to convert the data into actionable information. (50–51.)

### 2.3 Summary of the Theoretical Framework

The most significant factors from the literature review are presented in this chapter. The chapter forms a summary of the theoretical framework that is the foundation for the empirical study and research questions. Literature was reviewed from the following main topics: technology in sport business, definition of IoT and appearance of IoT in sports, definition of smart technology and examples of smart technology, creating value with IoT and Data analytics (in general and in sports) and IoT business models.

In the 21<sup>st</sup> century sports, health and well-being are areas that cannot work without technology and innovation; they can also be seen as one of the most important fields of research and work of our time (2016 1<sup>st</sup> International Conference on Technology and Innovation in Sports, Health and Wellbeing (TISHW) 2016). IoT, the networking of physical devices, is one of the opportunities of the fourth industrial revolution. It is expected, that IoT will offer advanced connectivity of devices, systems and services. (David et al. 2018, 92.) As IoT is an emerging trend (Panetta 2018) and wellness the new luxury, (Weinswig 2017) IoT can be seen as an intriguing technology for sport business.

Player development, player safety and fan engagement areas in sports have already utilized IoT (Internet of Things in sports. Bringing IoT to sports analytics, player safety, and fan engagement 2018, 4–6). All these areas are essential in smart stadiums that can be seen as a living laboratory platform of a smart city (Chakraborty et al. 2017, 2). IoT is also an enabler of ubiquitous computing (Alam et al. 2017, 9533) and generates big data (O’Leary 2013) thus the importance of data is strongly associated to IoT.

Added value can be generated for different stakeholders: suppliers, firms, and buyers of products and services of the company (Brandenburger & Harborne 1996, 5). Creating and capturing value with IoT also requires a mindset shift. After the initial product sale, other revenue streams like for example services that add value to the product, subscriptions and applications become possible. These other revenue streams can exceed easily the initial product price. In addition to the mind shift from selling only products to selling also additional services, focus changes to emphasize growing partnerships. It is essential, since one needs to think how their company will commercialize products and how the products will allow others to generate and collect value as well. In the long-term success, it is important to understand how others in the ecosystem earn money. (Hui 2014.) The main idea of creating value with analytics in sports is to transform raw data into significant, value adding information that helps sport business professionals in making strategic business decisions, resulting in company’s finance and performance improvement and a measurable and sustainable competitive advantage (Bukstein & Harrison 2017, 3).

Since IoT is still emerging there is no uniformed business model generated. Many business model possibilities that differed from each other were presented in chapter 2.2.2. One thing still stands out as essential when building a business model for IoT and is important to emphasize once more: in the world of IoT there is a movement from product to service innovation. Services become increasingly bundled with products. This phenomenon, where distinction between product and service is blurring is often described with a term product-as-a-service (PaaS). The phenomenon has a customer centric mindset, and is essential when generating a business model for IoT. (De Saulles 2017, 50–51.)

### **3 Methodology**

The methodology chapter introduces the objectives and methodological choices for the study, together with the research context. This chapter also includes information on the data collection, data analysis and ethical concerns related to the study.

#### **3.1 Research Objectives**

The purpose of this thesis was to understand the added value that the IoT can offer in a modern competitive sports center environment. Both technological innovations like the IoT and sports and wellness are current phenomena that are highly interesting to researchers as well as socially significant. To understand the added value of IoT in the chosen environment it was seen crucial to also look into the success factors and challenges related to IoT in business. In order to achieve added value the company must succeed and avoid the challenges that come in the way. Although academic and theoretical information can be found to support the thesis, there is still no academic research found on this specified subject of added value of IoT in competitive sports centers, and thus, the research is relevant and of current interest.

## 3.2 Research Methods

The main goal of this research was to gain deeper knowledge of the phenomenon of adding value with IoT to modern competitive sports centers. Kananen (2017) says that when the phenomenon under research is not known beforehand and there are no specific theories that could explain the phenomenon, then qualitative research is mainly used. He continues that qualitative research does not intend to make generalizations like quantitative research that always has theories and models behind it. In qualitative research, the main focus is on the phenomenon, and the big question is what it is about. (32.) The theme of this research is innovative and emerging and thus, the **qualitative** research method with an **explorative** approach was chosen. As Lewis, Saunders and Thornhill (2009) explain, exploratory research seeks new insights and tries to assess the phenomenon in a new light. It is useful when clarifying our understanding of a problem, for example, when uncertain about the precise nature of the problem. (139.) A quantitative questionnaire would contain interpretation errors since the phenomenon is so new and the related concepts are used in contradictory ways to some extent. In addition, the number of operators in the field is such that a sufficient population in the market for a broad survey does not exist.

Although IoT and competitive sports are subjects that have been widely researched separately, there is no research on the specified subject of this research, namely, the **added value** created by IoT for **modern competitive sports centers**. There are studies and innovations concerning the use of IoT in, for example, sports stadiums as described earlier in chapter 2.1.2. However, the studies focus on the possibilities of IoT in the specific environment, and the added value is only a by-product of them. In addition to this, a sports stadium is only one part of a modern competitive sports center. Since, there were no ready made theories or hypotheses about the phenomenon that could be verified or refuted with further research, the conclusions were drawn from the research data focusing on patterns and themes on the data that would unite different interviewees and perspectives. Hence, the reasoning was

**inductive.** As Lewis and colleagues highlight, in inductive approach the data is collected to develop a theory as a result of the data analysis. The aim is to 'get a feel' of what is going on to better understand the nature of the problem and the meanings. (Lewis et al. 2009, 124–126.) Kananen (2017, 34) also describes that the analysis of the research data in qualitative research is typically inductive, from practice to theory.

Since the subject is an area that is not well charted, rather it could be said that it is unknown and thus deep understanding is needed, interviews was chosen as the primary research method as suggested by Hirsjärvi, Remes and Sajavaara (2010, 205). **Semi-structured** interviews are non-standardized and often referred to as qualitative research interviews. The researcher has a list of themes and questions that will be covered, but these may vary from interview to interview. This means it is possible to leave out some questions in particular interviews paying attention to specific contexts. The order of the questions may also vary, and additional questions may rise depending on the flow of conversation. (Lewis, et al. 2009, 320.) These reasons led to the choice of using semi-structured interviews in this research. The themes of the interviews were the same for all, but the background questions changed according to which expert group the interviewee belonged. In order to obtain a deep view of the phenomenon, it was important to have the option of important additional questions arising from the flow of conversation.

Preparation in semi-structured interviews is important. First of all, sufficient knowledge is needed of the research topic. (Lewis et al. 2009, 328.) In addition to reviewing the relevant literature the author has

- read other theses and research articles concerning similar topics (for example from areas: wearable technology, IoT business opportunities, smart homes and sports marketing);
- subscribed to the SportTechie daily newsletter for latest news from the intersection of sport & technology;
- attended events and exhibitions related to IoT the and Industry 4.0 (for example Smart factory 2018 –exhibition);

- read newspaper articles and press releases on the development of the Hippos2020-project and
- simultaneously with this research, studied in an ICT-engineering degree program focusing on IoT.

All of the above-mentioned practices ensure that the author had a solid knowledge base of the research subject.

### 3.3 Data Collection

The interviewees should be selected keeping the phenomenon in mind; the selected interviewees should be involved or affected by it (Kananen 2011, 52). The aim of the study was to find out what added value IoT could offer modern competitive sports centers. The interviewees were selected precisely not by random sampling. Since the subject involves operations that are done in networks or even ecosystems, also multiple perspectives are needed, which suits qualitative research well. In recruiting interviewees, it is important to find knowledgeable informants, getting a range of views and choosing interviewees that can extend results (Gobo, Gubrium, Seale & Silverman 2004, 17). This in mind, it was decided that best experts to provide wide range of views and deep knowledge were

- IoT experts from the field of education and research;
- experts from a company providing IoT solutions and
- experts of sports (who have an understanding of IoT).

In addition to these requirements, it was also decided that one of the experts that will be interviewed is involved in Hippos2020-project. In an ideal situation, one of the other interviewees would be working in a modern competitive sports center already existing. These requirements were both met and this ensured that there is also the perspective that takes note on the specific environment in question. This supported

the idea that the interviewees consist of a representative sample; they are knowledgeable informants rich in data. They were also all involved in and affected by the phenomenon. The author had also asked for recommendations on suitable candidates to be interviewed from a personal network of specialists from the field of health, sports and technology. All of the interviewees selected had a specialist recommendation and the one recommending had been provided with knowledge about the subject of the research. The IoT company representatives selected had personal interest and background in competitive sports. The experts of sports were selected so that they had solid understanding of IoT to be able to answer the questions of the interview. The IoT experts from the field of education and research had versatile experience of IoT from many fields of business.

The total number of interviews was not decided beforehand, as many interviews was made as needed to start getting repeated answers, meaning reaching the point of saturation as suggested by Kananen (2011, 53). The profiles of each person interviewed was very precisely thought of beforehand. This was important and led to the fact that all the interviews were successful and the sample was representative concerning the subject. The curve of accumulation of new knowledge started strongly and bended downwards after 4-5 interviews were made. A total number of six interviews was conducted and it was evident, that saturation was reached. Two interviews were made per each expert category. The interviews were held within about two weeks time between 17<sup>th</sup> of September and 2<sup>nd</sup> of October, 2018.

The level of information supplied to the interviewee before the interview needs to be well thought out, since it may promote credibility. Providing participants with a list of the interview themes before the interview raises credibility as well as validity and reliability. It enables the interviewee to consider the information being requested and be prepared for the interview. (Lewis et al. 2009, 328.) The author gave the interviewees a question guide format (Appendix 1) in advance with also some pre instructions for the interview. The question guide format introduced the themes that were focused on in the interview in more detail. The research had an example environment, Hippos2020. The example environment helped the interviewees to land their answers into real, concrete context. Thus, all the interviewees were

provided with a brochure of Hippos2020 to familiarize with the example venue (Appendix 3.) except the one interviewee who is involved in Hippos2020 –project and already completely familiar with the environment. The brochure sent to the interviewees was in Finnish (in appendices is the English version of the same brochure). The aim was to make face-to-face interviews with all interviewees, but due to long distances and tight schedules, one of the interviews was made via Skype for Business and one by phone. The rest of the interviews were made face-to-face. The place of the interviews may influence the data collected and thus the location should be chosen so it is convenient for the participant, where they feel comfortable and are not disturbed (Lewis et al. 2009, 329). The author negotiated a neutral and convenient environment for the interview every time it was possible.

Before the interview questions were developed, theme categories were developed based on the research questions, as suggested by Hirsjärvi and Hurme (2011, 66). To recap, the main research question was: what added value IoT can offer modern competitive sports centers? And the two sub questions were: what are the main success factors when applying IoT solutions in modern competitive sports centers? And what are the main challenges when applying IoT solutions in modern competitive sports centers? The theme categories and number of questions in each category were

- background information: 5 questions;
- IoT in Sports: 2 questions;
- business success factors and challenges: 6 questions;
- added value category was divided into sub themes
  - financial benefits: 3 questions;
  - non financial benefits: 3 questions;
  - procedure: 2 questions and
- closing: 1 question.

Background questions were asked to justify that the interviewees have a suitable and relevant background to be interviewed to the research. They also acted as so called warmup questions to get the interview going. IoT in sports related questions were

asked to get familiar with the subject at hand by thinking of the possibilities it offers and to ensure the knowledge base on the subject is sufficient.

Business success factors and challenges category was formed to receive answers to the sub research questions. This category also included questions about the business models. As pointed out in Chapter 2.2.2 value creation (Hui 2014) and value proposition (Dijkman, Janssen, Peeters & Sprenkels 2015) are essential for business models. Since value creation and value proposition are so essentially linked to added value and the business model plays a big role in the possible successes or challenges that can be faced using IoT solutions in business it was essential to focus on business models as well. This category was viewed from the perspective of the company offering IoT solutions to a competitive sports center and also from the point of view of a competitive sports center applying IoT to their business.

The theme category of added value was very relevant to the research playing an important role in answering the main research question, and thus it was divided into three sub categories. Added value is seen on this research as a benefit, which has **financial benefits** (first sub category) and **non-financial benefits** (second sub category). As described in chapter 2.2, by Brandenburger and Harborne (1996, 5) value creation is dependent on characteristics of the three categories of players in the chain: suppliers, firms and buyers. Thus, the financial and non-financial benefits were viewed from the point of view of the company offering IoT solutions to a competitive sports center (supplier), the competitive sports center applying IoT to their business (firm) and the customer of the competitive sports center (buyer). **The procedure** (third sub category) was also seen as essential meaning here the actions made to gain the financial and non-financial benefits. This can be seen as **the mechanism to get the benefits out of the value chain**. This sub category was viewed from the perspective of the company offering IoT solutions to a competitive sports center and also from the point of view of a competitive sports center applying IoT to their business.

The question categories focused on getting an answer to the main or the sub research question as well as ensure that the interviewee is selected correctly giving

rich data of the research subject. Although as explained above specific categories were tailored to give answers to specific questions, they are also overlapping and the line is not strictly written. This means for example that the success factors may play an important role in the added value category as well and vice versa. The set of questions under each category, was put together to guide the conversation and help the interviewer to keep the interview on track. The interview question guide may be seen in Appendix 2.

### 3.4 Data Analysis

The language of the interviews was Finnish, since it was the native language of the interviewees and the interviewer. Choosing the native language allowed the interview to process fluently and to avoid linguistic misunderstandings. All the interviews were audio-recorded and transcribed afterwards. Hirsjärvi and Hurme (2011, 140) suggest that it should be decided beforehand how specific transcriptions are made. The transcriptions were made almost word-to-word. Only if the same word was repeated many times in a row without a new meaning to the sentence, the word was not repeated in the transcriptions. Total of 59 pages were transcribed in Finnish language using font Calibri, size 11 and line spacing 1.5. Table 1 shows the expert roles of the interviewees and for each of them, the current work role, education, professional background, work experience, the length of the interview in minutes and seconds and the number of transcribed pages. The data was gathered from the interview material (background information).

Table 1. Background information on interviewees

The expert role	Current work role	Education	Professional background	Work experience	Length of interview	Transcribed pages
IoT company expert	Quality Expert	M.Sc. & Licentiate of Technology	Telecommunications technology and IoT	Over 20-years of work experience	27 minutes 26 seconds	8 pages
IoT expert: education and research	Principal Lecturer, R&D projects related to IoT	M.Sc. of Technology	Planning, sales, marketing, projects, teaching, consulting and buying from the field of automation. From 2012 in R&D projects related to IoT.	Over 20-years of work experience.	43 minutes 33 seconds	13 pages
Sports expert: especially competitive sports	Consultant, Capacity Coach and Coach for national team level athletes	Physiotherapist, master of sports (coaching)	Sport physiotherapy, research, coaching the national team, teaching, working in sports academy, coach center management, business coaching and consultation.	Over 20-years of experience	38 minutes 34 seconds	10 pages
IoT company expert	Chief Development Officer, Digital Services	Media technology engineer	Software industry experience from several companies and teaching.	About 10-years of experience related to IoT	36 minutes 57 seconds	11 pages
IoT expert: education and research	Principal Lecturer, R&D project related to IoT	M.Sc. & Licentiate of Technology	Telecommunication industry (product development), teaching and R&D projects.	15-years of experience in IoT (mainly sensor technology)	32 minutes 10 seconds	10 pages
Sports expert: especially physiology and health technology	Research Manager and Company Founder	PhD in Exercise Physiology	Entrepreneurship, founder of health technology company (related to IoT).	8-years of experience related to sports, health and technology	23 minutes 53 seconds	7 pages

Inductive approach was followed through the data analysis process, since the data was collected to develop a theory as a result of the data analysis. The aim was to get a feel of what is going on to better understand the nature of the problem and the meanings. (Lewis et al. 2009, 124–126.) This was important to be able to identify relationships and patterns to build the theory. According to Hirsjärvi and Hurme (2011) the analysis of qualitative data has many phases. Essentially, it is analysis and synthesis. In analysis the material is broken down and classified and in synthesis the aim is to form an overall picture, the big picture of the phenomenon in a new perspective. (143.)

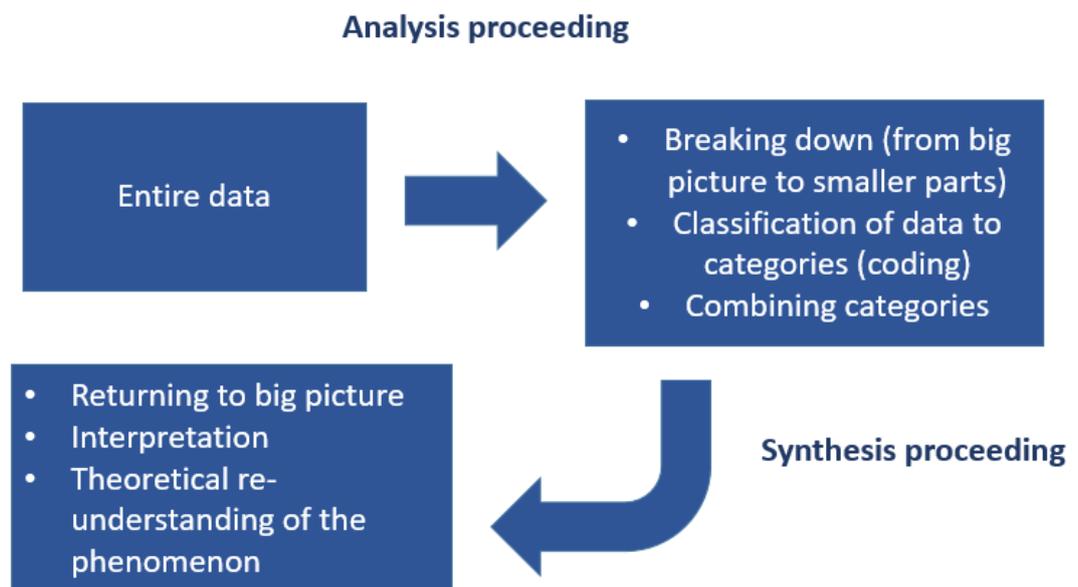


Figure 9. Processing interview data (adapted from Hirsjärvi & Hurme 2011, 144)

Figure 9 shows the process of processing interview data from analysis to synthesis. In this research, the data was processed according to this process: data was first broken down, classified into categories and coded, after that joined back together into a big picture, interpreting and re-understanding the phenomena (Hirsjärvi & Hurme 2011, 143–144).

Breaking down the data was started so that the entire transcribed data was broken down and summarized. The interviewee comments, with rich amount of data relevant in relation to the questions asked were capsulized. This was done to a separate word document. The 59 page transcribed data was summarized to 14 pages (same font size and line spacing as in transcriptions). The important terms were highlighted using bold font.

The process continued so, that the summarized data was classified to categories and codes according to the interview structure and themes: (C1) IoT in sports, (C2) possible usage of IoT in Hippos2020 environment, (C3) business success factors, (C4)

business challenges, (C5) business model generation, (C6) financial benefits, (C7) non-financial benefits, (C8) procedure to achieve benefits and (C9) additional remarks by the interviewees. To achieve confidentiality of the interview material the names of the interviewees were given codes: A1, A2, A3, A4, A5 and A6. The language was Finnish and the translation to English was made later, in the phase when writing the analysis. An example of the data analysis process is shown by an extract of the coded Word document in Figure 10. The sample shown in Figure 11 was separately translated, so it is more informative for the reader.

## 1) Added value

### C6: Financial benefits

- a) What additional return and savings could a company offering IoT solutions to a competitive sports center receive?

A1: For example, the IoT company could offer a solution **as a service**, and the competitive sports center sells the service forward to its customers and gains **service fees**. **Utilizing the resulting data**, whether it is accumulating from technology of the buildings or users, there may be found new opportunities. **Duplicating the service** to gain product **development savings** (the service can be offered slightly modified to another customer).

A2: IoT offers **real-time data** and a **massive amount of data**, **the one who owns the data is a market leader** in many senses, because the data can be used for **analysis** and to promote/ refine the business and this leads to the possibility to **pioneer** in the business compared to competitors with more traditional technology.

A3: **Selling data**, the company may get one part of the profit and the competitive sports center another part.

Figure 10. Extract of the data analysis process

The next step was to recognize patterns within these bolded comments rich in data. This was done by counting, thematizing and finding relationships (recognizing patterns), which are qualitative analysis methods mentioned by Hirsjärvi and Hurme (2011). By counting is meant how many times some phenomenon appears in the data. This can be visualized for example with a diagram with numbers. Thematizing on the other hand means that features common to several interviewees are looked into and grouped. The themes are based on the researcher's interpretations on what belongs under the same theme. Finding relationships or recognizing patterns in the factors that rise from the data is maybe the most important part of the analysis. (172–174.) To ease the process of counting, thematizing and finding relationships the summarized data was moved to Excel, so that only the bold phrases and concepts were listed in the Excel document. A sample of the Excel document is seen in Figure 11. The sample is separately translated so it is more informative for the reader. C7f stands for C7 Non-financial benefits and f for this specific question in that category f) What non-financial benefits could a customer of a competitive sports center receive via IoT solutions? The A1, A2... etc. represent the interviewees and the color codes represent classification of the data to categories. For example, the color red in this sample represents easiness and fluency as relevant non-financial benefits for the customer.

AA	AB
	C7f
A1	Networking
A1	Communality
A1	finding the right sport
A1	Easiness
A2	Easiness of visiting
A2	Real time information
A2	Systematic training and development
A2	Meaningfulness of watching games
A3	Tailored services
A3	Avoiding rush hours
A3	Using services fluent
A3	Entertainment
A4	Saving time
A4	Fluency
A4	Easiness
A4	Less stress
A5	Watching sports meaningful and easy
A5	More information available for sport followers
A5	Novelty value
A6	Better influence in health
A6	Events more tailored for oneself

Figure 11. Counting, thematizing and finding relationships in the data

### 3.5 Ethical Concerns

In this chapter, the purpose is to assess the research process and quality of the research. Since the study was on a novel subject, there was a limited amount of scientific data available about the specific subject at hand. This resulted in the fact that in addition to the scientific sources, the literature review consisted of other sources relevant to the research, for example, company websites and commercial research center information.

A common objection to interview analysis is that different interpreters may find different meanings in the same interview, and thus the interview is not a scientific method. The objection also involves a demand for objectivity, which means that the statement has only one correct and objective meaning and the purpose is to find this one and only meaning through analysis. (Brinkmann & Kvale 2009, 211–212.) As interviews are also the primary research method in this research, there was also the concern of the author (researcher) making wrong interpretations. To minimize the possibility, the author oriented herself to the subject of the research profoundly, prepared herself for the interviews carefully in advance, transcribed the interviews in detail and analyzed the data in an organized way based on analysis methods found in research literature. Still the possibility of making wrong interpretations or focusing on wrong parts of the interviewee's statement remains and cannot be totally avoided.

Hirsjärvi and Hurme (2011) also point out that the reliability of the interview data depends on the quality of the data. If the quality of the recordings is poor, the transcription process, for example, differs from first to last interview or classification of data is coincidental, the interview data can not be perceived as reliable. (185.) All the recordings in this research were made with a high quality recorder, and for the sake of possible technical errors two recorders were used just in case. The quality of all the recordings was very high. As described earlier the transcriptions in this research were made in a systematic way, and classification of the data was based on a systematic analysis method found in research literature.

There were some factors influencing the reliability of this study. A semi-structured interview allows a free flow of the conversation, which means that the order of questions may differ among the interviews. Moreover, since the semi-structured qualitative interviews resemble a conversation to some extent, the questions were not presented exactly the same way to each interviewee. Some interviewees also understood a specific question wrongly, typically not remembering from which perspective to answer the question (the IoT company, the competitive sports center or the customer perspective). This led to the fact that the same question needed to be asked again, and the interviewer needed to strongly focus on the interview

structure so that all parts will be covered. This may have affected the reliability of the study. The interviewees might have felt confused and frustrated of having to repeat the answer to the same question and focus on the perspective once more. The interviewer, on the other hand, might have missed an important point in the interviewees' answers that could have been focused on more, since the focus was on the interview structure at that moment.

Achieving total research reliability means that the findings should be reproducible at other times and by other researchers. This is one way of defining reliability. However, this definition is abandoned, especially if changing features are in question. (Hirsjärvi & Hurme 2011, 186.) In this study, the phenomenon under research was novel and constantly developing at a high pace, so achieving total reliability would not be possible, if the research would be repeated, for example, in ten years. The knowledge base and experiences of the same interviewee might be very different about the phenomenon due to development of the field and personal experiences. Hirsjärvi and Hurme (2011) explain that another way to define reliability is that the result is reliable if two assessors end up with the same result. This is quite an extreme definition, since total inter-subjectivity does not exist, every person makes their own conclusions, based on their own experiences, and it is unlikely that two assessors would understand the saying of a third person exactly the same way. A not so extreme version of this same definition is that the assessment is placed in certain categories, which rises the likelihood of two assessors ending up with the same result. Still, it is no more than an approximation of how the assessors have understood the specific answer. Because of these problematic facts presented, one should be at least to some extent reserved when reacting to the definitions of reliability. (Hirsjärvi & Hurme 2011, 186.)

## 4 Results

The results of the research are presented in this chapter. The results of the interview data were made utilizing the Excel document, the summarized 14-page document and the actual transcriptions of the interviews (these documents were presented in chapter 3.4). All the interviewees are referred to as “he” without regard to the actual gender of the interviewee. Most of the background information was already given in the data analysis chapter (Table 1). One background question that has not yet been covered is covered now before moving to the actual coded categories of the data. IoT experts from education and research and IoT company experts were asked in the background questions part:

What kind of personal experiences do you have of applying IoT in practice, if any? Is there something else you would like to point out?

Interviewee 1 pointed out that based on the experiences he had had of IoT projects, he had discovered that companies are often impatient and are not so enthusiastic about IoT solutions, since the results will be visible later and not immediately after taking them into use. Interviewee 2 said that he had been dealing with IoT in the company he is working at the moment, related to thermal and electrical energy. Interviewee 4 said he had been making IoT solutions in work projects. The solutions are related to the energy sector, the vehicle side and the health/ welfare sector. Interviewee 5 had experience of IoT in pilots of student projects and projects for companies, such as an energy related peatland application, which ran through the whole implementation chain.

The sports experts were asked in the background questions part:

How is IoT familiar to you? Is there something else you would like to point out?

Interviewee 3 answered, that he had made an interview round for Hippos2020-project about the technology needs, especially of the sports and research technology needs. Interviewer 6 said that IoT term is familiar to him, he is a founder of a startup

company, a health technology company that is related to IoT. The company collects daytime activity data and analyses it. He also told that his daytime work is related to welfare technology.

#### 4.1 IoT in Sports

The interviewees were asked what they know about the usage of IoT in sports. Figure 12 shows that

- fitness trackers and self-monitoring was mentioned by altogether five interviewees;
- sports equipment related solutions like for example rackets with sensors next often by four interviewees;
- positioning and sensing technology were both mentioned by two interviewees;
- analytics also by two interviewees;
- added value by one interviewee and
- entertainment for viewers and healthcare solutions by one interviewee.

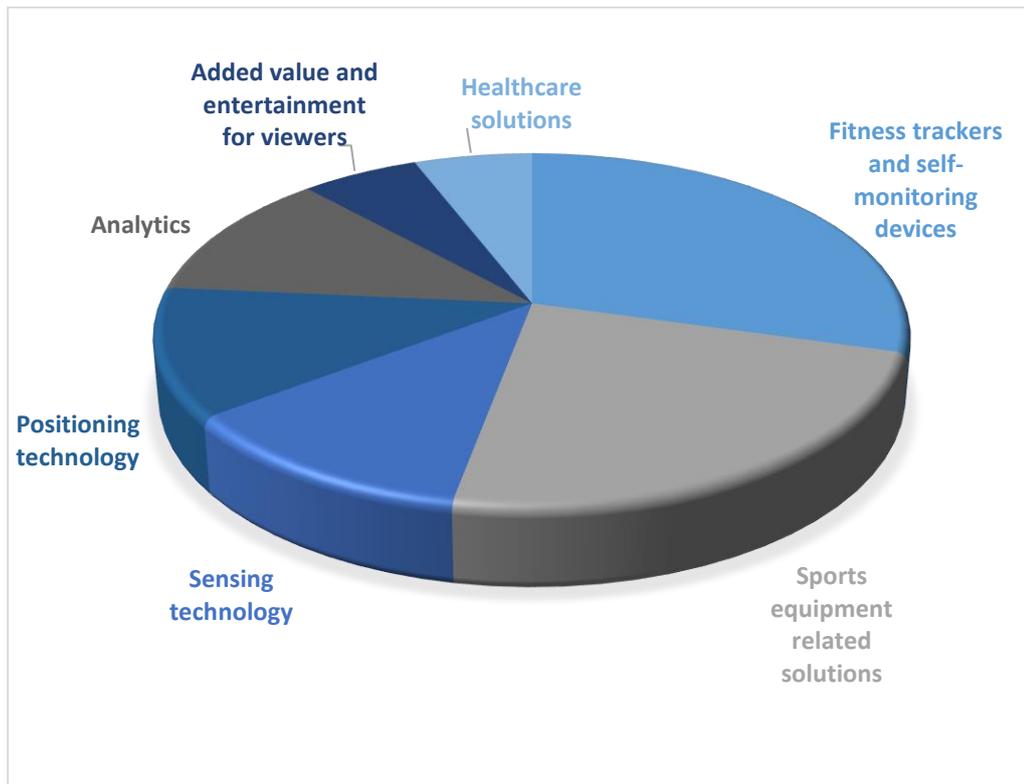


Figure 12. IoT in sports

The answers that appeared the most could be harshly categorized under IoT solutions: **listed by technological features** (sensing, analytics and positioning) and **listed as physical objects** (sports equipment related and fitness tracker/ self monitoring devices). 2-7 different usage examples were listed by each interviewee. Interviewee 2 also said that there are endless opportunities and interviewee 3 said that the question is very broad.

Next, the interviewees were asked if they could think of possibilities for the usage of IoT in a modern competitive sports center like Hippos2020.



Figure 13. Word cloud: possibilities for IoT in Hippos2020

A word cloud was created to illustrate the enormous amount of possibilities that were seen for IoT in competitive sports centers like Hippos2020 (Figure 13). Over 30 concrete usage examples were given and in addition, two interviewees responded that there are lots or even endless possibilities. A strong pattern that can be seen was that **data** was mentioned many times (the biggest font is used for this in the figure). Data was seen as an important by-product of IoT solutions and an essential part of further developing business and the production process. Data privacy was also seen essential. “The essential value is mining data and using it to optimize the production process and to create new business; these are the two things that Hippos2020 can gain money and success with” (Int 01). Interviewee 3 responded, that

*There are possibilities that can be divided to different levels: One level is related to the real estate, its' management and operations (ventilation, lighting, transport, logistics, equipment rental and maintenance). The second level is the teams that use the arena (coaches, team leaders and athletes). Here the technology is related to training facilities, equipment, devices related to recovery and access rights. Third level is fans and marketing. You can for example pre-order a smoothie/ fan products to your seat at a game, ticket sales, personalization of the camera angle (the viewer can decide whether to watch the goal keepers camera or the attackers camera). The fourth level is collaboration with research; the collected data can be given to the researchers and may return to the users through another way.*

This answer is especially interesting since it helps you to understand how broad possibilities IoT may offer in such a restricted location.

Many of the smart stadium possibilities that have been mentioned in chapter 2.1.2 were also mentioned by the interviewees (a bigger font used in Figure 13), some to point out:

- smart parking;
- in-seat concession;
- queue estimation;
- interactive watching (camera angle possibilities);
- pre-online orders and
- crowd understanding.

One that was mentioned by two interviewees and deserves special attention is increasing profitability by **smart infrastructure** as already mentioned above in different levels of possibilities as level one, real estate. One interviewee devoted deep thought on this subject:

*Large set of buildings, as Hippos2020, could be used as a so-called virtual power plant, meaning it is used to store electric energy, when it is sensible to store and the energy is used or even sold when the price of electricity is high. The first such virtual power plant in Finland is Cello –*

*shopping center. Savings and earnings per year may be hundreds of thousands of euros. (Int 01.)*

This view can be linked together with smart city and smart stadium real estate possibilities. What is especially interesting is the fact that it definitely represents a futuristic approach to how buildings can be smartly utilized as well as environmental friendly and sustainability image.

## 4.2 Business Success Factors and Challenges

This part is divided so that first the success factors are analyzed from the point of view of the company offering IoT solutions to a competitive sports center. Then the success factors are analyzed from the point of view of the competitive sports center utilizing IoT solutions in their business. The same two viewpoints will be covered from the point of view of the challenges. To understand the success factors and challenges better, important factors in business model creation will also be analyzed from both company offering IoT solutions and competitive sports center utilizing IoT –point of view.

### 4.2.1 Success Factors

First, the themes that were mentioned for both parties (company offering IoT solutions to a competitive sports center and competitive sports center utilizing IoT solutions in their business) as **success factors** will be gone through. **Customer need** was one of them, it was seen as a clearly important factor from both perspectives. Interviewee 2 said that you need to understand the customer need, what problem you are solving for the customer and this is important from the IoT company and the competitive sports center perspective. Interviewee 5 on the other hand said that

competitive sports center utilizing IoT in their business should have a clear customer need, so that the solution will be used. Interviewee 2 added that both sides need to keep in mind the law of demand and supply. **Customer benefit** was also mentioned in both views. Interviewee 5 described that the company offering the IoT solutions to a competitive sports center needs to offer the user of the technology some additional benefit. Interviewee 6 highlighted that the customer benefit needs to be crystal for the competitive sports center, since it is a competitive advantage. **Data privacy and security** issues were also mentioned as important success factors for both, the IoT company and the competitive sports center. Interviewer 6 commented that the transparency of collecting data is important and it has to be clear to people what data is collected and they need to have the possibility to forbid collecting data about them. Deciding the correct **revenue generation model** and understanding the business logic behind it was mentioned as a crucial success factor for the IoT company by two respondents (int 3 and Int 4) and by two other respondents for the competitive sports center (int 1 and Int 5).

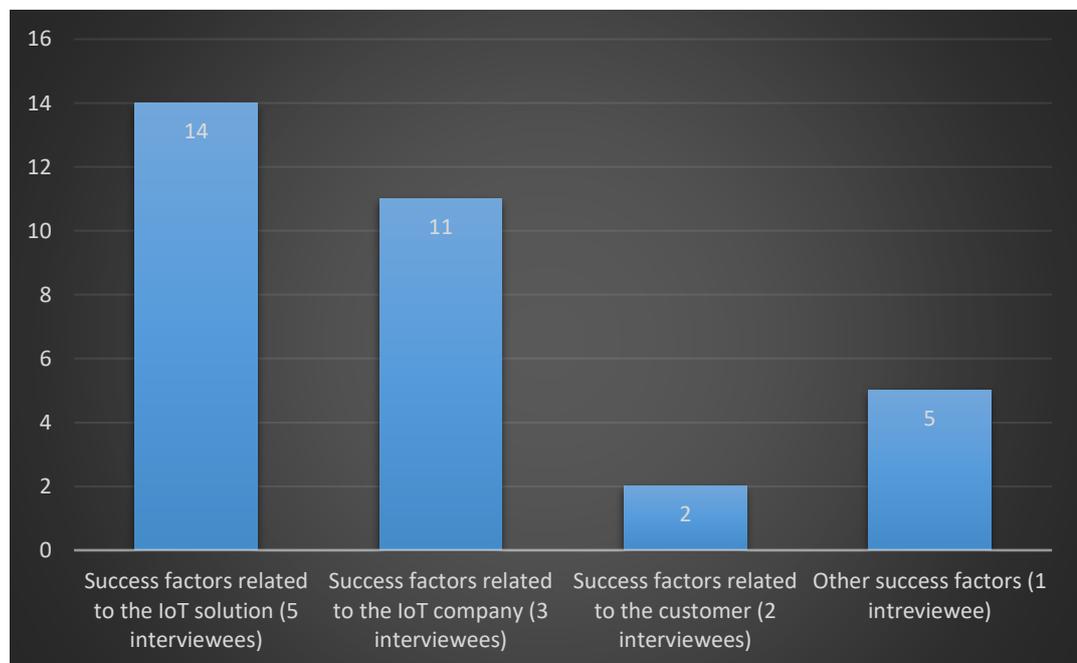


Figure 14. Success factor for the IoT company

Figure 14 shows the success factors of the company offering IoT solutions to the competitive sports center. From only the IoT company point of view one clear theme that emerged from the interviews were **features describing the IoT solution**, 14 features were mentioned by five interviewees. The user interface needed to be easy to use. This was mentioned by two interviewees (Int 1 and Int 5). Customization (Int 6) and scalability (int 1) of the platform as well as the IoT solution was also seen important. Interviewee 6 underlined that the solution must be customizable to a great extent, since at the point that the purchase for the solution is made, the final use might not be clear. The same interviewee gave weight on the importance of workable interfaces to other systems. Interviewee 1 stated that the solution needs to be cloud-based, so that it is scalable and not dependent on some specific technology. It is also important from the users point of view, it needs to work with 100 or 100 000 users. In addition to cloud based also mobility was mentioned by interviewee 1.

Three interviewees described important **characteristics** (altogether eleven characteristics) **of the IoT company** providing the solutions. These characteristics were

- experience of the specific industry in question;
- consumer-marketing experience;
- understanding the importance of partners;
- understanding the importance of ecosystems;
- large enough company;
- enough know-how resources;
- enough financial resources;
- understanding revenue generation models and
- understanding service models (Int 3);
- fixed price model between the IoT company and the competitive sports center (Int 4) and

- the need to find partners that pay for the costs of generating the IoT solution (Int 5).

**Customer related success factors** were mentioned two times by two interviewees. It was mentioned that the IoT solution has to offer added value for the customer (Int 5) and the customer need has to exist (Int 2). Interviewee 2 listed five **other success factors** that cannot be grouped under the previous categories

- keep in mind the law of demand and supply;
- remember that money is with the big masses;
- the big masses are essential for success;
- utilize a commercial mindset and
- proceed technology first.

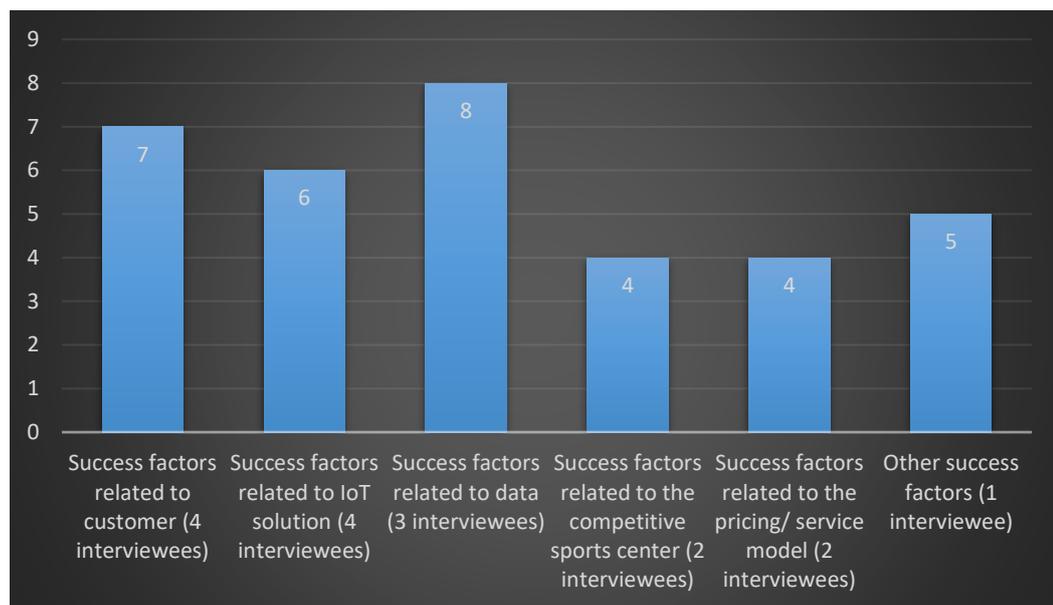


Figure 15. Success factors for the competitive sports center

**Success factors related to the customer** were mentioned seven times by four interviewees (Figure 15). The customer need needs to be clear (Int 2, Int 5 and Int 6),

since it is seen as a competitive advantage (Int 5). The mindset on the added value that the IoT solution offers the customer (Int 1 and Int 5) should be customer oriented (Int 1). **Success factors related to the IoT solution** were mentioned six times by four interviewees. Interviewee 3 thought that it is important that the IoT solution and its functions are reliable; it is adaptive and has novelty value. Data security (Int 2) was seen as an important success factor for the competitive sports center as well as data privacy (int 6). In addition, interviewee 4 mentioned that the solution should be easy to offer to other operators, for example for sports clubs. Eight **success factors related to data** were mentioned by three interviewees. Interviewee 1 pointed out the same issues as in chapter 4.1. that the essential value is mining data and using it to optimize the production process and to create new business in addition. He mentioned that to succeed it is important that the competitive sports center shares the data to the software specialists for product development use. Interviewee 3 mentioned that collecting and analyzing data is important and by analyzing data it is possible to gain better customer service and develop the organization. Interviewee 6 pointed out that the process for collecting data should be transparent. It should be clear to the customers, what information is being collected about them, and they should also have the possibility to forbid personal data collection. **Success factors related to the competitive sports center** were mentioned four times by two interviewees. Interviewee 1 pointed out that it is important to find good partners and create an ecosystem, since the competitive sports center actors cannot have all the needed knowledge alone. As explained above when going through the success factors from the IoT company point of view, Interviewee 4 mentioned that it is important that there is a fixed price model between the IoT company and the competitive sports center. The same interviewee thinks that the competitive sports center on the other hand should make a contract with the renters of the facilities (for example with a sports club) in a way that the IoT solutions are included in the rent price. "It inspires to try new solutions when they are included in the package, and the sale of additional services is easier" (Int 4). He also mentioned that,

*The competitive sports center could have an agreement with the sports clubs about selling their fan products in a centralized system and that way getting a small provision (1-2 %) of the sales. For the sports clubs it would be advantageous since card payments would anyway have a small commission, so both sides would benefit. The provision could be about the same as in card payments and the sports clubs would not have to think about systems/ sales channels and the amount of customers/ volume would be bigger in a centralized model. The fee is also psychologically easier to accept when it is taken only from the products sold. (Int 4.)*

**Success factors related to the pricing/ service model** were mentioned four times by two interviewees. Earning logic and pricing model were mentioned (Int 1 and Int 5) and also service model creation (Int 1). Interviewee 2 thought that the same five success factors that he had mentioned previously when the IoT company was viewed also apply to the competitive sports center perspective, these cannot be grouped under the previous categories:

- keep in mind the law of demand and supply;
- remember that money is with the big masses;
- the big masses are essential for success;
- utilize a commercial mindset and
- proceed technology first.

#### 4.2.2 Challenges

**Challenges** that were seen as crucial from both views (the company offering IoT solutions and for the competitive sports center utilizing IoT in their business) were related to not knowing the **customer needs** (Int 2 and Int 5) and the **customer segment** (Int 2) well enough. It was also several times mentioned (Int 5 and Int 6) that a challenge for both would be that the **product is hard to use** and the **system is inflexible**.

Challenges for the company offering IoT solutions to the competitive sports center can all be classified under three categories:

- challenges related to the actor itself (the IoT company);
- challenges related to the IoT solution and
- challenges related to the customer (Figure 16).

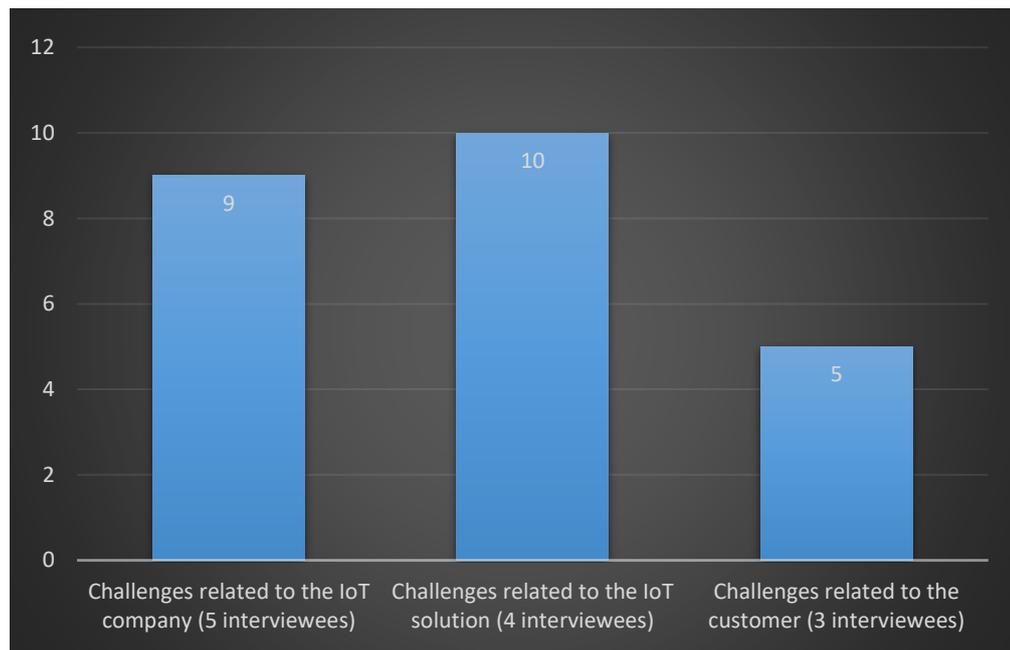


Figure 16. Challenges of the company offering IoT solutions

Nine of the challenges for the company offering IoT solutions to the competitive sports center mentioned by five interviewees were listed **related to the IoT company** itself. These were related to

- making the company credible enough (int 1);
- having enough developing resources (Int 1);
- problems commercializing the solution (Int 2);
- finding a workable logistics chain (Int 2);

- finding workable supply channels (Int 2);
- inexperience in providing IoT solutions (Int 3);
- wrong type of pricing strategy and (Int 4 and Int 5) and
- inability to predict actual costs (Int 5).

Ten of the challenges mentioned by four interviewees were challenges **related to the IoT solution**. These challenges were related to

- getting the technology reliable (Int 2);
- making the technology cheap enough (Int 2);
- making the product well-known (Int 2);
- data privacy issues (Int 3);
- making systems easy to use (Int 5 and Int 6) and
- making them work well (Int 5).

There were also five challenges mentioned by three interviewees **related to the customer** and these were related to

- not knowing the customer behavior (Int 1);
- not knowing the added value that the solution brings the customer (Int 1);
- not knowing the customer need (Int 2 and Int 5);
- not analyzing the need well enough (Int 1) and
- not finding the right customer segment (Int 1).

Challenges for the competitive sports center applying IoT to their business can also all be classified under three categories:

- challenges related to the actor itself (the competitive sports center);
- challenges related to the IoT solution and
- challenges related to the customer (Figure 17).

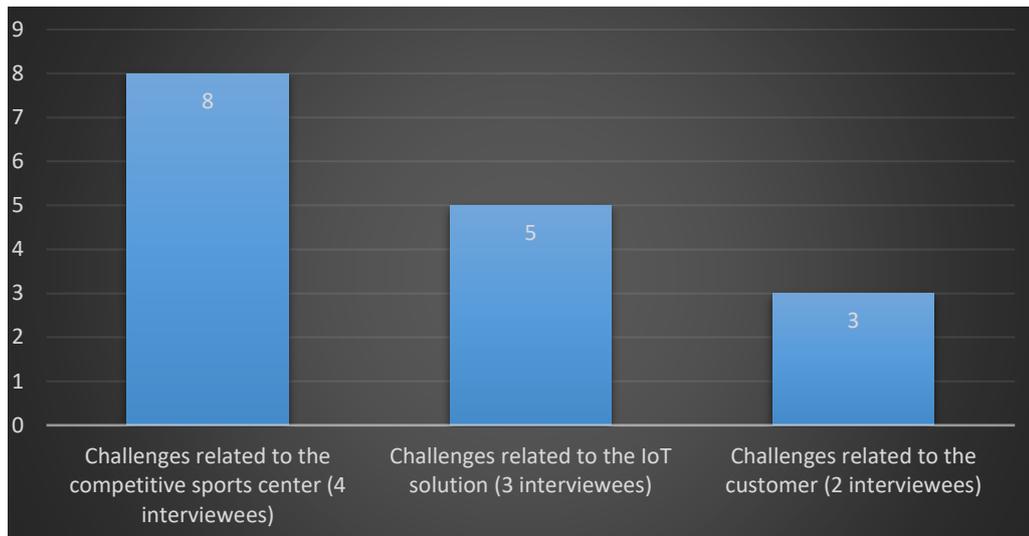


Figure 17. Challenges of the competitive sports center

Eight challenges mentioned by four interviewees from the competitive sports center side were **related to the actor itself**. There were worries of

- the ecosystem getting blocked (Int 1);
- the processes designed according to inner processes not in an agile way (Int 1);
- the commercialization process not succeeding (Int 2);
- problems finding a working logistics chain occurring (Int 2);
- finding the proper channels (Int 2);
- related to contracts between operators (who maintains the solutions etc.) (Int 5);
- the revenue model not being well thought out (Int 5);
- people getting paranoid and thinking that they are only monitored and controlled 'big brother watchin' (Int 6).

**Challenges related to the IoT solution** itself were mentioned five times by three interviewees. As from the IoT company point of view there were also worries from the competitive sports center point of view on getting the technology reliable and

cheap enough and making the product well-known (Int 2). Connecting the information systems (Int 3) was also seen as a challenge as well as the risk that the solution will not be used (Int 4). Three challenges mentioned by two interviewees were **related to the customer**. These were finding the customer segment and the customer need (Int 2) and that the solution will end up being hard to use for the customer (Int 6).

#### 4.2.3 Business Model Creation

Next, the interviewees were asked what is important for a company offering IoT solutions to a competitive sports center **when creating a business model**. Three of the interviewees mentioned that the **revenue model** is important (Int 1, Int 5 and Int 6). One mentioned that building the model for making business (Int 2) is important and this may mean similar. Two of the interviewees mentioned that the revenue model needs to be clear (Int 5 and Int 6). One also pointed out that it is important to **calculate service charges** for long periods (Int 4). One mentioned that **initial capital financing** and **sufficient resources** (Int 2) are important. A relevant issue mentioned by four of the interviewees was **partners**. It was seen that it is crucial to find the right, appropriate and reliable partners (Int 1). A companion contract might be an option with the competitive sports center (Int 5). It was also seen important to decide **who maintains and updates the systems** (Int 6). To get the supply chains and processes working was also mentioned important from the business model point of view (Int 2). One mentioned that it is important to build the business model to lean on the fact that the IoT solution is **offered as a service** (Int 4) so the competitive sports center would not need to maintain and update the systems. Some important issues were the same as already mentioned in the success factors:

- scalability of the solution (Int 5);
- identifying customer needs (Int 2);
- identifying added value to customer;

- mobility of the solution and
- that the solution is easy to use (Int 1).

**Data** was also again mentioned, one interviewee saw that it is important from the business model point of view to decide what data can be collected, what data is necessary to collect and to whom the data is collected (Int 3).

The same question was next asked from the competitive sports center perspective, what is important from that viewpoint when creating a business model. Interviewee 1 thought that the same issues as he had mentioned for the IoT company side apply here as well, he mentioned again

- the revenue model;
- added value;
- finding the right partners and
- a mobile and easily usable IoT solution.

In addition to these he mentioned data flowing smoothly in information systems and customer segmentation. **Added value** was also mentioned by interviewee 6 and **easily usable** was mentioned by interviewee 4. Interviewee 2 and 4 said that it would be important to have **a common infrastructure** that takes into account the **different target groups** and **functions** (viewers, competitive sports, events, organizations, consumers, clubs etc.). For the competitive sports center to be able to make a business model for IoT interviewee 2 pointed out that it is important that there is **knowledge of technology** in the competitive sports center side as well.

### 4.3 Added Value

As discussed in chapter 3.3, added value is seen on this research as a benefit, which has **financial benefits** and **non-financial benefits**. The **procedure** was also seen as

essential meaning here the actions made to gain the financial and non-financial benefits, the mechanism to get the benefits out of the value chain.

#### 4.3.1 Financial Benefits

The financial benefits will be examined from the company offering IoT solutions point of view, the competitive sports center point of view and the customer of the competitive sports center point of view. First, the interviewees were asked what are the financial benefits, the additional return and savings that the company offering IoT solutions to a competitive sports center can receive (Figure 18).

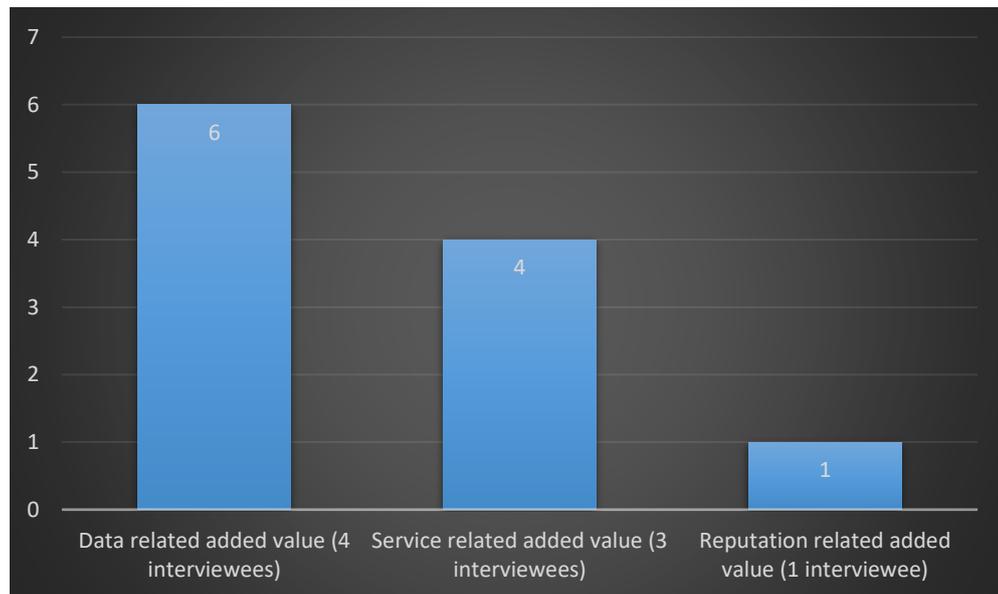


Figure 18. Financial benefits for the IoT company

**Data related added value** was mentioned six times by four of the interviewees as financial benefits, additional return and savings for the company offering IoT

solutions to the competitive sports center as seen in Figure 18. Utilizing (Int 1) and selling data (Int 3), gaining massive amount of data and real time data were mentioned (Int 6). It was also underlined by interviewee 2 that the one owning the data is the market leader. **Service related added value** was mentioned four times by three interviewees as financial benefits. Service charges (Int 1 and Int 4) and the possibility to duplicate the service (R&D savings) were mentioned (Int 1 and Int 5). **Reputation related added value**, pioneering, was seen to eventually end up as a financial benefit according to Interviewee 2.

The additional return and savings that the competitive sports center could receive via IoT solutions will next be looked at. From the three point of views, this one created clearly the most data (Figure 19).

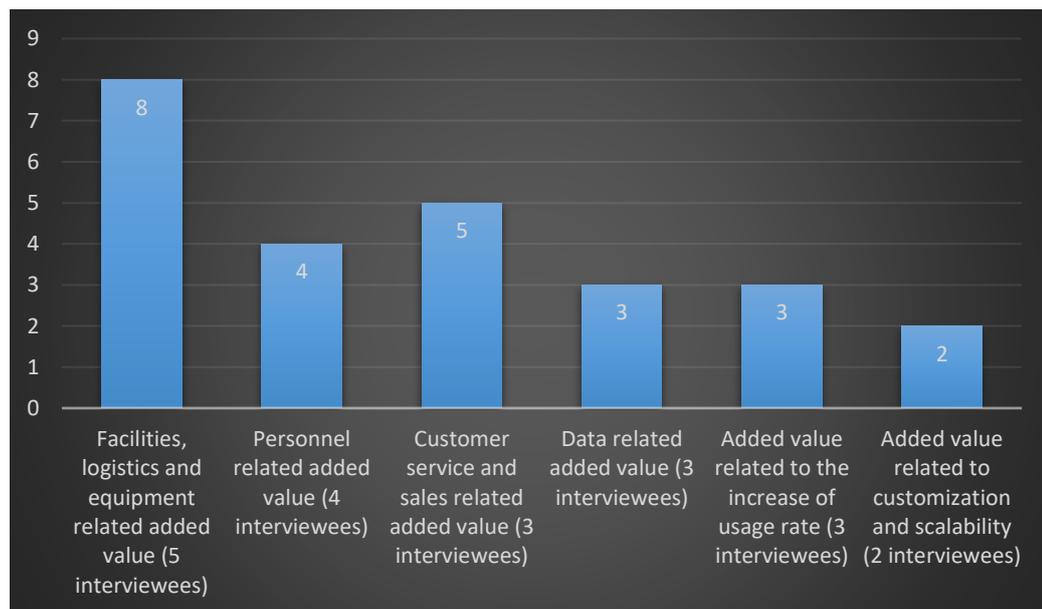


Figure 19. Financial benefits for the competitive sports center

**Added value related to facilities**, logistics and equipment was mentioned eight times by five of the interviewees. Three of the five interviewees (Int 1, Int 2 and Int 5)

mentioned financial benefits related to saving energy via IoT solutions in the facilities. Interviewee 2: “The sensible optimization of the building’s usage of energy, lighting and air conditioning control can cut the real estate operational costs significantly and smart maintenance can be implemented in the buildings.” Also the virtual power plant example (Int 1) mentioned earlier in chapter 4.1 was brought up again as a possibility for additional revenue and savings. Organizing logistics (Int 1) and optimizing the usage of facilities with IoT solutions (Int 6) were also mentioned as well as anticipatory maintenance of the equipment (Int 3).

**Personnel related added value** was mentioned four times by four interviewees. It was seen that there are possibilities to reduce personnel with the help of IoT solutions (Int 3 and Int 5). Interviewee 4 explained that it is possible to gain savings by organizing sales differently and utilizing pick-up points. Interviewee 6 pointed out that the savings are possible since it is easier to allocate personnel according to peak hours.

**Customer service and sales related added value** was mentioned five times by three interviewees. Interviewee 4 thought that the purchase transaction will be easier with the IoT solution and that it increases sales for fan products additional services. Interviewee 1 thought that service fees of the IoT solution itself would gain financial benefits. Interviewee 6 pointed out that the possibility to follow the development of the customers and access right management finally end up being financial benefits.

**Data related added value** was mentioned three times by three interviewees, selling data twice (Int 1 and Int 3) and gaining better predictability by analyzing data once (Int 4). **Added value related to the increase of usage rate** of the facilities was also mentioned three times by three interviewees. All three interviewees (Int 4, Int 5 and Int 6) mentioned, that the usage rate of the facilities will rise because of interesting IoT solutions related to them. One (Int 6) mentioned that the services will also be more efficient. **Added value related to customization and scalability** was mentioned two times by two interviewees (Int 1 and Int 6).

Next the same question about the financial benefits (additional return and savings) was asked from the point of view of the customer attending the competitive sports

center. This perspective resulted the least amount of data and it was clearly hard for the interviewees to think of financial benefits that the IoT solution could offer the customer (Figure 20).

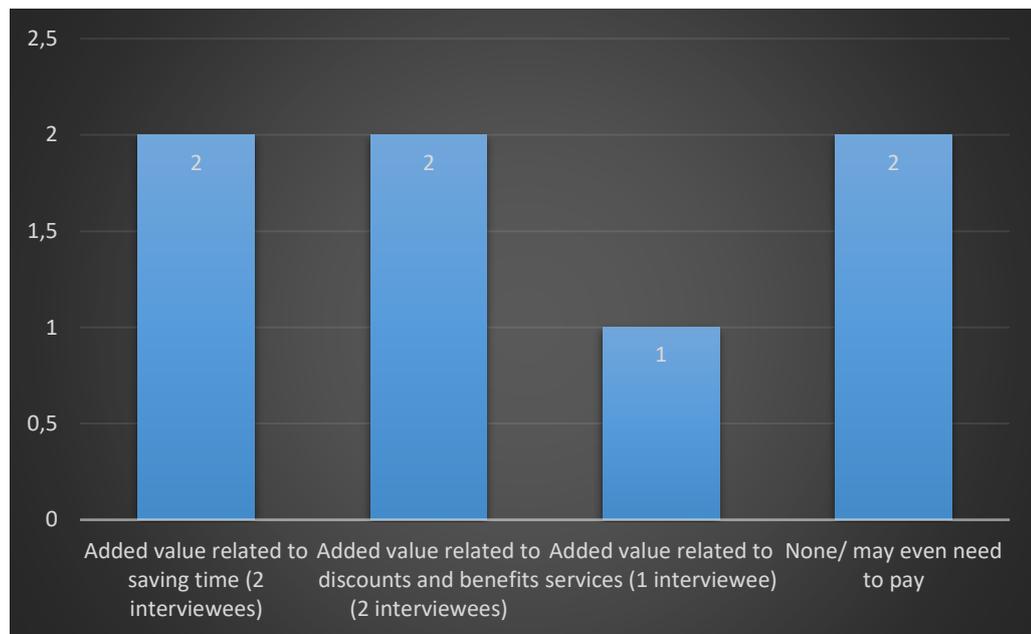


Figure 20. Financial benefits for the customer

**Added value related to saving time** was seen as a financial benefit for two of the interviewees (A1 and A2). Interviewee 2: “You can find your seat more easily at a game; you can see what queue is the shortest or is the stadium’s beer place crowded.” For these two respondents time was seen as money. **Added value related to discounts and benefits** was also mentioned two times by two interviewees. Loyalty customer benefit (Int 3) and discounts and services better suitable for the customer (Int 6) were mentioned. Interviewee 1 also mentioned that the customer can save money by renting the health technology IoT solutions, so there is no need to buy them for own use only, the customer would gain **added value through the services** offered. Two interviewees said that there are **no financial benefits** for the

customer (Int 4 and Int 5) and interviewee 5 even mentioned that the customer can receive other benefits that are not financial and should rather pay for the IoT solutions.

#### 4.3.2 Non-Financial Benefits

The Non-financial benefits will also be examined from the company offering IoT solutions point of view, the competitive sports center point of view and the customer of the competitive sports center point of view. **Image** was pointed out as an important non-financial benefit for both the IoT company (Int 1 and Int 4) and the competitive sports center (Int 1, Int 4 and Int 5) side. Although there were themes that recurred in each separate view of non-financial benefits, the data was slightly more scattered, and the amount of data that this section produced was less than in the previous part (financial benefits). For these reasons, a pie chart illustrates the relationships of the categories in a more appealing way and was chosen for the visualization of the IoT company and competitive sports center view.

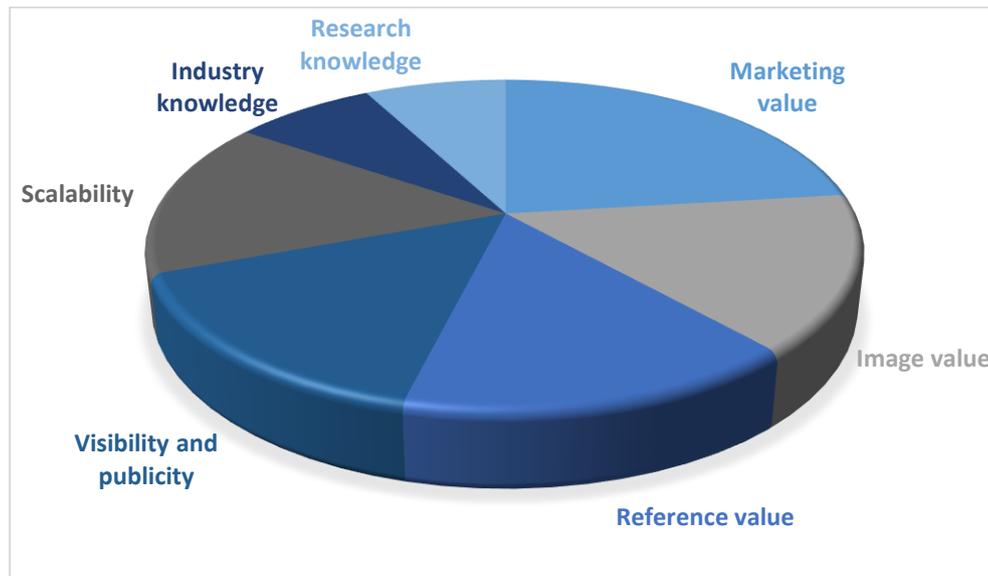


Figure 21 Non-financial benefits for the IoT company

First the interviewees were asked what non-financial benefits the company offering IoT solutions to a competitive sports center could receive. Figure 21 shows that **marketing value** was mentioned just about most often, by three interviewees (Int 2, Int 4 and Int 6). Interviewee 6: “These competitive sports centers are public spaces, so it’s a good marketplace for the company in that sense.” Answers that were slightly related to the same category were **image value**, which was mentioned by two interviewees (Int 1 and Int 4). Interviewee 1: “IoT solutions are digital so they are related to sustainable development and image value is of course important.” **Reference value** was also mentioned by two interviewees (Int 1 and Int 4). A little related to the two previous categories was **visibility and publicity** (mentioned by interviewees 5 and 6). **Scalability** was also underlined by two interviewees (Int 3 and Int 6).

*If one finds an exceptionally good option for scaling, first nationally, then globally, there is a good side in sports that the framework and rules are standardized. If you for example come up with a good solution for football that hits through, you have a huge global market. (Int 3.)*

**Industry knowledge** and **research knowledge** were both mentioned by one interviewee (Int 2).

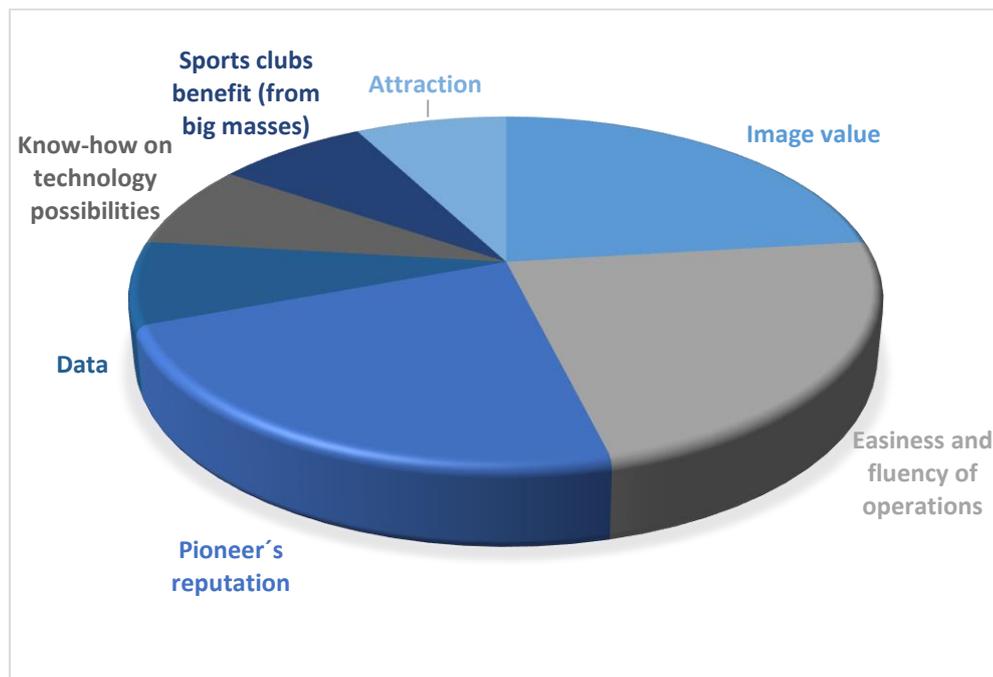


Figure 22. Non-financial benefits for the competitive sports center

In the next part the interviewees were asked what non-financial benefits the competitive sports center could receive via using IoT solutions in their business (Figure 22). **Image value, easiness and fluency of operations and pioneer's reputation** were all mentioned by three interviewees (Int 1, Int 4 and Int 5).

*If you think that there are competitive sports centers that do not offer these solutions and then there is a competitive sports center that offers them and they are included in the price, there is the image side to it, the place wants to offer the best possible setting (Int 4).*

From the operations perspective interviewee 5 pointed out that “In the starting point, the operations of the competitive sports center can improve.” Interviewee 6 mentioned about pioneering that “You get a pioneering reputation that the latest technology is in use. I have understood that these solutions are hardly anywhere used yet.” The rest of the mentioned issues in the figure were mentioned only by one interviewee. **Data** was again mentioned. The massive amount of data, the possibility to utilize and further refine the data was seen as a non-financial benefit (Int 2). The **know-how on technology possibilities** was seen important (Int 2). One interviewee commented that the **sports clubs benefit** when there are big masses of people around. He claimed that the possibility of finding new sport stars becomes more likely. The same interviewee mentioned that the **attractiveness** of the venue is a non-financial benefit. (Int 1.)

The next question was about the non-financial benefits that the customer of the competitive sports center could receive via using the IoT solutions (Figure 23). This question produced a great deal of data, but the data was quite scattered, for these reasons a word cloud was created to visualize the data.



Figure 23. Non-financial benefits for the customer

There were some answers, which were repeated more than once and can be categorized. A bigger font is used in Figure 23 to highlight the terms that are included in these categories. Four interviewees (Int 1, Int 2, Int 3 and Int 4) mentioned **easiness and fluency** as relevant non-financial benefits for the customer (biggest font). **Tailored services** were mentioned by two interviewees (Int 3 and Int 6) as well as the fact that the IoT solutions make the **experience** of watching sports more **meaningful** for the customer (Int 2 and Int 5).

#### 4.3.3 Procedure

The procedure means here the actions made to gain the financial and non-financial benefits already mentioned. This can be seen as the mechanism (or procedure) to get the benefits out of the value chain. First, the interviewees were asked what

procedure the company offering IoT solutions to a competitive sports center could use to gain the financial and non-financial benefits related to the IoT solutions. Three themes or categories could be noticed from the answers. The one that was most clearly seen was the importance of a **customer centric approach**.

*Understanding customer needs is the key issue. Technology will certainly be available as long as it is successfully combined with customer need. (Int 2.)*

*Proceeding through service design thinking and keeping the end customer in the center is important. You need to think what solution is the easiest for the customer and then move to think about the technical side. This way the solution will respond to customer needs. (Int 4.)*

*Customer satisfaction / customer orientation must be at the center, solutions must be easy and reliable, and you have to think about the customer's point of view first, not technology first like engineers (Int 5).*

Another theme or category was that the **processes between different functions and operators** should be well thought out.

*The booking, renting and billing systems of the facilities should be implemented so that they can be used via a mobile phone application as well as for example buying tickets to seminars or ice hockey games (Int 1).*

*The starting point would be that the company could provide a platform, a solution to which it is easy to connect the results of a service or measuring device. The process of building interfaces should be very simple from the early stage on. (Int 3.)*

*You need to understand the big picture, what else happens in there (in the competitive sports center), so that the IoT solutions are part of that whole (Int 6).*

**Financial issues** related to the revenue model and commercialization were also mentioned as important from the IoT company point of view when thinking about the procedure.

*It should be a very effective and attractive process, and the revenue model should be built in it for the commercial operators (Int 3).*

*You need to be able to commercialize your own operating sequence, get it to generate income from the market (Int 2).*

Next the interviewees were asked what procedure the competitive sports center could use to gain the financial and non-financial benefits related to the IoT solutions. There were similarities to the results of the previous viewpoint; **customer centric approach** was again mentioned as having an important role in the process of gaining the benefits (Int 2 and Int 5). Also two new categories could be distinguished. **Service design** being one of them.

*The service design process could be utilized. In the early stages of the process you should very openly and innovatively think about what kind of things could be done in the future. It is a bit of a “propeller head” job. You could think that this is what we are doing now and this we have done for 50 years, but you should also think what the consumer is like in the future. What kind of services and sports there are in the future. (Int 3.)*

*There is understanding in the buyer organization about the technical needs of the IoT solutions when the service design process has first been utilized. Technical knowledge is needed also from the buyer organization side to be able to require correct things from the operator side. (Int 4.)*

**Requirements** related to the **facilities** were also mentioned.

*The process related to the facilities’ lighting, heating and air-conditioning, there is a chance to get great savings. Energy consumption could be examined in relation to energy prices. If energy could be stored and then used from the own stocks when the price of energy is at its peak, then significant sums of money could be saved. (Int 1.)*

*If we talk about the solid facilities, then we also have to think about the technological capability of what is built inside, it is important that there*

*are adequate data channels and places for collecting and analyzing data (int 2).*

#### 4.4 Additional Remarks by the Interviewees

In the last part of the interview (named in the interview structure closing) the interviewees were asked if there is something else they would like to share, or if they think that the interviewer forgot to ask something relevant in their opinion. In other words, the interviewees were given a chance to make additional remarks. Some of these facts have already risen in the previous questions, but the interviewee wanted to emphasize it and brought it up again. The answers could be roughly divided into two categories: **threats** and **solutions**.

Threats:

*Threat of an ecosystem bloc (Int 1).*

*You need to be aware not to produce an image that the competitive sports center (Hippos2020) is only for the elite and not for regular users (Int 1).*

*There is a challenge of diversity. When sports clubs, organizations and volunteers are added to the palette, their ability to be involved in developing a technical system or an electronic service are quite limited. (Int 3.)*

*If every sport has its own systems and partner companies, the palette is no longer manageable (Int 5).*

Solutions:

*The buildings are massive investments with severe operating costs and society's ability to maintain them is limited so the reasonable use of the building's energy consumption, lighting, air-conditioning and pre-maintenance should be payed attention to (Int 2).*

*You need to be able to make solutions for several different groups, but still not everything for everyone. You need to be careful about*

*segmentation and the platform provider (IoT company) must be alert at this point. (Int 3.)*

*There are a lot of ideas about the subject and it would be a good idea to organize an open workshop/ brainstorming day for the citizens. There would be a possibility to get a lot of ideas and then it would be good to proceed by service design methods. (Int 4.)*

*Different sports have very different and specific needs. It should be decided, if such a big place like Hippos2020 would have a different solution for all IoT applications or a bit generic system that can be tailored (Int 5).*

## 5 Discussion

A qualitative research was carried out by implementing six semi-structured interviews that were recorded in audio and then transcribed. The entire set of interview data was broken down to small parts. After that, it was classified into categories, so the results could be more systematically analyzed and presented along with supporting quotes from the interviewees (Chapter 4). The next step (as seen in Figure 9) is to return to the big picture, interpret the results and re-understand the phenomena. This chapter will focus on that by first answering the research questions, then comparing the results with literature. The chapter will also cover the implications and limitations of this research as well as ideas for future research.

The added value that IoT can offer in a modern competitive sports center environment like Hippos2020 is a complex phenomenon. Although the environment in question is isolated, it is very diverse and offers a massive amount of possibilities or even endless opportunities for IoT solutions as seen from the results. Since possibilities for the solutions are so vast, the possible added value can also be looked upon from different angles depending on what type of IoT solution is in question. Still there can be perceived clear patterns and themes that rise from the data. Findings that stand out and are in line with previous research, create ideas for practical implications and future research.

## 5.1 Answers to the Research Questions

The main research question was: What added value IoT can offer modern competitive sports centers?

One of the main findings was that **data** generated by the IoT solutions was seen as highly valuable. The importance and emphasis on the data was mentioned in all parts of the interview,

- it was seen as a crucial success factor;
- a possible failure aspect (if not successfully exploited);
- important to consider when making business models;
- a financial benefit;
- a non-financial benefit and
- important when thinking about the procedure to get the benefits out of the value chain.

Collecting, analyzing and mining data was seen important for example in optimizing the production process and creating new business opportunities. Data privacy and security issues were mentioned many times and considered important to focus on. It was seen crucial to decide what data can be collected, what data is necessary to collect and to whom the data is collected. Sharing data to for example, the software specialist's so they may utilize it in product development was also seen important. It was stated that the one owning the data is the market leader.

**Service** was a term that was repeated and emphasized in many respects. Building the business model to lean on the fact that the IoT-solution is offered as a service not only as a physical technical solution became apparent. The service charges offer continuous revenue flows and get the customer hooked to the solution. If the service provider is clever, it is possible to scale the same service for different customers or

even different markets and that way produce savings in R&D costs and generate growth.

The results also indicated that other than financial value can be of great worth. Image value and reputation lead to see the competitive sports center and the IoT company as pioneering in the industry. A pioneering position in the market was seen as attractive and as a possibility to gain reputation and financial benefits in the long turn. Alongside that, the competitive sports center and the IoT company would be getting essential knowhow of the technology as well as the industry. All of the above mentioned findings on added value were important from the IoT company point of view as well as from the competitive sports center point of view.

In addition to the above, from the competitive sports center side IoT was seen to have a role in making the operations run more easily and fluently in general. The IoT solutions were seen as solutions that simplify, ease and customize customer service experiences and end up proceeding in savings in personnel costs. Personnel might not anymore be needed in simple functions like sport equipment rental since it may be atomized with the use of IoT.

Enormous revenue saving possibilities for the competitive sports center were seen via IoT solutions that enable sensible **optimizing of the facilities' energy consumption**, the heating, lighting and air-conditioning. The competitive sports center consists of many large buildings and by smart sensible solutions to for example store energy when it is sensible to store and use it when the price rises can end up in tremendous money savings.

In the essence of the procedure of gaining the added value **customer centric approach** was most crucial from both the IoT company and the sports center point of view, understanding customers' needs and placing the customer in the core when utilizing service design thinking. It was also seen important that processes between different functions and operators of the ecosystem are well-organized and financial issues related to for example revenue models are clear from the start. The competitive sports center should in addition to the customer centric approach focus on the **facility requirements** from the technological capacity point of view. This is

especially important so the facilities enable the IoT solutions and support the future development in technological solutions in general.

Added value that the customer gains via IoT solutions in the competitive sports center were **saving time**, using services becomes more fluent and easy and the services are more tailored for individual needs. The IoT solutions were seen to bring **meaningfulness** to watching and following sports. **Discounts and customer benefits** were seen to raise customer loyalty. The possibility to use IoT services and equipment in the competitive sports center was seen attractive since the customer does not need to buy them only for his/her own use.

The first sub question was: What are the main success factors when applying IoT solutions in modern competitive sports centers?

Understanding the **customer need** and the **customer benefit** were seen essential success factors in applying IoT in competitive sports centers. Again customer centric approach was underlined, this time as a success factor. **Data privacy and security** issues were also in the core of succeeding and highly emphasized. It should be clear to the operators and the customers what data they collect. Cyber security issues need to be taken into consideration and resolved by the company and the solutions should be safe to use for the competitive sports center and the customer. In addition generating a **revenue model** and understanding the **business logic** behind it was seen important. There is an enormous amount of technological solutions in the market, but they fail to succeed if the revenue model and business logic behind is not brilliant. Understanding the importance of **partners** was also seen crucial. One company cannot be responsible for everything from the technology side and the sport center also needs to partner with different actors like sports clubs, researchers, sports associations and coaches. It is important that there is a workable ecosystem supporting the development and introduction of new technologies. All of these factors were mentioned important from the IoT company and the competitive sports center point of view. To be able to create a successful business model for IoT, in addition to focusing on partnerships, the competitive sports center has to focus on adding value with a workable solution and there has to be technical knowledge also

on the competitive sports center side to understand the possibilities and limitations of the technology.

The second sub question was: What are the main challenges when applying IoT solutions in modern competitive sports centers?

Challenges are faced if **customer needs** are not clear and the **customer segment** is not known well enough. Again, the emphasis is on understanding the customer and if that is failed upon, problems are seen ahead. **Technical issues** may also be challenging, for example if the IoT solution is hard to use or the system is inflexible. This may result to the fact that the solutions will not be used at all and that of course results in total failure. These factors were seen as challenges for the IoT company and the competitive sports center.

To summarize the main findings of this research understanding the added value that the data gained by using IoT solutions can offer is vital, as well as utilizing the data by analysis and mining it for further purposes. To succeed in gaining added value customer centric approach should be in the core, as well as making the IoT solution easy to use and appealing for the customer. The importance of smooth processes between functions and operators also raises the possibility to succeed. If the customer does not see the need or the attractiveness, failure becomes more probable and the IoT solution may end up dormant. Understanding the value that lies in the infrastructure, must not be put aside, since there are enormous money saving opportunities by energy optimization of the buildings. Last but certainly not least, it is vital that the IoT solution is offered as a service. The product-as-a-service approach is highly important to succeed in obtaining continuous cash flow and customer loyalty. It seemed that the added value is more in a wisely formed service wrapped around the solution than the technical solution itself. This reminds of Peter Drucker's quote from chapter 1.2 that "What the customer buys and considers value is never a product. It is always utility – that is, what a product or service does for him or her." (Drucker 2011, 57.)

## 5.2 Theoretical Implications

Due to the fact that the area of research is novel and emerging there is a relatively small amount of academic literature already completed. Still it can be stated that mostly all of the references of literature were supported by this study.

When it comes to reflecting the results of this research to the prior knowledge base, the first contribution that can be made is regarding the importance of **data** resulting from IoT solutions (Memmert & Rein 2018, Chandrol et al. 2018, De Saulles' 2017) and adding value with data driven decision making in sports (Bukstein & Harrison 2017, 3). As Abdalla Ahmed and colleagues (2017) have discovered, to successfully benefit from IoT, companies must also create a platform where they can collect, manage and analyze big amounts of sensor data in a scalable and profitable way. Making use of a Big Data platform that is able to assist in consuming and reading versatile data sources and also accelerate the data integration process, becomes vital. Companies can use data analytics tools to transform enormous volumes of sensor-collected data into valuable insights and business opportunities. (1.)

Another essential contribution when comparing the results and prior knowledge base is the mindset of focusing on **service** innovation, as Hui (2014) explains it, earning money is not limited to physical product sales. After the initial product sale other revenue streams become possible. These other revenue streams can actually exceed easily the initial product price; they are services that add value to the product. De Saulles (2017) also points out similarly that services become increasingly bundled with products. This phenomenon, where distinction between product and service is blurring is often described with a term product-as-a-service (PaaS). (50-51.).

This leads to the next essential contribution, **customer centric mindset**, as De Saulles (2017) continues: the product-as-a-service phenomenon makes the manufacturers increasingly having to think how their customers use their products. A deeper relationship is created between producers and customers and it does not end the

moment the product is sold, but continues throughout the lifecycle. (51.) Kranz (2017b) also pointed out that the essence of IoT is connections between customers, partners and suppliers. Customer relationships were seen crucially important from business model creation perspective by Dijkman et al. (2015) and Jae-Hyeon et al. (2016, 887).

When dealing with IoT, there is a need for technology experts who have business and people skills to be able to collaborate across different departments. IoT solutions generally reach different parts of the company: information technology (IT), operational technology (OT) and core business functions. (Kranz 2017b.) In the results of this research it was pointed out that for the competitive sports center it is important that there is knowledge of technology, to be able to make a successful business model for IoT.

Finally yet importantly, in the results of this research energy optimization of the modern competitive sports center's physical infrastructure was mentioned. Utilizing the buildings as a so-called virtual power plant. Energy optimization was also underlined by Smart City – Research Highlights (2015, 8) as crucial when creating sustainable smart environments. Similarly, Smart Stadiums Take the Lead in Profitability, Fan Experience, and Security (2016) states that the infrastructure of a smart stadium allows to control the heating, ventilation, air conditioning and lighting systems. To maintain operating costs low, the systems can be automated to save energy and reduce the number of people that are needed to operate them. (1–3.)

### 5.3 Practical Implications

This research focuses on the added value that IoT can offer modern competitive sports centers. Finding out what the added value is should be the starting point for business before moving to the technical details of the solution itself. Hippos2020 acted as the example environment in this research. Construction work of this future

leading sports and wellness center of the Nordic countries, is about to start next year (2019). The findings of this research can be utilized by

- Hippos2020-project;
- sports stadiums;
- sports centers;
- gyms;
- sports clubs;
- sports associations and
- other sports operators.

The core rallying point is that the operator is interested in adding value with IoT solutions to their business in the field of sports. Innovative and future centric mindset is needed as well as true interest in investing in IoT technology.

Smart city projects may also find insight and suitable findings from this research. As Chakraborty and colleagues (2017) propose, a smart stadium can be used as a living laboratory platform to more easily evaluate IoT technologies and smart solutions that can be further applied to smart cities (2). The stadium is only one facility of a competitive sports center and thus not all the findings are usable. Some of the main findings like full utilization of the data, producing a service around the IoT solution and customer insight are broad general findings and can be applied for smart city projects as well.

IoT is a current phenomenon and the findings of this research can definitely be useful for technology companies thriving to expand their business in the field of sports, health and even for companies interested in smart city solutions. In addition, there might be new knowledge and insight to companies already operating in these fields of business.

## 5.4 Limitations of the Research

Although as Kananen (2011, 69) states that there is no absolute truth concerning reliability and validity in qualitative research there are issues that may affect them. The number of interviewees was six in this research and they were from three different expert groups (two from each): IoT experts from the field of education and research, experts from a company providing IoT-solutions and experts of sports (who have an understanding of IoT). Although saturation and a comprehensive understanding of the phenomenon was reached with six expert interviews rich in data, the results of this study cannot be generalized to a larger public. Repeating the research within a few years may also have a different result as the IoT technology is such a fast developing phenomenon that offers new innovations with a fast pace having diverse added value possibilities.

Although the author tried to remain neutral throughout the research process, bias may have influenced how the interview form was designed, how the questions were asked and interpreted. It is hard to estimate whether a fully objective perspective at all stages of the research process was achieved. It is difficult to assess one's own impartiality.

Also by focusing this research on the added value of a complex and broad environment like modern competitive sports center resulted in the fact that the collected data stayed at a more superficial level, if compared to a research where the focus would have been on a narrower environment. On the other hand, a broad and complex environment ensured that the research would produce results from many perspectives and not end up being too narrow.

## 5.5 Recommendations for Future Research

This research focused on the added value that IoT can offer modern competitive sports centers, which is important knowledge for gaining initiative understanding and foundation knowledge of generating business with IoT in the environment in question. Although this research did not focus on the possibilities and innovations that there are for IoT solutions in modern competitive sports centers some glimpses were given in the results of the background questions (chapter 4.1). For further research, it would be interesting to focus entirely on the possibilities that there are for IoT in modern competitive sports centers. The research could have an innovative future oriented approach using for example the Delphi method.

Service design thinking was mentioned in the results of this research. This led to the idea of another interesting research opportunity in the future to develop the Hippos2020 service process through service design thinking. The results would give answers to the critical points that effect the customer's quality experience and provide ideas for further development of the service process. The research could be done even right away by focusing on the current state of today's Hippos environment, finding out the workable issues as well as the current bottlenecks to avoid in the future Hippos2020 environment or it may be done when the Hippos2020 environment is being built or ready and in use.

Variations of this research, for example focusing on a slightly different environment, for example only on sports stadiums could be a possibility for an interesting research. Interviewing the operators of sports stadiums in the whole Finland or in some other country could have interesting results. It could be illustrative to discover what added value IoT can be seen to offer or already offers to stadiums from the point of view of the current operators.

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## Appendices

### Appendix 1. Question Guide Format and Instructions Sent Beforehand

#### **Background information**

- What is your current role in your work? And how is your work related to IoT? OR How is your work related to sports?
- How long have you been working with IoT related issues? OR How long have you been working with sports related issues?
- What kind of personal experiences do you have of applying IoT in practice, if any? OR How is IoT familiar to you?
- What is your educational and professional background?

#### **IoT in Sports**

What do you know about the usage of IoT in Sports? What possibilities there could be for the usage of IoT in Hippos2020 environment?

#### **Business success factors and challenges**

What are the crucial success factors and challenges as well as issues to be taken into account in the business model: From the point of view of a company offering IoT solutions to a competitive sports center / from the point of view of a competitive sports center utilizing IoT in their business?

#### **Added value**

Financial and non-financial benefits and the procedure to achieve these benefits: from the point of view of a company offering IoT solutions to a competitive sports center / from the point of view of a competitive sports center utilizing IoT in their business? / Customer point of view.

To make it easier for you to perceive the competitive sports center environment of this research an example is given to you, Hippos2020. Please familiarize yourself with

the brochure attached (of Hippos2020 project) before the interview. Hippos2020 is a sports, wellness and research center that will be built to Jyväskylä. It is also possible that you think about some other competitive sports center, as long as it is a modern competitive sports center (not a regular gym for example).

## Appendix 2. The Interview Question Guide

### 1) Background information

- a) What is your current role in your work?
- b) How is your work related to IoT? **OR** How is your work related to sports?
- c) How long have you been working with IoT related issues? **OR** How long have you been working with sports related issues?
- d) What kind of personal experiences do you have of applying IoT in practice, if any? **OR** How is IoT familiar to you? Is there something else you would like to point out?
- e) To gain more context, please tell me about your educational and professional background?

### 2) IoT in Sports

- a) What do you know about the usage of IoT in Sports?
- b) Could you think of possibilities for the use of IoT in a competitive sports center like Hippos2020?

### 3) Business success factors and challenges

- a) What do you think are the crucial success factors for a company offering IoT solutions to a competitive sports center?
- b) What do you think are the crucial success factors from the competitive sports center point of view when applying IoT to their business?
- c) What do you think are the most common challenges for a company offering IoT solutions to a competitive sports center?

- d) What do you think are the most common challenges from the competitive sports center point of view when applying IoT to their business?
- e) What is important for a company offering IoT solutions when creating a business model?
- f) What is important from the competitive sports center point of view when creating a business model concerning IoT?

#### 4) Added value

##### Financial benefits

- a) What additional return and savings could a company offering IoT solutions to a competitive sports center receive?
- b) What additional return and savings could the competitive sports center receive via IoT solutions?
- c) What savings could a customer of a competitive sports center receive via IoT solutions?

##### Non-financial benefits

- d) What non-financial benefits could a company offering IoT solutions to a competitive sports center receive?
- e) What non-financial benefits could the competitive sports center receive via IoT solutions?
- f) What non-financial benefits could a customer of a competitive sports center receive via IoT solutions?

Procedure meaning in this case the actions made to gain above mentioned financial and non-financial benefits

- g) What procedure could a company offering IoT solutions to a competitive sports center use to gain financial and non-financial benefits?
- h) What procedure could the competitive sports center use to gain financial and non-financial benefits via IoT solutions?

#### 5) Closing

a) Is there anything else you would like to share?



# HIPPOS2020 – Jyväskylä



Sports and wellbeing centre and centre of expertise

## Vision

The leading promoter of sports, exercise, wellbeing and health in the Nordic countries.

## Mission

To promote sports, exercise, wellbeing and health by creating

- a **research network**
- an **education network**
- a **training network**
- a **product and service network**
- a **business network**

High-quality information, technology, services and commercialisation of **knowhow**, created with **passion**.



## GROWING MARKETS

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Sports, exercise, wellbeing and health are growing rapidly as business sectors.

- Commercialisation of these fields
- Commercialisation of services
- Technological innovations
- Digital services
- Smart technology

Hippos2020 strikes a hot, attractive market.

## Digital health and wellbeing are global megatrends.

Consumers, businesses, mutual pension insurance companies and social operators are making increasing investments in wellbeing and health.

Focus on preventive means.



” Hippos2020 will strengthen Jyväskylä’s status as Finland’s leading development centre of sports expertise, where the Faculty of Sport and Health Sciences of JYU, KIHU and the Finnish Olympic Committee’s Elite Sports Department will work in close cooperation. Combining the **conditions** and **expertise** with **daily training**, the way that the Hippos2020 project does, is the core of Finnish success in elite sports. Only solutions like this can enable the constant cooperation and mutual learning between the best experts.

Mika Kojonkoski,  
Head  
of the Finnish Olympic Committee’s Elite Sports  
Department



## Everything starts with solid research knowledge capital

Hippos2020 is part of an extensive centre of wellbeing expertise in Central Finland that is formed by 16 organisations, including



Research Institute for Olympic Sports



Research Centre for Physical Activity and Health



UNIVERSITY OF JYVÄSKYLÄ



UNIVERSITY OF EASTERN FINLAND



Central Finland Health Care District



Central Finland Chamber of Commerce



The Regional Business Federation of Central Finland



6

## Hippos2020 creates an ecosystem

Combines  
extensive  
expertise.

Combines  
the  
resources.

Expansion of  
top-level  
expertise.

New success  
stories are  
born.



” The research in this field is crucial to our business, in order for us to continue competing on an international level. It is great that these investments are being made in sports research and facilities that promote wellbeing. Hippos provides an excellent location for the centre, while increasing the attractiveness of the entire Jyväskylä region.

Juho Tuppurainen  
Vice President of  
Firstbeat Technologies Ltd



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## Sports and Wellbeing Research and Commercialisation Centre of Excellence building

**The heart and brain of the centre of expertise.  
The network of networks connects the best research and business experts.**

- Next to the multi-purpose arena.
- Sport and Health Sciences Laboratory of the University of Jyväskylä.
- Strong centre of research knowledge capital.
- Combined with strong business activities related to the promotion of exercise, sports, wellbeing and health – including startups.
- Big Data – the technology that enables the collection, processing and analysis of data covers the entire area.





The construction of a new and modern sports and health laboratory in Sports and Wellbeing Research and Commercialisation Centre of Excellence at the heart of the Hippos2020 area will offer magnificent opportunities for high-quality research in sports, health and exercise promotion.

Lasse Kannas

Dean

Faculty of Sport and Health Sciences,  
University of Jyväskylä



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## HIPPOS2020 complex



## Hippos2020 is also an event centre

Sports and entertainment events, meetings and congresses, lifestyle events.

### Strengths:



### The area's facilities

- Multi-purpose arena for over 6,000 people
- Sports and Wellbeing Research and Commercialisation Centre of Excellence building for research and business activities
- Sports centre for dozens of sports, includes an MID arena for approx. 2,000 spectators
- Football hall
- Gymnastics hall, facilities also for other sports
- Exercise park, an open and stimulating outdoor park area.
- The sports boulevard is an indoor space connecting the multi-purpose arena and sports centre
- The arena's business centre, wide variety of services
- Hotel and budget accommodation
- Grocery store
- Business premises for promoting exercise, sports, wellbeing and health
- Restaurant world
- Five blocks of flats
- All buildings are new
- Parking under the buildings
- Next to water sports centre Aalto Alvari

## Hippos2020 will make Jyväskylä the leader in sports and wellbeing

- A unique complex.
- Central location.
- The services cover the human life cycle from babies to seniors.
- A unique centre of top-level expertise.
- Research, education, training, multidisciplinary approach, product development, technology, services, digital operation.
- A day-to-day activity spot for active people.
- A centre for events.
- A housing area.
- Wellbeing and health services.
- The area's retail, restaurant and hotel services.
- The city centre's services within walking distance.



” Hippos2020 is the most important investment that has ever been made in sports and exercise in Jyväskylä. Hippos will be the most diverse indoor sports centre in the Nordic countries, giving Jyväskylä further boost as the country’s leading sports city.

The new funding model of the Hippos2020 project is important, as it will use the same amount of tax funds that a complete renovation of the existing facilities would cost, but instead the sports facilities will triple in size.

Timo Koivisto,  
Mayor of Jyväskylä

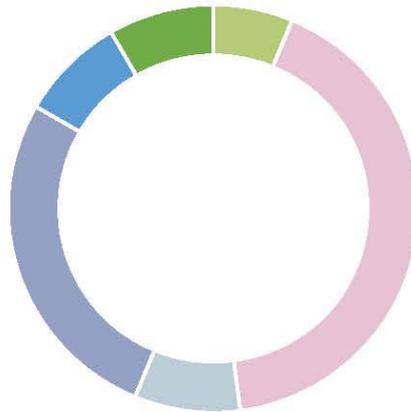




As many as  
**5 MILLION**  
visits annually

## User estimates

3–5 million visits per year



- 0.2 - 0.3 M Office space
- 1.5 - 2.0 M Exercise, sport, research and development
- 0.25 - 0.4 M Events and exhibitions
- 1.0 - 1.3 M Food and wellness
- 0.25 - 0.4 M World-class sports
- 0.2 - 0.4 M Dwelling, accommodation and travel

## Sports clubs at Hippos

Currently, the area is home to more than 100 clubs and Jyväskylän Urheiluakatemia (Jyväskylä Sports Academy).

Over 20 sports.

In the future, the number of sports offered will increase.

The facilities will triple in size, and they will be more efficiently used.

Hippos2020 will offer clubs a new type of platform to develop their activities and events.

Hippos2020 needs the clubs and the clubs need an updated version of Hippos.

Shared interest: in the future, the clubs can operate better!



## The city's "Exercise" pledge

The current sports offered at Hippos will be able to operate at Hippos2020 as well.

Only reasonable increases will be made to the current user fees.

The growing facilities and their shared use will bring new operators to share in the running costs.

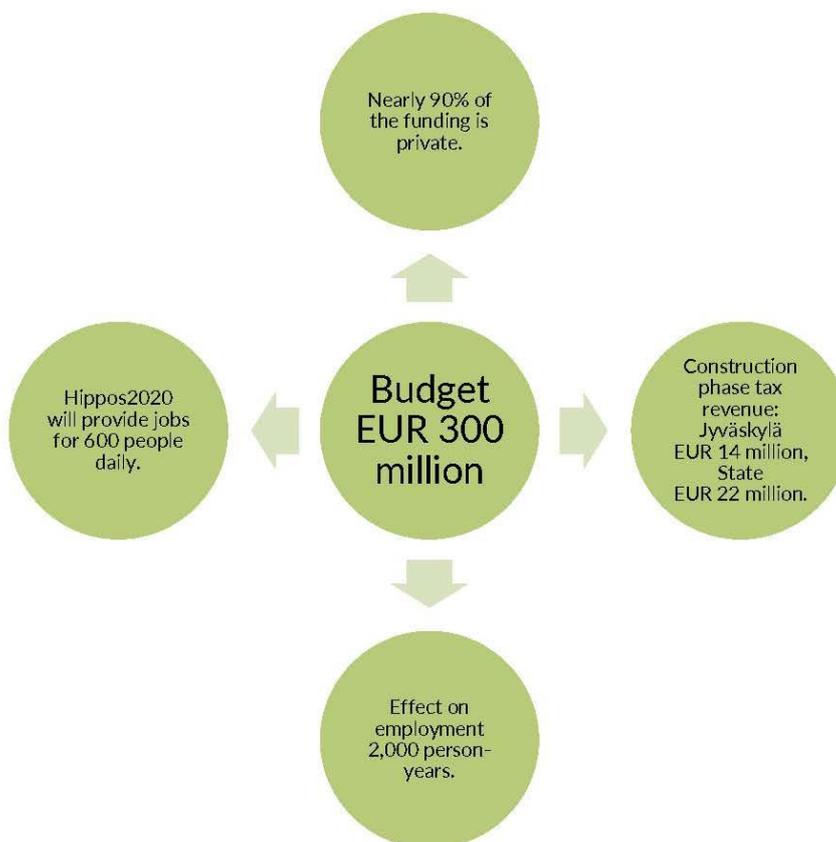
The quality and usability of the facilities in use will improve.

The time slot distribution will remain the same.

The city has committed to supporting exercise by EUR 5 million annually.

The Culture and Sports Board will decide on awarding subsidies to different sports.

## Hippos2020's financial figures



## Hippos2020's public funding

Hippos's current repairs debt of EUR 23 million will be transferred to the new company as capital.

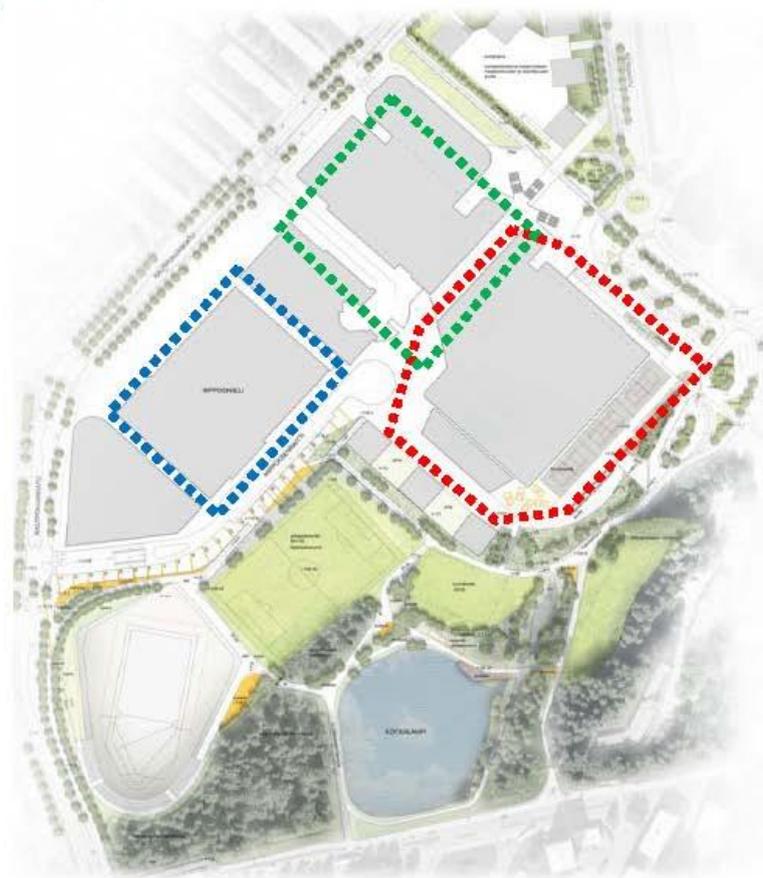
The existing buildings will be managed by the new company and be transferred to it as a transfer of assets worth EUR 7.6 million.

The city will profit approx. EUR 17 million from the permitted building volume.

The city will fund the area's infrastructure and the construction of the exercise park.

The city will support the clubs with EUR 5 million per year. This amount is approximately a quarter (27%) of the expenditure of the City of Jyväskylä Sports Services.

## HIPPOS2020's preliminary phases



The tender process for the main investor was launched as a public procurement in 12/2016. Ten operators signed up.

The Jyväskylä City Council confirmed the alteration of the area's plan in 4/2017.

The selection of the main investor will progress to the final phase through negotiations and tenders in late autumn 2017.

The City Council will decide upon the main investor and the final launch of the project in late autumn 2017.

The main investor and the project will then undergo an innovation phase related to the final implementation as required by the new Act on Public Contracts.

The aim is to start construction in spring 2018.



**FRIENDS AND  
PLAYING  
TOGETHER IS  
THE BEST  
THING EVER**

Elmo, 13  
Floorball junior



**MOVE,  
ENJOY AND  
FEEL GOOD**

Veera, 25  
Badminton  
player



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Brochure illustrations: HIPPOS2020 / PES-Arkkitehdit Oy