INNOVATIONRUNWAY

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The Innovation Runway Project

Project Report

A new Digital Tool for Building Inspections -

Market Analysis & Suggested Market Positioning

#KEYnet

PAPER WITHIN *Strategic Entrepreneurship and Innovation*
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JÖNKÖPING December 2018

Acknowledgement

Executive Summary

The presented project report provides a market analysis and a subsequent suggestion for a market positioning for KEYspect, a new digital tool for building inspections.

KEYspect is a mobile application, that is currently developed by KEYnet Sweden AB, a small sized IT and software company, based in Hestra, Sweden. KEYnet's regular business is the development oft tailormade software solutions, such as websites and different modules, linkable to ERP-systems, e.g. intranet, e-commerce-platforms and task management systems. KEYspect is their first app. The aim is to ease to inspection process with the app and enable the post-processing of inspection data via a KEYnet module. Therefore, provide a learning effect for the approaching stakeholders Flexator, Obos and Gar-Bo, and thus reduce the number and cost of errors and make the processes more efficient. As 20 % of causes are responsible for 80 % of effects, the identification and categorization of errors is an important part. While Flexator and Obos are contractors, responsible for the construction of buildings, Gar-Bo is an insurance company, employing inspectors for buildings.

The investigation showed, that attributes of the app should be the usability, to convince the inspectors to actually use it as well as the ability to use it with different operation systems and an integrated document manager, all of which the existing competing tools in the market are failing. Other important attributes, among others, are the easy generating of protocols and the flexibility.

It was concluded that the solution should be a two sided one, with the inspectors on the one side, mainly delivering data and the contractors on the other side, mainly drawing data to process. Everything should be connected in a cloud and a task management system, that also allows to assign tasks to sub-contractor, and a document manager should be integrated for both, to ensure good communication

It is suggested for KEYnet to use and leverage their close customer relationship as one of their biggest assets and work in tight collaboration with the stakeholders to bring the tool to market maturity. The app should be tested in two consecutive pilot projects, in an iterative way, with taking the user' feedback directly into account.

For the second part, the data collection, three ways should be tested: manual categorization through the inspectors, a tagging system with an evolving tag database and machine learning, which is viewed as the best way by the authors.

Table of Contents

1. Background

This first part briefly describes the institutional context and setting of the project. It shortly outlines the Innovation Runway Project's aim, the involved parties, the project group and defines the goal and purpose, as well as the project scope and its delimitation.

1.1. The Innovation Runway Project

The Innovation Runway Project, run by Science Park Jönköping in cooperation with Jönköping University and Almi, supported and funded by the region of Jönköping County and the European Regional Development Fund, is a program that aims to enhance innovation and innovational behavior in SMEs in Jönköping county. Its main focus is to provide support in inventing and verifying business ideas in order to create growth opportunities and competitive advantages.

1.2. Project group

This project was carried out by master's students within the study program "Engineering Management" at Jönköping International Business School (JIBS) as part of the course "Strategic Entrepreneurship and Innovation". Supervision to the project group was provided by Science Park Jönköping in terms of business matters and Jönköping University in terms of academic support.

1.3. Goal and Purpose

In today's construction industry, hardly any emphasis lies on the post-processing of inspection data, thus making a learning process non-existing. Due to this, a lot of work is repetitive and redundant. Errors could have been avoided if companies would value the inspection data.

According to the agreement with the client company KEYnet, the goal of this project was to map and analyze the market for digital tools to be used in the building inspection process, with an emphasis on the post-processing of collected data. Furthermore, based on the conducted market analysis, the project group was to propose a suggestion for the positioning in the market for such tool, recommend further actions and report the findings in written form.

1.4. Project scope and Delimitations

The conducted research was focused on the Swedish market as the home- and first-entrance-market. Different potential user group were defined and described, and the involved stakeholders' needs were evaluated in more detail from their different perspectives and so were the most important competing digital tools in this market.

The construction/building industry as a whole was examined and key facts are presented in this report. Additionally, possible future markets, namely Norway, Denmark, Finland, Germany, Poland, the Netherlands and the Baltic states were taken into account and

investigated regarding the existence and functionality of digital inspection tools and the market sizes.

The project group observed the inspection process itself and described and analyzed it. Potential flaws, major problems and potential for improvement in the process were identified and, among others, used as input to identify the possible future tools attributes.

The client company KEYnet Sweden AB was thoroughly investigated, strengths and weaknesses as well as opportunities and threats were identified and, in combination with the other mentioned findings, used as part of the suggested market positioning, and a proposed Business Model.

The report suggests further actions towards the tools market maturity.

1.5 Project stakeholders

Flexator AB
Flexator is one of the largest companies within the module house industry. The company focuses on larger constructions such as schools, offices and apartment buildings (Flexator, n.d.). In 2017, Flexator had a turnover of roughly 490 MSEK (Amadeus, n.d.).

Gar-bo AB
Gar-bo is the leading insurance company in Sweden that focuses on construction related insurances (Gar-bo, n.d.). Today, they have 105 employed or freelancing inspectors in their portfolio (Personal communication, Nov 15, 2018). In 2017, Gar-bo had had a turnover of about 270 MSEK (Amadeus, n.d).

Obos Sverige AB
Obos is in the largest company in Sweden within the pre-made/module wooden house industry (Amadeus, n.d.). They own several companies, such as Myressjöhus and Smålandsvillan. They had a turnover of nearly 3 BSEK in 2017 (ibid.).

2. KEYnet – The client company

KEYnet is a software development company with their head office located in Hestra, Sweden. KEYnet has 10 employees and had a revenue of approx. 7 MSEK in 2017 (amadeus, n.d.). KEYnet's mission is to make digital information more accessible, easier to handle and (re-)usable. Acting in the heavily crowded industry of "computer programming activities" (NACE-code 6201), with 13,715 companies in Sweden alone (amadeus, n.d.), KEYnet is focused on web-based solutions, persisting of different modules, from which the customer can freely choose, which to adapt and tailor for his own business. In this way KEYnet provides solutions for customer-specific and, if applicable, ERP-linkable modules, which fit the unique needs of every single customer, in an easy-to-handle way. The modules range from simple corporate websites to intranet solutions and more sophisticated applications such as case management systems and e-commerce platforms, (plus a broad variety of subsets). This

makes KEYnet as a solution specifically attractive for SMEs (Small and medium sized enterprises), which want a user-friendly ERP-system, that fits their specific business processes in a flexible, convenient and relatively easy way, rather than using one of the big ERP[1]-systems on the market (SAP, Oracle) solely on its own. Since they are complicated to handle and tend to require a change in business and not in the program's software processes; and whose thorough implementation can be very cost-intense due to the complexity and dependencies between modules, respectively the enormous effort needed, to fit software and specific business. KEYnet does not provide an Enterprise Resource Planning (ERP) system itself, but rather modules, that are linkable to various existing ERP-systems on the market and work as easy-to-use interface between ERP-system and user. Therefore, KEYnet eases the use of ERP-systems in general and enables SMEs to benefit from the softwares' capabilities, while avoiding its shortcomings.

At the time of writing KEYnet had around 200 SME from various different industries as customers in the Swedish market, using the KEYnet software in one way or another. Most of these customers are located in a vicinity of 150 km to KEYnet's headquarter in Hestra, as KEYnet regards it as one of its benefits to keep a tight customer relationship and be able to provide personal software maintenance. Although, the building of companies' corporate websites is the biggest part of KEYnet's daily business by number of customers, the ERP-related modules including e-commerce generate the most revenue. That is, most importantly, recurring due to the necessary maintenance and regular trainings as well as subscriptions/licensing.

2.1. Internal motivation

It can be presumed that nowadays ERP-software on its own is not an advantage anymore (at least in bigger enterprises) -simply because it can be seen as standard- but merely a hygiene factor[2], that brings companies on one level, leaving just the one's out, which do not use ERP somehow. Therefore, it is crucial to see not the software itself as advantage, but the possible extended usability capacities (P. Hill, personal communication, October 17, 2018). Thus, the focus on further improvement of the ERP concept's usability should be the main premise for companies providing ERP-related software and services. The trends of globalization and interlinking, as well as the interactive processes in between companies, suppliers, customers and other stakeholders, make it necessary to provide a real time information data flow among these parties, in a more efficient way, than there is right now (Tzuo, 2012).

In order to differentiate from the mentioned crowded industry and to widen the company's portfolio, making the KEYnet-ERP-modules more than a hygiene-factor as well as by approach of several stakeholders, KEYnet is currently developing a digital tool, respectively a new

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[1] Enterprise Resource Planning (ERP) means a set of software and systems, companies use to administer business activities and data streams between different business units (e.g. purchase, sales, production, accounting, project management, quality management, etc.). The purpose is to assure data integrity: the use of only one single set of data in all units and therefore the reducing of redundant or divergent data (Oracle, 2018).

[2] Herzberg's two-factor theory (1959), originally designed to understand employer motivation, describes the concept of "hygiene factors", which are factors that are not an advantage when present, but a disadvantage if not.

module along with their very first mobile application, to be used during inspections of construction sites and houses/buildings and therefore digitize data, which is at the moment usually collected and handled in rather inconsistent ways, e.g., with pen & paper, laptop, mobile. The planned functionality of the new app, called KEYspect, combined with the module is not limited to be just a pen and paper replacer, but much more holistic and proceeding. The basic idea is simple: Transfer the data directly into the memory device/cloud and enable post-processing to make it usable; identify errors, solve and prevent them from happening. Thus, implement and ensure a learning process. And while the learning effect, in alliance with the resulting continuous improvement process and therefore less errors, higher efficiency and a subsequent reduction of costs, is the targeted main outcome, the needs of all stakeholders, potential customers and users must be evaluated and taken into account.

KEYspect's module part will be based on KEYnet's existing software architecture and is therefore planned to be easily integrable into the existing modular structure. As there are numerous possibilities on how to link all this information and how and in which directions and ways to steer the data streams, the finding of the targeted customers' and user' needs as well as the benchmarking with already existing digital tools for inspections, construction industry related or not, and their strengths and weaknesses/flaws in relevant markets and hence, the analysis of the market for such tools and the resulting proposed market position, that should be envisaged is the next big step. It is of great importance that the market's needs are the baseline for the development and implementation of the new software KEYspect to ensure an actual benefit and advantage in using it.

2.2. External motivation

Defining the motivation of the stakeholders, especially Flexator and Obos, as the need for a learning effect, emerging from the collected data during inspections, this leads to the question what they wish to accomplish through this effect. It can be taken as granted, that companies in the competitive economy always strive for an increase in efficiency and therefore the identification of errors, error sources, and subsequently prevent them from happening. As the retrieved data and information from inspection processes right now, respectively the post-processing of such data, does not facilitate the possibility for such error handling, but merely just enables the stakeholders to react after the error has happened and is limited to every individual inspection case, the learning process is meant to draw a bigger picture. Due to the envisaged cross-inspectional aggregation of larger amounts of inspection data, KEYnet and the KEYspect app will provide a database, in which errors can be categorized, organized and followed through the processes, leading to their source, which then can be eliminated. Hereby, the stakeholders can take direct and active action, prevent errors from happening and most importantly, identify regularly occurring redundant errors and impede them.
And while there is the general perception that the cost of quality, especially through the correction of occurred errors is high (personal communication, L. Birging, Dec. 5, 2018), there was no valid data found available. The authors believe, that there is a great possibility that this is due to the fact, that there is no established method to collect and process this data in a sufficient way. To provide a general overview concerning the over-time development of

error or failure costs, it can be referred to the "rule of ten", a theory widely accepted in quality management (QM). The theory states that the cost of failures multiplies from process step to process step by the factor 10, while the ability to directly influence the failure costs decreases diametrical (Quality Services & Wissen GmbH, 2017). Concluding, it can be said, that the ability to track down an error to its source and exclude it from happening again, not only eases up the workflow but also has a tremendous cost reduction potential. Reviewing the method of Pareto analysis, another QM method, which states that 80 % of consequences are evoked by 20 % of causes, it becomes clear that categorization and subsequent prioritization of errors cannot be underestimated in its importance, as 20 % of errors are responsible for 80 % of the all-over error costs (Gorecki & Pausch, 2016). Furthermore, following this logic, 20 % of failure sources, are responsible for 80 % of failures.

Taken the mentioned theories in failure/error costs, and the present inability to make use of this knowledge into account, the stakeholders' motivation in relation to the desired learning effect becomes more than understandable.

3. Analysis of KEYnet

This chapter consists of an analysis of KEYnet itself as a company. The Analysis is focused on understanding KEYnet's pros and cons in the project and is based on Porters five forces and further on merged into a SWOT analysis.

3.1. Understanding the competitive industry

Porter (2008) argues that there is more to competition than just rivalry among existing competitors, and to understand the profit level of a market, a necessity would therefore be to identify what porter refers to as the five forces, thus understand the underlying market and the structure of it. Accordingly, the five forces are as follows: Bargaining power of suppliers, threat of new entrants, threat of substitute products or services, bargaining power of buyers and rivalry among existing competitors (ibid.). In order to identify KEYnet's existing competition regarding the industry of house/building inspections, a five forces analysis was conducted.

Bargaining power of suppliers refers to how much the suppliers can affect their position towards and industry or a specific company. It is their power to affect factors such as the price and the quality without offer anything back. One example could be that a company is dependent on a supplier, because they are the only one selling a product that the company needs. That company is dependent on the supplier.

The suppliers would in KEYnet's case be the ones who supports the inspection tool with inspection data, which are the inspectors. It was concluded that the inspectors have great bargaining power due to the independence which they possess in regard to the tool. There are several alternatives to choose from, e.g. pen and paper, excel & word and other inspection tools. KEYnet on the other hand, is solely dependent on the inspection data, to enable a post-processing. According to Porter (2008), the dependent/independent rivalry is what creates the bargaining power in the first place. In this case, inspectors have great power and could, for example, affect the outcome of the tool to a high extent, both in quality and price.

Threat of entry is to what extent new entrants are threatening to enter the market, and thus compete over the same market shares. The threat of entry is set by several barriers and the level of these, e.g. supply- and demand-side benefit of scale, swishing cost and the level of needed capital investments.

For KEYnet, there were no demand or supply side benefits of scale identified. KEYnet does not produce anything on a large scale and cannot enjoy scale-economy, nor affect buyers' eagerness to pay more, as it could be the case if KEYnet was possesing a broad customer base in the industry already. However, customer switching cost could be a barrier of entry. At least for those who uses KEYnet's modules as of now. The project group cannot see a barrier of entry by the capital needed in order to enter the market. The cost of developing the application is believed to be a fraction in relation to the possible industry size and thus, the profit levels. It is believed that KEYnet has some advantages by their connections and stakeholders/distribution channels in the development process of a future tool. However,

over the time that the project group has been involved in the process, it has been discovered that the most critical part for inspectors to actually use the tool, is the user-friendliness and the level of improvement it will create. So, if a better product would appear and no other parameters would affect customers willingness to switch tool, it would not be surprising if they did.

Threat of substitute products or services would be products or services that can please the same needs, but with a different approach. Plastic could be a substitute for aluminum for example.

Returning to KEYnet and the tool, there are several substitutes for it. In today's inspection industry, different inspectors use different tools. As been mentioned earlier in the report, there are some already existing inspections tools that are used by a few inspectors. Also, According to P. Wipp (Personal communication, Nov 15, 2018), the inspection industry has since the "beginning" used pen and paper as a method, which is still used in some occasions. Moreover, Wipp also mention that the office package, with Excel and Word is used widely in today's industry.

Bargaining power of buyers refers to the opposite side of the power of suppliers, namely to what extent buyers in an industry, or to a company, can affect factors as price or quality, without paying more.

The buyers of KEYnet's offering are the ones who either buy the inspection tool or the post inspection data (learning process). Firstly, the inspectors are the suppliers, but they are also the buyers. They are the customer group that will pay for the service of using the application simultaneously, as they are the ones that will supply the tool with data. Due to this fact, the same argument as stated in the "power of suppliers" part will be included here. Customers of the post inspection data however, will have a fairly low bargaining power according to the project group. There is no tool, as of now, that offers the same services and it is also of great value for the customers, such as contractors, to be able to access this kind of information regarding post inspection data (T. Andersson, Personal communication, Nov 20, 2018). These customers can thus be seen as dependent of KEYnet's service and, because of that, possess low bargaining power.

Rivalry among existing competitors is what, in popular speech, would be called competitors. That is, competitors who are active in the same market, offering resembling products to the same customers.

The project group has identified 3 existing inspection tools competing for the same customers. For a deeper analysis of those products and what they offer, see chapter 6.1.3. in the report.

3.2. SWOT analysis

Based on porters five forces and what KEYnet as a company offers, the project group conducted a SWOT analysis for KEYnet in this project, related to the tool itself, which can be seen in fig.1.
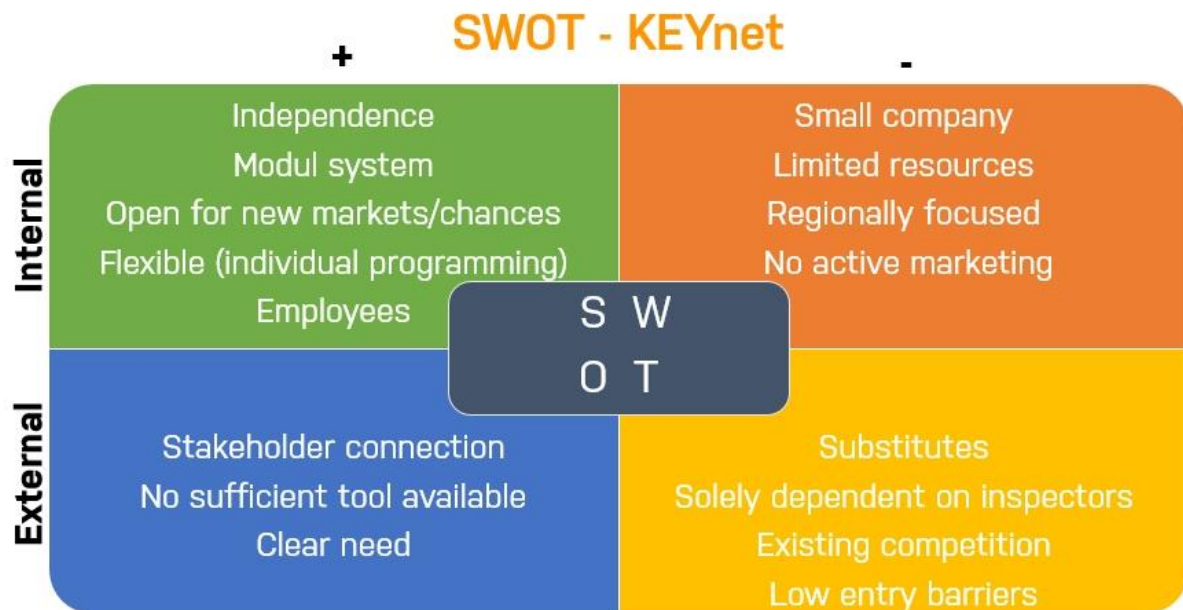

Figure 1 SWOT analysis for KEYspect

Strength (S)

The strengths are what KEYnet internally possess that could help them to achieve their objectives.

- KEYnet is independent and flexible. They code everything by themselves and do not rely on other companies or sources. As of this, they also offer flexibility since they can do individual programming.
- They are unique in their offering. They offer several modules that can be combined or stand by their own.
- KEYnet is not afraid of moving into new markets.
- The employees are skilled and KEYnet's most important assets.

Weaknesses (W)

The weaknesses are what KEYnet internally lack that could overturn their opportunity to achieve their objectives

- KEYnet is a rather small company, with 10 employees, which limits their resources and manpower, and could potentially limit the ability to take on a higher workload and grow.
- For today, KEYnet do not have an active marketing and do not have any sales personal. This could limit their market reach.
- KEYnet is regionally focusing on customers nearby (150 km) from their office in Hestra. The project group believe that this could limit their possibility to grow in the future when entering new markets.

Opportunities (O)

The opportunities are external factors that could help and affect the project positively.

- KEYnet has great connection with their stakeholders, which are some of the largest companies in their fields of work.
- No sufficient digital inspection tool on the market for now, and there is no tool that offers the learning process (there is needs that are unsatisfied as well as market shares to win).
- A clear need for such tool is stated.

Threats (T)

The threats are external factors that could obstruct the project.

- There are several substitute products that are widely used e.g. pen & paper, Word, Excel and other tools.
- In order for KEYnet to offer the learning process in the tool, they depend on the inspection data, thus the inspectors.
- There are existing digital inspection tools on the market.
- The market is fairly easily accessible since the entry barriers are low.

Furthermore, the project group applied the SWOT analysis in order to reach an understanding in how KEYney could exploit their strengths, overcome weaknesses, neutralize treats and protect their market position. The result is presented in fig.2.
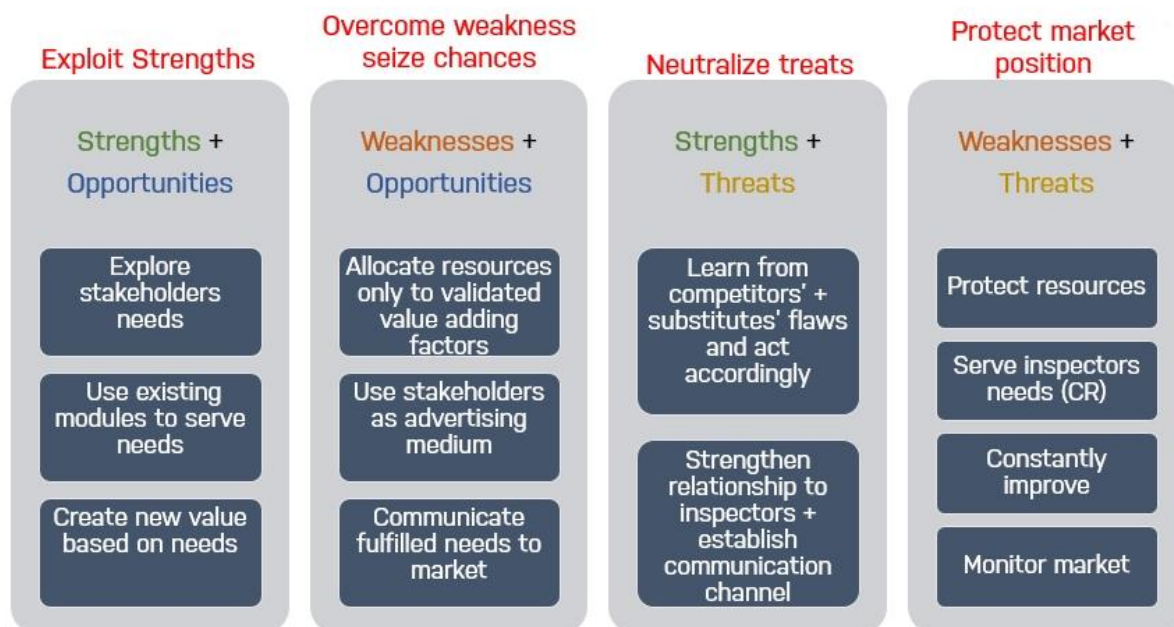

Figure 2 Applied SWOT

Exploit strengths can be done by combining them with the opportunities and, by that, explore stakeholders needs, use existing modules to serve the unsatisfied needs and create new values based on the identified needs.

By using the opportunities, weaknesses could be overcome. The project group believe that KEYnet should exploit their connection with the stakeholders when moving into the market of digital inspection in order for them to minimize the limitation of their resources. And also use the stakeholders as an advertising medium when moving into the new market.

Neutralizing threats can be done by understanding the industry of inspections and its flaws and act upon that. Moreover, the relationship with inspectors should be strengthened to minimize the threat of them using other products or substitutes.

KEYnet should perform work to protect their market position, now and in the future. This includes protect their resources, always serve users'/customers' needs (CR), work with continuous improvements and monitor the market.

4. Inspection process

This chapter explains the house inspection process both on a general level, how the different parts are connected, and also exemplifies an actual end inspection of a newly build family home.

4.1. Overview

When all required permits and decisions have been obtained, it is time to begin construction. During the construction phase, the contractor carries out the assignments procured by the client in accordance with the agreement. The building process is concluded with a final inspection, a final consultation/final clearance and a handover of the contract to the client. There are several factors that determine what steps need to be taken before production may begin. For example, the municipality must have issued a starting clearance. But other permits and registrations may also be required, for example from the Swedish Work Environment Authority or the county administrative board. Once a starting clearance has been obtained, the measures covered by the building permit may begin. At least once during the production, the local building committee shall visit the work site.
An inspection manager represents the developer and has the task of ensuring that the project meets the requirements in the planning and building legislation. Among other things, the inspection manager shall help the developer prepare a proposal for the inspection plan. The inspection manager shall also ensure that the inspection plan is followed and shall be present at the technical consultation, inspections and other inspections of the work site.
Normally, the local building committee holds a final consultation when the building is completed. The local building committee also assesses if they will be able to issue a final clearance.

The developer normally convenes the final inspection at the end of the agreement period or when the production has been completed. It provides an objective basis for determining if the contract work shall be considered completed whereby the contract is approved. Upon an approved final inspection, the contract period ends and the responsibility for the building is transferred from the contractor to the developer and the guarantee period begins. The

local building committee provides a final clearance once the developer has shown that all requirements are met. Only then may the building be brought into use.

The content of the final inspection shall be based on the contract agreement(s) that have been created. The inspector, or inspection group, determines if the contract has been carried out according to the agreements made or if deviations have been identified. If the inspector finds faults that are numerous or of substantial significance, the contract can be rejected. The inspector shall approve the contract if the faults found are not of a major extent or of major significance. In the inspection report, deficiencies and remarks that the inspector does not consider to be the responsibility of the contractor shall also be noted.

4.2. The Inspection Process

The following described inspection process took place on the 18th of October 2018 and was carried out as an end-inspection of a newly build single-family house in a fast-growing new housing area. The inspection was observed by Filip and Felix from the project group and Patrik from KEYnet. The inspection took approximately 1.5 hours and was conducted by a freelancing inspector on behalf of Gar-Bo as the responsible company. Present during the inspection were also the new house owners, sub-contractors representing both the builders and the painters and a representative of Gar-Bo.

As there is a lot of freedom for the inspector himself, in how to conduct the inspection exactly, and depending on how the earlier inspections were carried out the steps may not be exactly similar in every inspection process and may also vary between inspectors. But on the basis of doing a market analysis for digital tools for inspections, the project group thinks that this description and understanding of an inspection process is sufficient to get a first-hand inside and can therefore be used in the further steps. An overview of the precepted outcomes and learnings from inspection process can be seen in in fig.3.
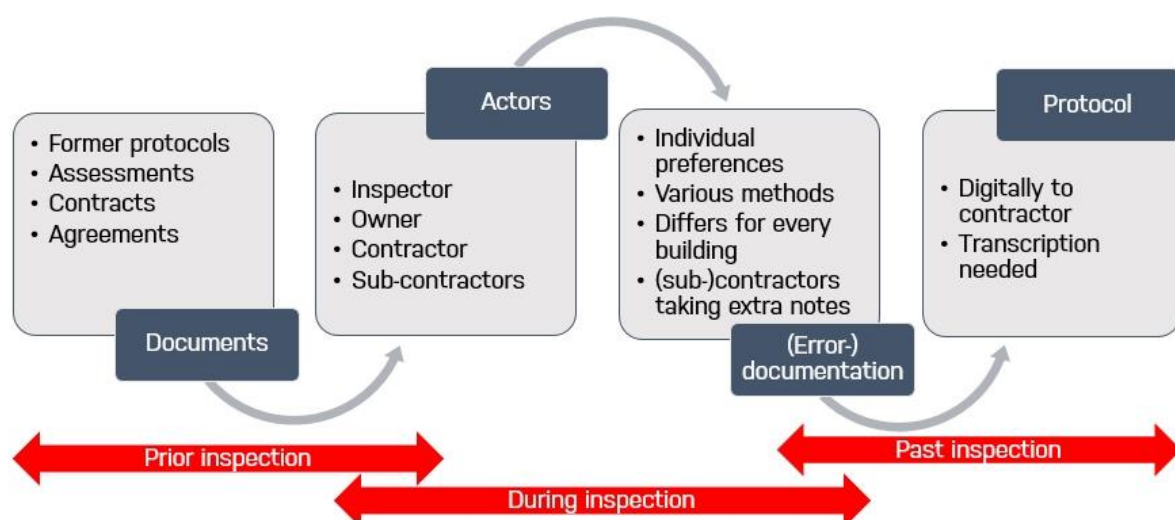

Figure 3 Visualization of inspection process

- Before the inspection can start it is crucial that all the necessary paperwork is in place and available to the involved parties. This includes the former inspection

protocol(s) as well as further documentations, contracts and agreements in the right forms and versions.

- Regarding the inspection protocol itself it is not obliged to be handled in a particular way. Although there is a guideline or templates for how an inspection report should look like in general, the participating inspector is basically free to choose. This inspector told us that he had tried different kinds of documentation as pen & paper, smartphone, tablet and laptop. He decided that for him the handling via laptop is the most convenient solution right now. This is explained through the fact that the existing software for smartphone and tablet (Apps) is not sufficient in terms of usability and alterability, meaning that it is too complicated to work in or re-work data in real-time in the desired form.

- The usage of pen & paper is rejected, due to the fact, that this would require a thorough redundant revision later on, as the end protocol is supposed to be handed in to Gar-Bo in digital form.

- The inspector used his laptop with Excel and Word lists of identified errors known from former inspections in this particular house and the corresponding responsibilities of who should have solved which problem, and works directly in this document, erasing repaired errors and adding new one's if occurring. He carries the laptop with him through the house from room to room.

- The inspector only has the documentation (protocol) explicitly regarding the inspection. Directly in the beginning we encountered the situation that some other documents were missing and the whole process was therefore delayed.

- During the inspection the inspector follows the list (errors) from room to room and controls last time's deviations (The numeration of errors/deviations follows a simple principle: when entering the house, the first room on the left side is room number 1, regardless what kind of room it may be. When entering room 1, the first wall on the left side is wall 1, respectively room 1 wall 1, 1w1 or similar. The same applies for windows, doors etc. In this way the whole house is inspected in clockwise order.

- The painter as well as the handcrafter were present the whole time fixing not remedied/new occurring errors immediately. While they are working, they are not always able to follow the inspection carefully, therefore had to ask several times. The now solved errors are erased from the list instantly.

- There are no photos taken from the errors nor the solved one`s.

- As the inspection came to an end the person from Gar-Bo took a picture of the finished protocol/error list.

- If there are errands to run left, this will be noted in the protocol and the responsible trades will get a defined timeframe to solve them.

- There are some errors that are not being corrected, as there are very minor or "normal". It is not clear how this is defined.

- The inspector informs the new to be owners on their rights, in terms of signing the acceptance, timeframes, etc. He as a neutral "judge" can suggest what amount of money to withhold for which errors until they are solved.

- The inspector finishes up the protocol and sends it to Gar-Bo.

5. Understanding market needs

Initially, an overview of stakeholders' needs is presented. Moreover, the identified needs are tested and verified by a conducted questionnaire that 47 inspectors responded to and later merge into the KEY attributes of a future digital inspection tool.

5.1. Stakeholders' needs

Stakeholder interviews have been held, with the purpose of understanding their points of view. Representatives from Gar-Bo, Flexator and Obos has been interviewed and the questions regarded both their involvement and connection to the inspector process, but also their needs and what they are expecting from the future tool. Furthermore, pre-studies on stakeholders needs that were made by KEYnet have also been taking into account.

5.1.1. Gar-Bo

All information below was retrieved by an interview with Lars Fahlgren, manager of contract inspections and Patrik Wipp, CEO of Gar-Bo. The interview was held on the 15th of November 2018.

Gar-Bo believes that existing tools, such as Ispect and Icontrol, are too complicated. They are complicated in that sense that they demand a great number of clicks and requires to choose between far too many options/data i.e. to be able note an error in the app, the inspector needs to go through far too many steps to actually be able to make that note. What Gar-Bo needs is a tool that is more user-friendly, and that the time that is requires to make a note is dramatically reduced compared to the alternative forms of make the notes/protocols today. According to Gar-Bo, the most important factor/need is the user-friendliness and they believe that this could be done by voice-recognition. Moreover, Gar-bo would want a tool that could cover the total process, from booking to generate and distribute protocols and to the post processing of data. The learning process is important. The tool would be even better if it was possible to connect the protocols (errors) to 3D modules of the object itself.Furthermore, it is also of interest for Gar-Bo to have all the documents stored all together and be able to connect all these documents with each other, even if they are in different formats, by an open interface.

Preferably, Gar-Bo would like to pay per inspection or through a license deal. But it is hard to tell for now according to Gar-Bo, it depends on the price and on the quality of the tool; how much time inspectors actually would save by using the app.

5.1.2. Obos

An interview was held with Tommy Andersson, project manager southeast PU on the 20th of November 2018. Information presented below will be based on this interview as well as on the pre-study made by KEYnet.

Obos sees the inspection tool as a portal/app in which they could have access to all documents instantly and retrieve information if needed. Also, to be able to see what object

that is going to/is being inspected and when they are carried out. Moreover, Obos emphasize on the importance of the learning process; to be able to retrieve statistics and data from all inspections. A more uniform inspection process would also be of value for Obos. That the process of evaluating, marking and describing errors are similar in all cases, that the process is standardized. Furthermore, a picture function that inspectors as well as contractors/sub-contractors can use would also ease the process according to Obos. And they also want to be able to run errands via the tool, and to be able to generate different protocols for different sub-contractor so that specific sub-contractors will get their responsible parts from the protocol. Obos likewise wants to follow the process of errors, when they are fixed or how far they are from being fixed. The picture function will also be of interest in this scenario, when sub-contractors completed the work, they could take pictures so that Obos could confirm it without physical attendance

Obos points out that their work is, of today, limited to some extent as a consequence by the inspection process. In one way, by the inspection protocol (it is communicated in different ways by different inspections), but it could also be due to the different expressions and descriptions, which makes the interpretations harder.

Obos believes that they will pay for the inspection tool in two ways. Firstly, through the inspectors as their prices will be adjusted (higher) when they are using this tool, simply because they enhance their offerings. Secondly, through KEYnet when accessing the inspection data for the learning process.

5.1.3. Flexator

Information presented below were retrieved from pre-studies conducted by KEYnet.

The inspection protocol is of great value for Flexator, how it's structured and delivered. Flexator would want the protocol digitally and with the possibility to run errands through the app, to the responsible sub-contractor, e.g., painter, electrician and plumber. They would also want to see the status of all errands, and for finished tasked to be reported to Flexator. The post process of inspection data is also of great importance for Flexator. They see great value in studying data and doing analysis such as how many wrongdoings per category or sub-contractor etc.

Flexator wants a tool that works on different platforms, such as Android and Apple and also as isolated tool. They do not want to be limited by different systems, but instead be able to access the tool from anywhere, on any device.

5.1.4 Key attributes

The project group identified the key attributes for a digital inspection tool, based on the needs of Gar-Bo, Flexator and Obos, mentioned in the previous chapter. The result can be seen in fig.4.

Identified key attributes for a digital tool for building inspections

Flexibility: change order/procedures during inspection	**Different OS**	**Document Manager**: store all (necessary documents at one place	**Task Manager**: cover the whole process. What, When, Where, Who?
Protocol: one-click, Real-time delivery, different addressees	**Multiple Users**: different actors can work in process	**Pictures**: possibility to take and include pictures	**Standardization**: pre-made terms & categories to describe errors
	Stand-alone App	**Usability**: easy usage, uncomplicated,	

Figure 4 Identified key attributes for a digital inspection tool

5.2. Inspectors' Needs

In order to test and verify the identified key attributes, the project group conducted a questionnaire directed to inspectors. The questionnaire was made via google drive and was distributed by a link through Lars Fahlgren, manager of contract inspections at Gar-Bo to all their 105 employed or partnered inspectors. In total, 45 certified inspectors replied, which represents approx. 10 % of all inspectors in Sweden. The questions were asked in Swedish since all inspectors are Swedish speaking and the project group wanted to minimize the risk of questions being misinterpreted.

Initially, it was asked if the inspectors had encountered any inspection tool before (fig. 5) and the result shows that 37 inspectors had not. Three inspectors had tried Ispect and three inspectors had tried Icontrol.

Har du varit i kontakt med någon av de följande applikationerna?
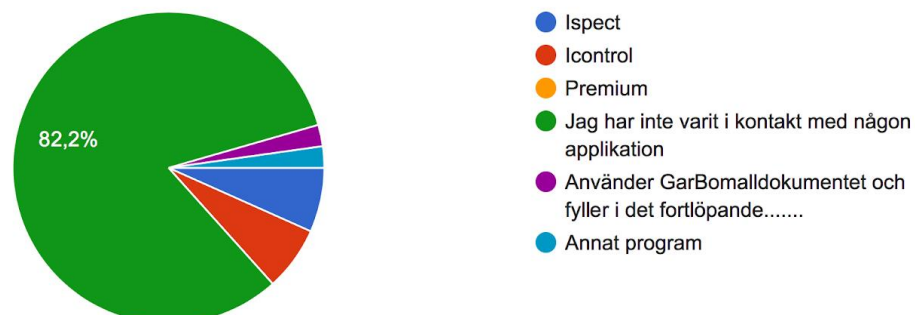45 svar

82,2%

- ● Ispect
- ● Icontrol
- ● Premium
- ● Jag har inte varit i kontakt med någon applikation
- ● Använder GarBomalldokumentet och fyller i det fortlöpande.......
- ● Annat program

Figure 5 A pie chart showing how many (in percentage) of the inspectors that have been in contact with some digital tool for inspections.

15

As a follow up question, it was asked why they do not use any digital tools and to summarize: The existing tools are not finished products, they are too complicated to use. The documentation process is to "stiff" and inflexible. Also, the usage of pre-constructed sentences does not fit in all occasions. The price tags are also to high on the existing products.

Further questions regard the importance of different factors or attributes, that potentially could be included in a future tool. The different factors were ranked from 1-6, where 1 meant least important and vice versa 6 the highest importance. The attributes/factors themselves were defined on the basis of stakeholders needs, as mentioned above.

The first question (fig. 6) was about the user friendliness. In this context, this means how user friendly the tool is, its interface and the overall impression. Based on the interviews with Gar-Bo, this was the single most important factor for inspector to actually use the tool, and the results of this question supports this claim, with 33 inspectors believing it is of highest possible value.
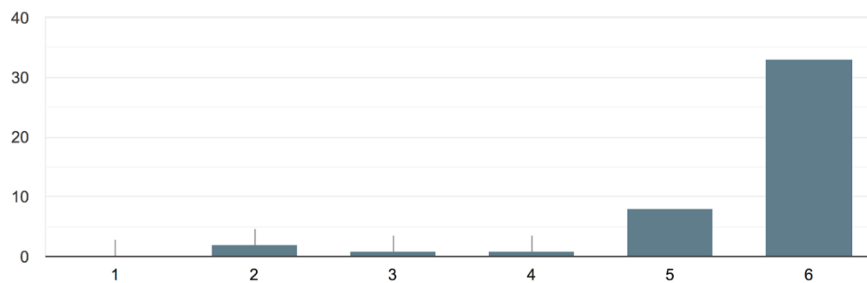

Figure 6 A bar chart showing how inspectors values user-friendliness.

The second question (fig. 7) was about the ability to take photos and add them within the tool itself and the answers was rather scattered, with about equally many inspectors giving it the values 6, 5, 4 and 3. However, based on the interviews and pre-studies with Obos and Flexator, photos are of great value. The project group believes that the difference in needs in case, could be explain by the different usage of the inspectors and the contractors. The photos simply do not add any value for the inspector him/herself, but for the constructors it does. It will help the constructors to identify the error quicker and thus, ease the process.

Möjlighet till att fotografera?
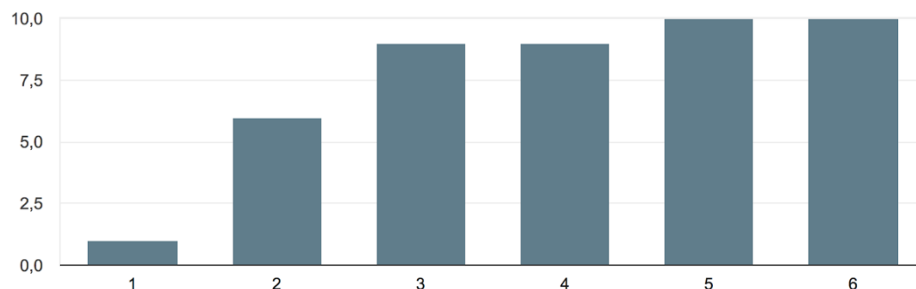45 svar

Figure 7 A bar chart showing how inspectors values the ability to take photos.

Further on, it was asked if the ability to assert responsible contractor or subcontractor to identified errors were of value (fig. 8). And again, the majority of the inspectors (26) believes that this is of highest value. This question was based on the interviews with the stakeholders. Also, during the project group's attendance in an inspection, it was discovered that a part of an inspector's work is in assessing the responsible actor.

Möjligheten till att ange ansvarig för funna fel?
45 svar
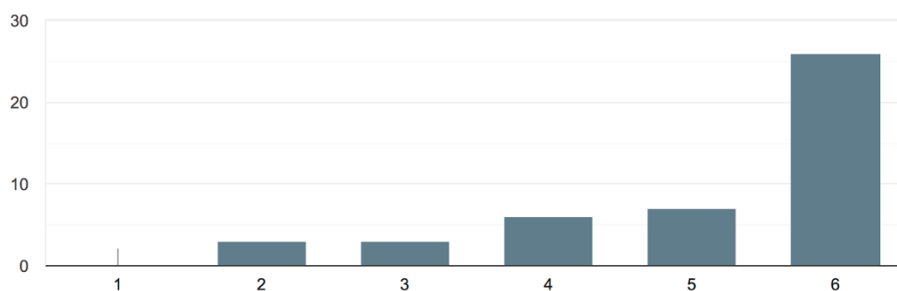
Figure 8 A bar chart showing how inspectors values the ability to assert responsible parties.

The fourth question (fig. 9) was about the importance for the tool to be available on different platforms such as Apple and Android. Again, the stakeholders were united in their needs. All of them wants to be able to use both Android and Apple, and the inspectors also confirms this, with 32 of them giving it a 6.

Kompatibel med flera operativsystem? (exempelvis både apple och android)
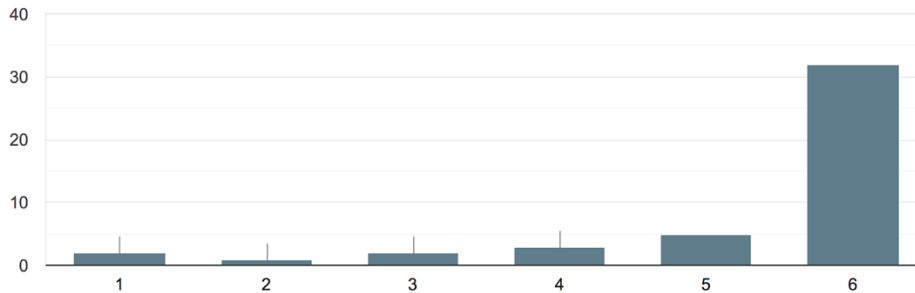
45 svar

Figure 9 A bar chart showing how inspectors values the opportunity to use different operations systems.

Moreover, a question about the ability to collect and gather all document in one place were asked (fig. 10). Both Obos and Flexator stresses the need of a solution on this. Also, during the inspection, there was some documents missing that was needed in order for the inspector to give his verdict. This question was thus based on these facts. 28 inspectors value this function as either a 6 or a 5, thus making it an important factor as well.

Möjligheten till att samla alla dokument på samma plats, även dokument från andra parter?
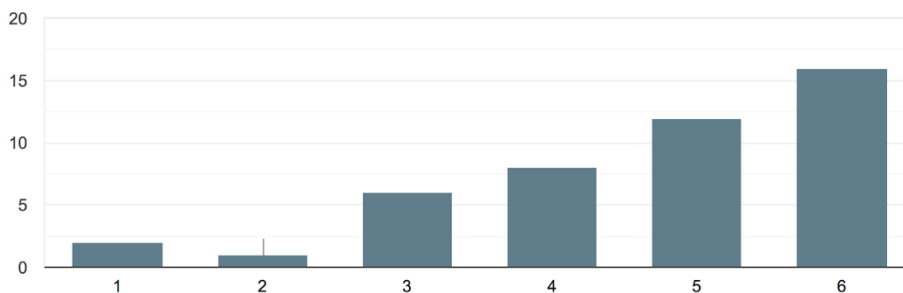
45 svar

Figure 10 A bar chart showing how inspectors values the ability to gather all documents in one place.

All stakeholders believe that the tool should be a stand-alone application, and not a tool that requires different systems or special devices. Due to this need, a question about this subject was asked (fig. 11), and 32 inspectors either valued it as a 6 or a 5 hence, an attribute of great value. The project group's market research also tells that no existing tools provides the ability to use it on several platforms, for now, they are only compatible with Apple.

Att verktyget i sig är en egen applikation? (krävs inte flera system)
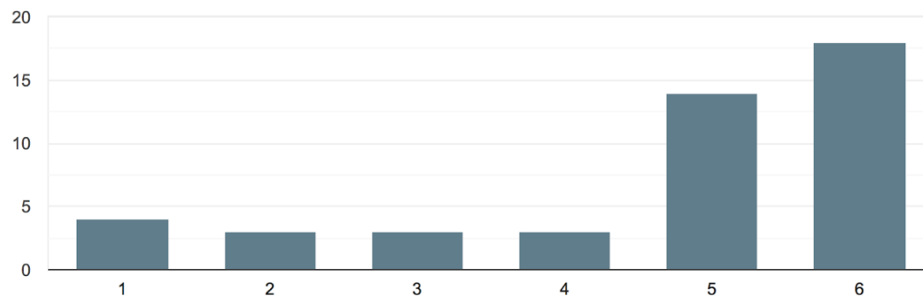45 svar

Figure 11 A bar chart showing how inspectors values the tool being a standalone application.

Obos pointed out, that they would like to be able to add data simultaneously as the inspector carry out the inspection. This question was also asked to the inspectors (fig. 12) and in the question, it was stated that this would not have an effect on their protocol, but only be information for the contractors to see. However, the inspector was not convinced, and 24 inspectors gave it either a 1, 2 or 3 and 21 gave it a 4, 5 or a 6. The project group conclude that on explanation for this result could be that many of the inspectors believes that they would be disrupted in their work as a consequence of this feature.

Möjligheten till att andra parter också kan addera information i applikationen under tiden som du utfö...märkningar kommer inte att påverkas)
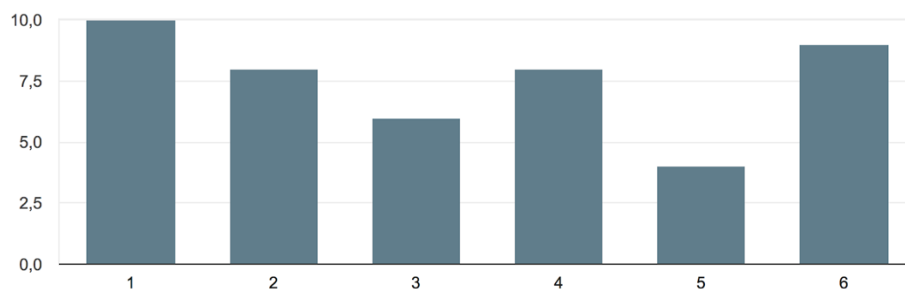45 svar

Figure 12 A bar chart showing how inspectors values the ability for other parties to add data simultaneously as the inspector carry out the inspection.

According to Obos, their process would be greatly improved if the inspection protocol were more uniform. That all inspections were being made in the same way and that errors are marked and described similarly between inspectors. A question was asked regarding the freedom for the inspectors to decide how the inspection would be carried out e.g. in which order or how do document it (fig. 13), and the results tells that it is very important, with 32 inspectors valuing it as a 5 or a 6.

Friheten till att själv välja hur besiktningsprocessen ska vara upplagd? (exemplevis ordning och dokumentation)
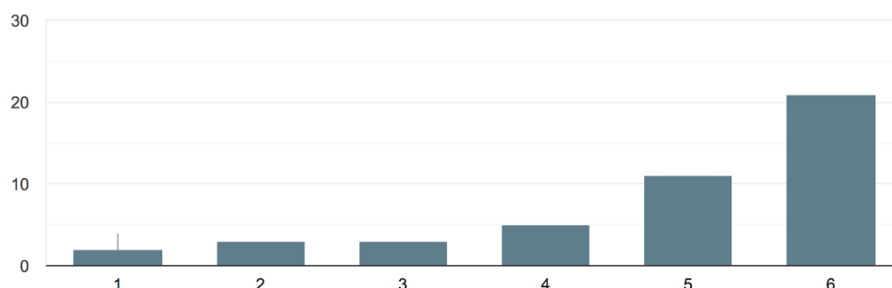45 svar

Figure 13 A bar chart showing how inspectors values the freedom in the application.

A further question (fig. 14), also regarding the uniformity was, if the inspectors would want the ability to choose between pre-constructed terms and categories when marking errors. And their answers tell that it would be of value. 30 inspectors value it as a 5 or a 6. This attribute would also be in line with Obos request about the standardized way of marking errors.

Möjligheten till att välja bland standardiserade termer och kategorier? (för att kategorisera anmärkningar)
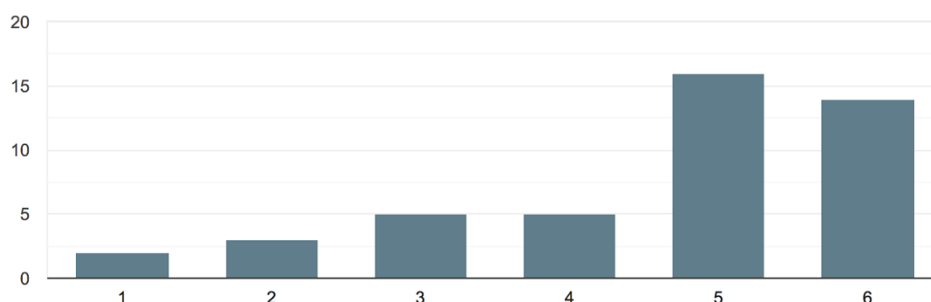45 svar

Figure 14 A bar chart showing how inspectors values the ability to choose between pre-constructed terms and categories.

The last question (fig. 15) was about the ability to generate inspection protocols in the tool itself. This is an important aspect for the contractors. Both Obos and Flexator would want to receive the inspection protocol instantly after the inspection. Today, they are limited by the protocols since there often is a lag between the inspection being carried out and when the protocol is delivered. The inspectors also believe it is an important factor, 36 inspectors valuing it either as a 5 or a 6.

20

Möjligheten till att automatiskt generera protokoll i applikationen?
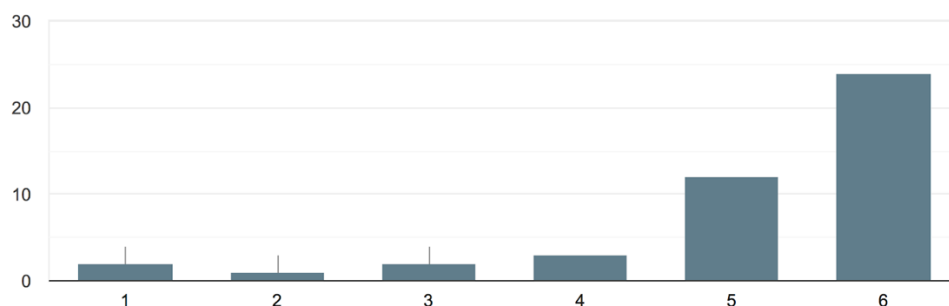44 svar

Figure 15 A bar chart showing how inspectors values the ability to generate inspection protocols in the tool itself..

5.3. House owner

The House owners or the owners of the object that is being inspected could potentially add value for the tool itself, but also contribute to the tool being used to a higher extend. It is believed that, if the owners would be included in the tool, the flow of data would be more complete. There are several documents and decisions provided or made by the owners, which makes it logical to include them in the digital tool. The rationale to include the owners would also be, that it will create incentives for the inspector and other parties to use the tool. A general saying is that consumers drives demand, so if the house owners would "demand" usage of the tool, then the market will eventually adapt to this customer need.
There must also be incentives for the house owners themselves to use the tool. Based on the project group's knowledge and some informal interviews with soon-to-be house owners and house owners, the conclusion would be that the owners' need is to see the process and all steps on the way of their house being built in some easy way. The process must be visualized in some way, so that it is easy to see, where in the process they are now and what is left/what needs to be done? Both from their side, but also from other parties.

5.4. Sub-contractor

The research indicates that the most important factor for sub-contractor to even consider the usage of the tool, would be that it does not contribute to more time being put on documentation, hence their need would be an easy-to-use interface. Sub-contractors would want to see what work needs to be done now and in the future. Also, if there is an error that needs to be corrected, an easy way of identifying this error (could be pictures and explanations on where to find it, etc.). Sub-contractors also want to be able to notify completed work at the push of a button i.e., no extensive extra work.

5.5. Researchers

Researchers would not be involved in the process itself, rather they value the data from the inspections. Thus, researchers need is to be able to access the data. Specific data would

most certainly be classified, but general data that does not directly reflect companies' performances could be offered in the tool. But the project group believes that the post processing of data is for the companies involved in the process, for their own learning process; due to security/classified/legal issues.

6. Market analysis on existing tools

This chapter gives an overview of the sizes of building construction markets in Sweden. Also, it includes market researchers on existing inspection tools and their offerings.

6.1 Sweden

Sweden is the primary market of interest, since it is the introducing market for the application.

6.1.1 Overview of building construction market

NACE Rev.2: 4120 is the code that represent companies within the construction of residential and non-residential buildings. Over 15100 companies within this industry are active in Sweden and together, they had a total turnover of about 300 billion SEK in 2016/2017 (Amadeus, n.d.). Most of the companies active in the industry have a turnover under 5 million SEK, but there are also some huge players. 79 companies have a turnover over 500 million SEK, the biggest player is Skanska with a turnover of approximately 2.4 billion SEK in 2017 (Amadeus, n.d.).

6.1.3 Competing digital tools related to inspections

Ispect
iSpect is an iPad application (only works with IOS devices) for all types of house inspections. The application supports the entire inspection flow from start to finish (ispect, n.d.). Ispect is used by beskiningsman.se, which have roughly 30 inspectors working for them (besikningsman.se, n.d.).

Booking an inspection:
iSpect offers booking and scheduling features that automatically generates a group of inspectors who can perform the inspection specified. The user specifies the requirements in terms of the address, what kind of project that is being inspected and the type of inspection; With this information, the system then returns a reservation with appropriate inspectors (Svenska byggbranschens utvecklingsfond, n.d.).

During the inspection:
The inspector choses which type of room and notes any errors in the app directly, and simultaneously chose the craftsmen/entrepreneur responsible for the error. There is also the possibility to take photos (Svenska byggbranschens utvecklingsfond, n.d.).

After the inspection:

The statement/protocol will be finalized on the day the inspection was carried out, which means that the process of correcting the errors can begin immediately. The inspection protocol is automatically generated after the inspection. The system can also automatically generate the correct protocol to the right subcontractor. The subcontractor can then sign when the error is corrected. When a final inspection is approved, a post-inspection can be performed. If the customer invokes this, ISpect automatically creates a new post-inspection where all information from the final inspection including the unsuccessful errors is copied over (Svenska byggbranschens utvecklingsfond, n.d.).

Icontrol

Icontrol is an application for iOS-devices. Both Icontrol and Ispect is developed and owned by sellingsolutions Scandinavia AB (icontrol, n.a.). It is not an inspection tool itself but offers a solution that eliminates the need for documentation with pen and paper in documentation (ibid.). There are roughly 50 inspectors that uses Icontrol for the error statements according to A. Dahl (personal communication, Nov 7, 2018).

Icontrol is much like Ispect, it can perform most of what Ispect can, however Icontrol does not cover the booking part. When making notes in Icontrol, the inspector first defines the error by type, it could be a deviation of some sort, then describe the error. After the description, the inspector has the possibility to tag the note (tags could be of the room or the apartment itself etc.). The inspector choses the responsible contractor or sub-contractor (the one responsible) and, if needed, adds a deadline. It is also possible add pictures. And when the inspection is done, a complete protocol will be generated, and all responsible contractors and/or sub-contractors will receive a report with what is relevant for them (Icontrol, n.a.).

Premium.se

Premium offers different products, one of which is called Mobile Inspector Pro. The application is design for ios-devices and is a complete IT system/tool for managing the administration of inspections, not the booking part however. The system is designed to allow for easily perform inspections in a traditional way directly on an iPad. There is a library of pre-constructed sentences for common errors and It is also possible to add pictures to the notes. When the inspection is done, the protocol is automatically generated in a PDF-file or an excel document (premium, n.d.). The tool is designed for the inspector and does not include all different parties connected to inspections (house-owners, sub-contractor, contractors etc.) however, Premium offers the opportunity for involved parties to see statistics from their inspections through a generated link/portal from the tool itself. (ibid.).
The pricing varies depending on how many inspections that should be included and what extra features that is added. The price is 1350 SEK per month for unlimited inspections and includes two users. Per user added, an extra 300 SEK will be charged.

The mentioned tools and their offerings are visualized in fig. 17, whereas the green symbols mean that the tool is offering the attribute, red mean not offered and yellow is if there are uncertainties about if it is offered or not. The offerings are cross-referenced with the identified key attributes.

	Ispect	Icontrol	Premium
Flexibility	○	○	○
Different OS	☒	☒	☒
Document management	☒	☒	☒
Task management	☑	☑	☒
Protocol	☑	☑	☑
Multiple user	○	○	☒
Pictures	☑	☑	☑
Standardization	○	○	☑
Stand-alone-app	☑	☑	☒
Usability	☒	☒	○

Figure 16 A summary of the offerings from the above-mentioned tools.

It can be seen that none of the existing tools offers all attributes and thus, explains why the tools is not used to a high extent. The current offerings are simply to low. Critical parts such as document management, usability and flexibility need to be in place, in order for inspectors to use it.

7. Conclusion

The conclusion part of this report aggregates all findings the project group has made and suggests operation modes for the KEYspect app and the interconnected KEYnet module plus the envisaged linking between them and their users based on the retrieved information concerning the stakeholders needs and wishes. Furthermore, a business model for the positioning of KEYspect in the market and a suggested practical proceeding towards this position is provided.

7.1 Suggested Operation Mode – KEYspect

As fig. 18 shows, the concept for KEyspect as the actual inspection application and the associated KEYnet module is divided into two parts, interlinked in a cloud-based storage, and follows a multiple user approach. The front-end part is KEYspect, as the mobile application, used on-site during the inspections. The back-end part on the other hand is the module, which is installed and integrated in the contractors IT-system, possibly to their ERP-system. The sub-contractors are thought to receive notifications via e-mail, with the possibility to link assigned tasks to their mobile calendar and report the status as well as photos back in the same way. Everything is interconnected in a cloud. This scheme is a simplification and displays two main, the inspector and the contractor company, and one subsequent, the sub-contractor, users only, to provide an overview on the general functions. The real-world

application can be much more complicated with additional users, e.g. several inspectors in bigger projects or most likely multiple sub-contractors.
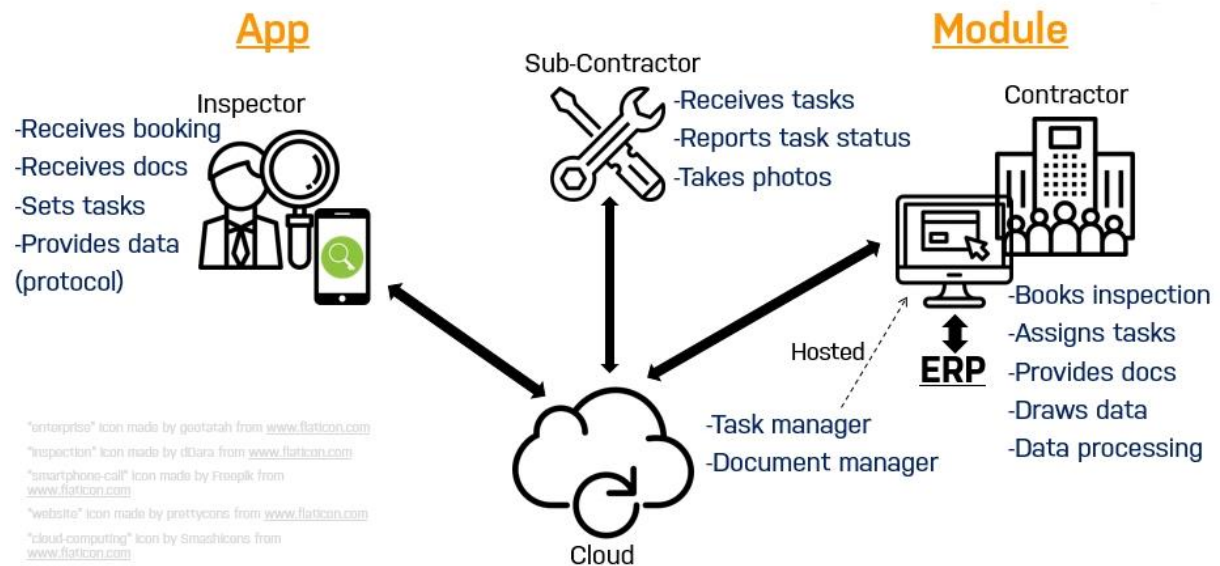

Figure 17 Operation mode KEYspect

As the contractors are the ones responsible for the overall building process, the booking of inspections is located here. The request is sent to an available inspector via the cloud and it is then confirmed, when the inspector is available. This booking is then logged in into the task manager, where a new project is created. Inspectors and contractors use the document manager to upload all necessary paperwork that evolves in the process. Task managing as well as document management module are hosted at the contractor as project-owner and accessible via cloud, to the authorized extent.

All collected information from the inspection itself is transferred to and saved in the cloud, this includes detected errors and notes on them, tasks that are to fulfill, issues that need to be solved and the inspection protocol, naturally. The inspector also has the possibility to take private notes, which will not be shared. Tasks that need to be taken on or errors that need solving are assigned to the responsible sub-contractor and handled as mentioned above.

After the end-inspection is sufficiently completed and the final protocol, the "utlåtande", is submitted the projects ends and the process is completed for the inspector. All collected data is stored in the data pool and can be brought to further use by the contractor. Over time, with an increasing number of inspection processes stored a data/information library will emerge, which will enable the drawing of statistics, categorization and structuration of information and ultimately the identification of (major) error sources and flaws and the elimination of such - the desired learning effect.

7.2 Suggested Business Model

The suggested business model to position the digital tool KEYspect in the market is split into various themes, all of which are based on possibilities, advantages and restraints the

authors find in the analyses of KEYnet as a company, the stakeholders' needs and the envisaged market segment.

7.2.1 Customer Segments
While nowadays KEYnet does not have defined customer segments to serve by definition, simply because the offered services are very specific and custom-made for every single customer, while the customers come a broad variety of industries are completely different firms. Naturally, it would be possible to define customer segments from this, e.g. small sized companies, medium sized companies, c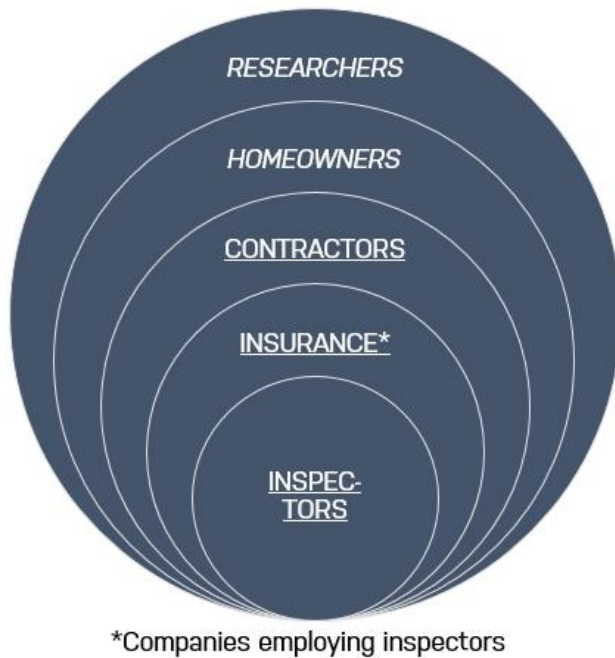ompanies within a range of 150 km from Hestra, companies in need of task managing software. And while this list could be continued without limits, for this specific case a more precise segmentation is needed to identify potential customers and then fulfill their unique longings. As fig. 19 displays the segmentation was done in a five-layer model, with three primary customer segments and two subsequent secondary layers. As first and central customer segment the inspectors were defined. Due to the fact that their participation and use of KEYspect is the crucial condition for the functionality of the tool and whole idea, there must be a main focus on this group.

*Companies employing inspectors

Figure 18 Customer segments

The second layer, here called "insurance", represents the companies employing inspectors or commissioning freelancing ones. At first sight this segment could be integrated with the first one, but as the successful convincing of these companies facilitates favorable conditions for the implementation of KEYspect, and therefore can win over larger numbers of inspectors at once, it was decided to uphold this segment as separate. Moreover, they as companies could have an interest in statistics and accumulated data, drawn from inspection process, to increase their efficiency, e.g. servicing all inspectors with similar knowledge on particularly relevant issues. In the third customer segment the contracting companies, like Flexator or Obos, are represented. While this segment embodies main stakeholders and drivers of KEYspects' development, it was put in the third layer by reason of the mentioned inevitable data providing by the former mentioned ones.

The fourth and fifth layers, homeowners and research are sorted as secondary potential customer, who could also gain from the new tool. The homeowners in the form of faster and more effective building construction, and finally flawless houses. This also includes owners of non-residential buildings. Researchers could be interested in the evolving information database, e.g. regarding efficiency of different trades or construction material robustness, durability and flaws.

7.2.2. Value proposition

The presented value propositions (Fig. 20, Fig. 21) derive from the inspectors and contractors labor scopes plus their needs and the consecutive pains they want to overcome as well as desired gains. These factors are linked to, and concluded in, components KEYnet should deliver with KEYspect to the distinct parties in order to relieve their pains and create gains, and thus propose new value adding factors improving the execution of their labor scopes.
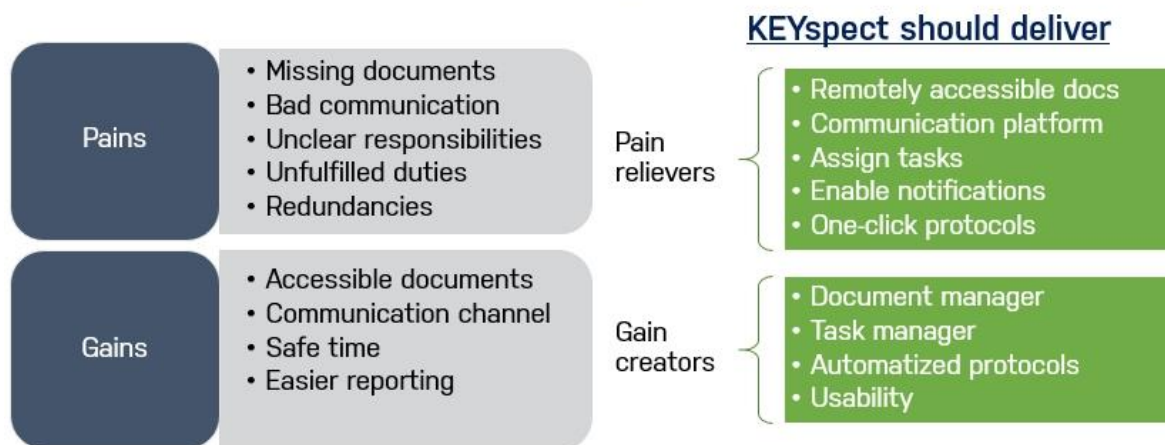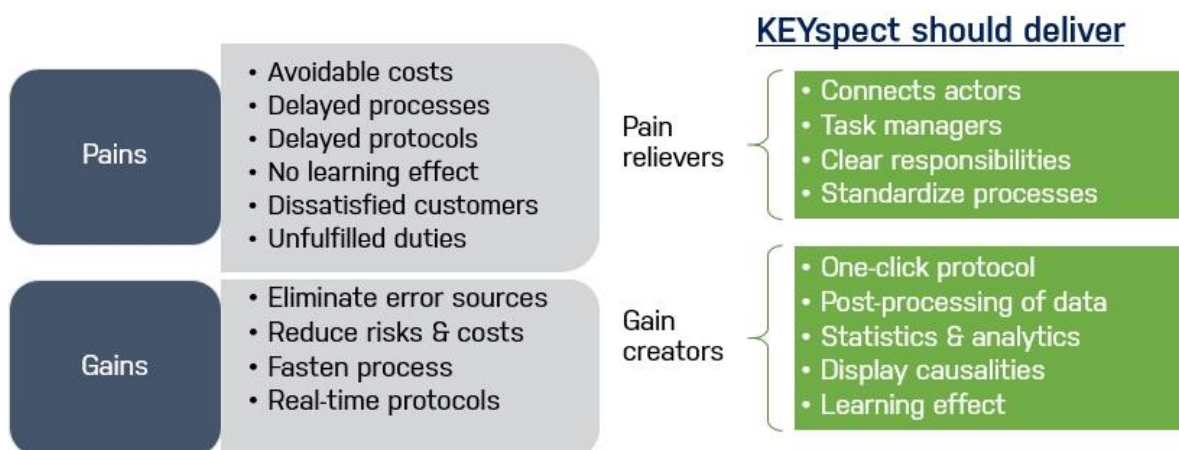

Figure 19 Value proposition - Inspector

Figure 20 Value proposition – Contractor

7.2.3 Channels and customer relations

In order to reach the right customers and take target-orientated actions, it is important to communicate information through the right channels in a purposeful way. To achieve this several channels are proposed (Fig. 22).

Figure 21 KEYspect comminication channels

KEYnet's current mostly used channels are mouth-to-mouth advertisement and the corporate website. The first is well working and of great worth, as present customer companies recommend KEYnet to other companies, what establishes a great level of advance trust, simply because it is much more believable and enhances the credibility, as they would probably not endorse something they were not satisfied with. This channel, facilitated through KEYnet's close customer relationship, on which the firm heavily emphasized and relies on, for example with the credo of keeping the customer regionally close, to provide personal customer services and the completely customized and tailor-made solutions, is one of, if not the most valuable and important advantages KEYnet has. The close customer relationships are to leverage and use as asset against competitors. Especially in this for KEYnet new field of mobile applications must the relationship and close cooperation with the customers be stressed and integrated into the development process. If the present stakeholders are convinced and spread the word-of-mouth, it is very much possible, due to their size and influence, to reach a big brand recognition and make the KEYspect a known name.

To be not solely dependent from the stakeholders, with the goal of gaining customers and a sizable share in the market of digital tools for building inspections, actions must be taken to open up new channels and therefore actively widen the the field of possible clients. KEYnet should be present at all fairs related to building and construction, where actors from the targeted industries can get to know KEYspect and its benefits. On-site testing and free trials should be used to convince potential customers and to increase the brand recognition. Other active marketing measures as part of the introduction of KEYnet and KEYspect to new

service recipients should be the advertisement in relevant industry magazines, on websites or via google ads to lead interested actors to the company's website.

Additionally, the KEYspect app should be available in the App-, as well as in the Playstore.

7.2.4 Revenue models

Taken into account that different actors and institutions will use the new product, different revenue models must be considered.

As Fig. 23 displays three revenue models for the application KEYspect are to consider. The first, the classical subscription model is based on regular payments (per month). It is suggested to provide a lite-version, with trimmed-down functions for casual users, which only contains the inspection process and creation of protocols for a reasonable price and a pro-version, with all functions included for a higher price. The subscription model is thought for freelancing inspectors.

Figure 22 Application – KEYspect revenue models

Another possibility is the licensing for companies employing many inspectors, such as Gar-Bo. They would make one bigger payment and buy the right to distribute the app to a defined number of inspectors, which then can independently work with it. The license could be limited to defined time-span, e.g. one or two years and would then needed to be re-purchased. As third possibility the pay per use is regarded. User would pay only if they actually use the app. The price could be determined by the number of inspections, per user or through combinations of both. This could also be done by selling credits, which then could be used for different actions in the app.

The possible revenue system for the module-part (Fig.24) proposes a one-payment licensing model, similar to the above mentioned one, with the restriction that it would be only for one user, which means one company in this case. As the modules will need customer specific adjustments and integration into the existing IT-architecture, the pricing would be different from customer to customer and highly dependent on the needed effort and the client company's size. As an additional revenue source, while the subscriptions and licensing are thought to be overall cost-covering, the modules most likely would need trainings, to educate the employees on the usage; and regular maintenance, in case of bigger updates or changes, this should be covered by the acquired license to some extent. Irregular maintenance or trainings, requested by the client can be charged as additional service.
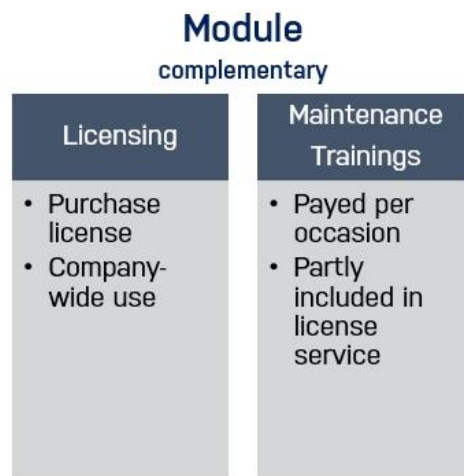

Figure 23 Module revenue model

In this stage of the development it is difficult to estimate any hard numbers, as the stakeholders do not want to, and cannot, name prices they would be willing to pay, as they cannot assess the worth and quality of the digital tool. During the development process, they need to be convinced by function and actual worth.

7.2.5. Key activities, resources and partners

To achieve the anticipated development, several key activities should be prioritized and extended. Fig. 25 presents the most relevant ones in relation to the new tool, as the authors percept it, in a hierarchical order. On top of the chart the customer relation (CR) and user research was places. CR is also defined as key resource (Fig. 26), which is crucial for KEYnet nowadays as well as in this new situation, as this is what can highlight them from the competition and consequently lead to competitive advantages over competitors, that are not fully focused on the customer. Following this line, the users', respectively the customers -defined as Key partners- needs should always be the base and starting point for further developments and improvements. The active collection of user data and truly understanding their motivations, problems and needs, is essential to deliver true values, that are real values in the eyes of the user, too. Keeping the software up-to-date should be self-explanatory and a natural key activity, considering the software a key resource, which is ultimately the product. Flaws, shortcomings and possible weakness in the software itself or in the surveyed user experience should continuously be investigated and monitored, and quickly

repaired, successively. That is to accomplish a continuous improvement process. Having defined the software as a key resource, which's protection as intellectual property is of great importance, the employees as carriers of the necessary know-how to successfully use the software and their accumulated knowledge regarding KEYnet's processes and ways of working, as well as actors, who interconnect KEYnet and the customers in a personal way, are regarded as major resource, which is to protect and build on. This especially applies because KEYnet is a small company, remote from big and attracting cities, and has to leverage their resources in the most vigorous ways available. Therefore, the communicated excellent working atmosphere cannot be valued enough and should be retained as Keynet's credo.
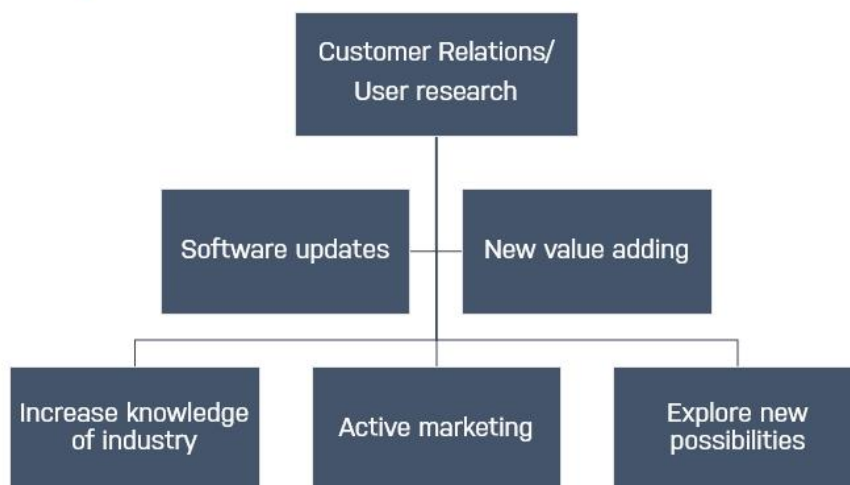

Figure 24 Key activities in relation to the new tool

Figure 25 Keynet's key resource

In order to grow in the market, gain new customers and market shares, as well as develop and drive KEYnet further, the ongoing examination of new possibilities and chances should be facilitated and amplified. This should be done via open-ended collection of knowledge respecting the industry, to understand it in-depth, and from that the exploring of needs, yet undiscovered. This leads to new opportunities, enabling KEYnet to satisfy customers with new value propositions.

7.3 Suggested proceeding – from pilot to market

In this chapter the authors provide a suggested framework to bring the product KEyspect and the data post-processing module to market maturity. The process is split in two parts: 1. The front-end: KEYspect the mobile application (Fig. 27) and 2. The back-end: the module (Fig. 28).

As displayed, the first part follows a triple circular structure, with the first and second circles as pilot 1 and pilot 2, and the third circle as initial roll-out to the market and further proceeding. The three individual circles follow a common collective pattern but differ in the extent and expression of the different dimension. The architecture as a whole follows an incremental and iterative approach, as Tonnquist (2016) suggests, and heavily relies on testers'/users' feedback to be integrated in the ongoing development process. The focus here lies on the inspectors as future users of the app and first customer segment. It is recommended to make use of the close customer relations and jointly cooperate with the stakeholder Gar-Bo. Since they have a motivation, as they were an initially approaching stakeholder, to benefit from a well-performing application, they are willing to take part in the pilot (personal communication, P. Wipp, Nov. 15, 2018). An important factor is the selection of the test persons. The focus groups in the pilots should consist of real inspectors, whose daily labor is inspecting buildings, not former inspectors, managers or others. Also, to get real picture, the group should include different ages, genders and mentalities. These two attributes are crucial to maintain relevance and applicable results.

Defining the procedure in a scrum-like way, the testers' feedback goes directly in the scrum masters' backlog and is to be processed during the following sprint. The resulting updates should be mainly based on the given feedback, to serve the user's needs and create value for them. The circle starts again and again until the desired functionality is reaches. If one circle ends, the next begins. The iterative process, facilitating testing-updating-testing-updating and so on, has the advantage that a constant improvement process is installed, which is based on the actual users' needs and therefore creates true value.

While, as mentioned, the general design is the same or all phases, the size of the user group grows in the process from very few, with very close personal communication between user and developer, over a bigger group with additional remote communication, to the integration of all users, using KEYspect after the roll-out. The update frequency over time is supposed to decrease, but must continuously and regularly be executed, to help the application grow better in an organic way, rather than providing big changes at once, with the danger of alienating customers.
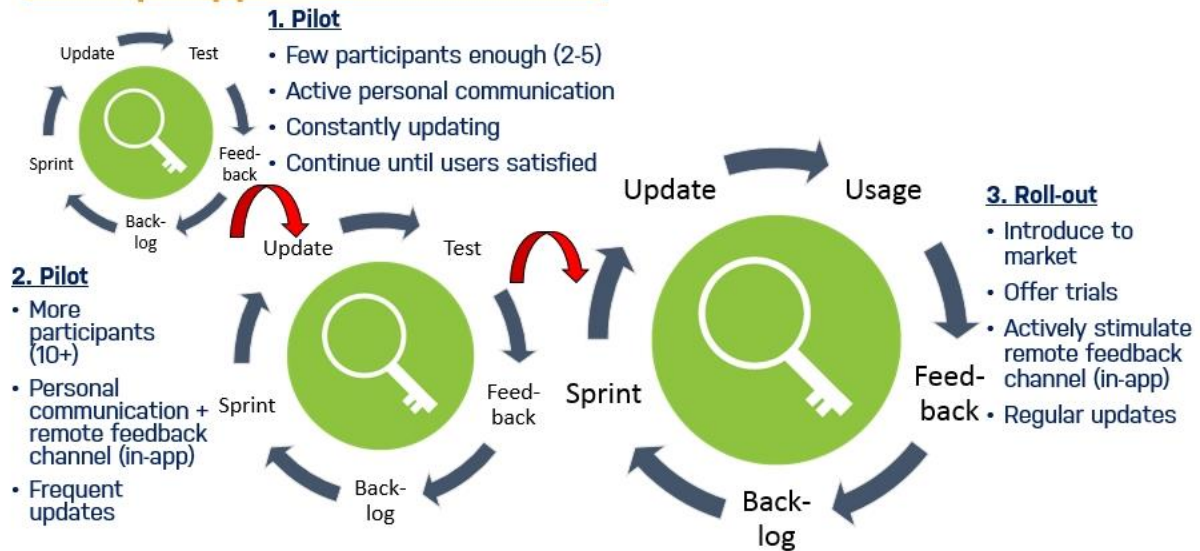
Figure 26 Suggested proceeding – 1.

When it comes to the second step, the back end, respectively the data processing part, the project group advises to evaluate three possibilities, as explained in fig. 27. The different options are evaluated as follows:

Manual categorization: It is advised against this possibility, as there is the danger of over-complicating the application and losing the emphasized usability, and thus the improvement and superiority towards the competing inspection tools. Nevertheless, it could be tested in the first pilot, to verify the strong need for usability on the inspectors' side. Additionally, the rejection of this is thought to be dependent on the number of categories that needs to be chosen and the effort and time this would take.

Tagging-system: This proposal is thought to be a relative easy way to achieve a categorization, while not undermine the usability too much. Through the pre-feeding with desired tags, and suggestions while typing, the inspectors could be guided in the wanted direction. The freedom of choosing whatever tag wanted, could lead to the problem of various differing tags, which are difficult to overview, let alone to categorize.

Machine learning: The full-tech solution, which is viewed as the most promising one. Would demand the most effort in the beginning, with developing the necessary algorithm and teach it the needed features. On the long-run, it offers the greatest value, due to its capacity in processing large amount of data, as well as, and the project group emphasizes on that, the numerous possibilities to use it in other industries and applications. Basically, everywhere where larger amount of data needs categorization or post-processing in general.
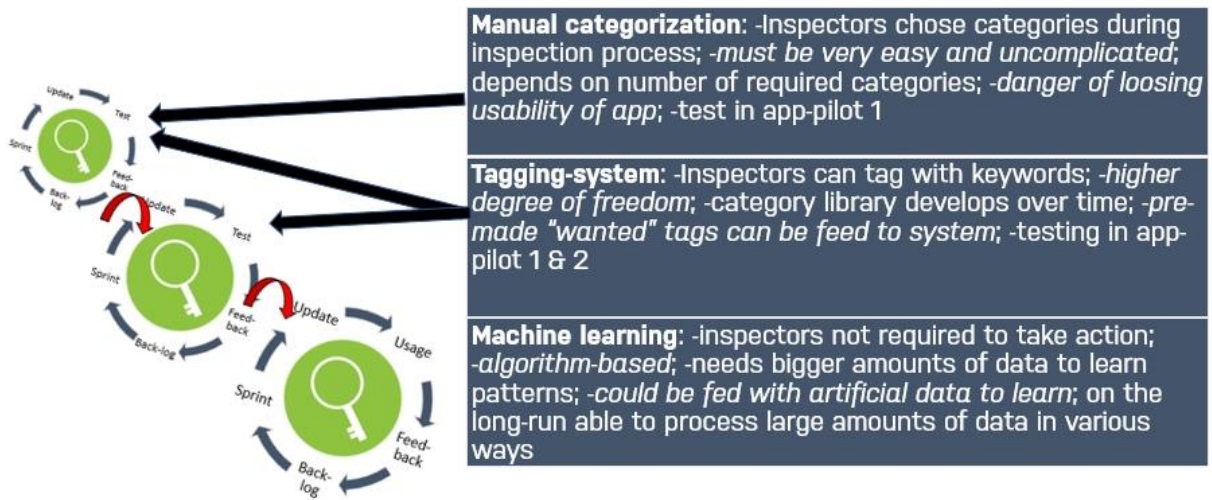
Figure 27 suggested proceeding – 2.

7.4 Further suggestions and possibilities

Abroad markets: While the abroad markets of interest, namely Norway, Denmark, Finland, Germany, Poland, the Netherlands and the Baltic countries, were only investigated with the premise to get an overview and lay the ground for further studies, basic information, concerning market size and a selection of inspection tools, the authors found relevant can be found in the appendix A. What can be said, is that the environment for inspection tools for building inspections is differing from the Swedish situation, at least as far as the authors can tell. As there are almost no full-time inspectors just for building inspections, this industry is not really promising. Although, there are inspections done as well, this is mostly done by authoritative assigned experts, which are only auditing security related issues, e.g. ventilation; or the random sampling of compliance to building permit. The end inspections, in Germany for example, are often done by the home-owners themselves or maybe their architects (personal communication, J. Zimmermann, Nov 28, 2018).
Maybe in this case, there is the possibility to alter the application, to a kind of inspection guideline for home-owners, which are mostly not proficient in this topic.

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Appendix A

Abroad markets

Norway

The project group could not find a digital tool for inspections in Norway. The explanation is believed to be that the inspection industry does not look the same in Norway as in Sweden. According to P. Wipp (Personal communication, Nov 15, 2018), the buyer of a house is doing the inspections himself usually, and only 7 or 8 % of house owners in Norway are using inspection services. The inspection industry in Norway is not of scale and the project group believes that this could be the explanation to the lack of inspection tools in Norway.

Denmark

The construction of residential and non-residential building industry in Denmark have a forecasted turnover of approx. 7.7 billion EUR 2018(Statista, n.d.). And in Denmark, one digital inspection tool exists, is called Ajourinspect and is a product from ajoursystem. An overview of its functions is presented below:

Ajorinspect (https://ajoursystem.com/produkter/ajourinspect/)
- A tool for construction management and technical inspection with follow-up and documentation
- Generate inspection protocols
- Assign tasks to relevant people
- Attach descriptions, photos, comments and GPS coordinates if needed
- Current status and who is to perform the different tasks
- Ajorinspect could be connected to other products from ajoursystem such as Ajurbox, were files and documents can be stored for quick and easy access.

Finland

There are over 15600 companies within the construction of residential or non-residential building industry in Finland, with a forecasted revenue of 15.11 billion EUR in 2018. The revenue will amount to approximately 16 billion EUR by 2022 (Statista, n.d.).

The German market features Europe's biggest industry of construction of residential and non-residential buildings, with a forecasted revenue of 70,12 billion $ (around 640 B SEK) in 2018 (forecast (2022) 72,63 B $) (Statistisches Bundesamt & Statista, n.d.) and almost 15,200 companies active in this industry (Amadeus, 2018c). While the legal requirements for building inspections differ from federal state to federal state, the general modus is the same: 1. the responsible building supervisory authorities perform sample inspections to ensure the strict compliance with the official building permit and the legally responsible chimney sweeper is obligated to certify the correct functional capability of the ventilation system - This results in the final acceptance certificate, which allows the use of the building in the intended means; 2. The mandatory audit of the contractual agreements through the owner (Immobilienscout24, n.d.). And while there is the possibility to book an inspector (e.g. from TÜV) to conduct the audit, it is highly uncommon and usually done by the owner and/or the architect (J. Zimmermann, personal communication, Nov 28, 2018).

In Germany several digital tools/apps in the field of inspections in different forms exist. To give an overview on such tools in the German market[3], this report exemplifies a selection and states the main features.

Firstaudit (https://www.firstaudit.de/en/)
- Stand-alone app
- Back-end/Front-end system
- Operation system: Android, iOS and windows
- Multiple users in different roles/with different rights
- creation of completely new lists
- Linkage to relevant guidelines possible
- alterability of all checklists (Back-end)
- Photo function + individual notes
- Report exportable in different formats
- For a wide range of different industries (incl. construction/building)
- Purchase-License (2 Users) from 2249 €
- Individual development possible (Connection to CRM, ERP, RFID-technology; augmented reality)

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[3] Tools/apps from German speaking countries (Austria, Switzerland) were included

Poland

The revenue of residential and non-residential construction industry in Poland is approximately 12.49 Billion EUR in 2018.

The Netherlands

In the Netherlands, there are about 12800 companies within the construction of residential or non-residential building industry, and the revenue are forecasted to be approx. 27,72 EUR in 2018 (Statista n.d.).

Alphaplan is a construction consulting firm that fulfill more than 10.000 inspections and uses their own digital inspection tool. Some of its offering are presented below:

Alphaplan (https://www.moreapp.com/en/blog/alphaplan-inspection-app/)
- A customized inspection
- Works without WiFi or 3G
- Multiple users possible
- Enter an email address where the data is forwarded directly to
- Works on tablets or smartphone
- The protocols can be signed

Estonia

In Estonia the revenue of the construction of residential and non-residential building industry are forecasted to be approx. 1.6 billion EUR in 2018 (Statista, n.d.). The biggest player is Norde can AS that had revenue of about 137 th EUR in 2017 (Amadeus, 2018).

Latvia

In Latvia almost 3,500 companies are active in the industry of construction of residential and non-residential buildings (Amadeus, 2018). The revenue is forecasted to be 1.1 bilion US dollars in 2018 (Statista, n.d.).

Lithuania

Over 4,400 companies within the construction of residential or non-residential building industry is active in Lithuania. The revenue was approx. 2.2 billion EUR in 2014 (Statista, n.d.). No data after 2014 is presented.