



RESEARCH DOCUMENT

7 March 2013

ASSIGNER |
Bruno Giebels

PROJECT MANAGER |
Loes Bogers

TEAM |
Jelmar van Voorst
Aishwarya Babu
Sabrina Doornekamp
Linda Janssen

ABSTRACT

The ageing and retiring population in the Dutch construction industry is leading to a knowledge gap, which STIHO, a dealer of construction materials and tools wishes to address. Our project is to develop a concept which helps preserve and circulate this knowledge. Our research focusses on the various stakeholders and their roles, understanding how education is imparted in the construction industry and exploring existing digital media solutions.

TABLE OF CONTENTS

1	Introduction	07
2	Method	08
	2.1 Participants	08
	2.2 Design	08
	2.3 Materials	08
	2.4 Procedure	08-09
3	Results	10
	3.1 Understanding the customers' perspective	10-11
	3.2 From the point of view of the dealers, the STIHO employees	11-13
	3.3 The suppliers' role	13-14
	3.4 Current state: Knowledge transfer in the construction industry	14-15
	3.5 Multimedia technologies and knowledge transfer	15-16
4	Discussion	17
5	References	18
6	Appendix	19
	Journey maps	19
	Stakeholder maps	20
	Persona's	21-23

1 INTRODUCTION

Construction is a field that requires a highly technically skilled and experienced workforce in order to deliver quality products. This education is effectively imparted by watching, doing and mentoring (Styhre 99-101; Goulding et al. 103-16).

The use of multimedia to impart construction and manufacturing education is gaining popularity and is manifested in the numerous techniques that have been adopted by companies and professionals (McCullough and Patty, Howard 3-9). Examples are uses of Virtual Reality (Goulding et al.) and game based simulation learning platforms (Goedert et al.). Instructional videos are also used widely, a good example is a company called de Bouwbox who produce instructional videos for the construction industry covering topics of safety, health and environment in order to avoid unnecessary failure costs.

The Dutch construction industry is currently faced with the challenge of preserving and circulating its knowledge and skills. Bruno Giebels, Innovation manager at STIHO indicates that this issue has come to the fore because the specialists in the field are now ageing and as a result retiring. Thus, there is a “knowledge gap” between the new generation and the more experienced personnel in the field.

STIHO, a leading building materials supplier in the Netherlands, plays an important role in the knowledge circulation in this industry. They learn from their suppliers who have information about the products and how to use them. The end-users gain knowledge from STIHO through advice and information regarding tools and materials. STIHO is a source of information for the newer generation when there are few seniors around to teach them on the job. However, STIHO is also affected by the ageing population and wants to retain this knowledge so that it doesn't fade as experienced employees retire. STIHO has approached us with the task of developing a media application concept using digital storytelling to address this concern.

Before we can develop a concept we need to outline the perspectives of the stakeholders, constraints, and all other attributes that will affect the design. In this paper we present our research methods and hypotheses towards designing this system.

Research Questions

What is the role of multimedia and each of the stakeholder in the construction knowledge loop?

- What problems do the clients encounter while working and how or when do they get the information needed to get it solved? What sources/tools do they use?
- How do STIHO employees get the information to help the customers and how do they help the customers? In what ways is information exchanged?
- How do the suppliers convey the information to their different users and what kind of feedback do they get?
- What are the best means of knowledge transfer and more specifically for the construction industry?
- What are the existing multimedia technologies custom-built for the construction and related industries?

2 METHOD

2.1 Participants

The target audience for our research comprises the three groups of stakeholders i.e. the STIHO employees, their customers and the suppliers of the materials. STIHO's customers are construction workers, contractors, freelance construction workers and, to some extent, hobbyists.

2.2 Design

Our concept will be dependent on the needs and desires of the stakeholders involved. Thus, our research strategy was primarily to interview and observe the audience that our design will cater to.

We invited some employees of STIHO to be part of semi-structured interviews wherein they were asked to answer some questions. We conducted contextual interviews i.e. at the STIHO bouwplein (building square). We chose the semi-structured interview method because we wanted a qualitative outcome of the research. Along with specific questions that we wanted answered, we had the opportunity to ask them new questions that came up during the conversations. When the employee said something that was interesting for our research we pursued the subject.

While at the bouwplein we also observed the interactions between customers and employees which would help us develop a stakeholder and touchpoint map. These maps could help us get a better understanding of the interaction between the STIHO employee and a customer.

To get an idea of how the suppliers convey their information to their different users and what kind of feedback they get, we interviewed one of the suppliers, Makita and hoped to be part of a supplier workshop.

In addition to the ground research, we read papers and searched the web for current trends and existing cases where multimedia is used in construction education. We paid attention to articles that discussed education and knowledge management in the construction industry.

2.3 Materials

Articles, papers, surveys and interviews served as inputs for our research. Subsequently, we used a range of service design methods to compile and analyze the data. This includes debriefing, infographics, personas, stakeholder maps, customer journey maps, touchpoint maps and service design maps (we will create those after our interviews with the customers).

2.4 Procedure

Our first step was the definition of the research problem. Meeting with Mr. Bruno Giebels, innovation manager at STIHO, followed by a debriefing, made the problem statement clear. We then developed an infographic based on our assumptions of the stakeholder relationships. The research phase was further divided into two stages, the data gathering and the data analysis.

The data gathering involved desk research in which we read about different topics like education, multimedia, mentoring and peer-learning keeping in mind their relevance to the construction industry. Field research comprised observation of various customers at the STIHO bouwplein and interviews with the various stakeholders.

Our desk research gave us great insights into education in the construction industry and the importance of multimedia in education. We focused on articles and papers that revolved around construction education and use of multimedia in education. We were exposed to the different implementations of multimedia in construction education like instructional videos, interactive mobile and tablet apps, magazine apps, forum apps, blog posts, dictionary apps, calculator apps and hypermedia.

We interviewed five STIHO employees to find out how they receive their education, what their background is, what their average day looks like, how they help the customers, what kind of customer queries they encounter, what kind of problems they encounter and how they solve these problems. These employees have different responsibilities. Few work in the back office and are expected to help customers transfer materials from the shelf to the vehicle and perform

some warehouse tasks, like sawing wood. The front office employees work in the shop where they help customers if they need any help and they work at the payment desk. A third type of employee is the floor manager who manages STIHO bouwplein.

While two of us interviewed the employees, the other two observed and spoke with nine clients at the STIHO bouwplein. We asked customers who were waiting at the service desk to fill out a survey focusing on trying to gauge the extent to which technology is used by them. We asked them whether they use smart phones, tablets, the internet or phone apps and if and how they share knowledge with others.

An interview with one of the many suppliers of STIHO, Makita, was also arranged where we got an idea of how they currently convey knowledge about their products and what service they offer to STIHO and its customers.

In the analysis phase, we developed personas for the stakeholders, customer journey maps, stakeholder and touchpoint maps, and service maps based on the data we gathered. And formed some areas and themes for further discussion.

3 RESULTS

After compiling and analyzing the data that we gathered, we tried to answer our research questions. We found that our research not only answered these questions but also gave us important insights into aspects that we may consider while developing our concept.

3.1 Understanding the customers' perspective

What problems do the customers encounter while working and how or when do they get the information needed to get it solved? What sources/ tools do they use?

We spoke to and observed some of the customers who visited the STIHO bouwplein. We asked them what their work background was, how they keep themselves up to date, if they have questions and doubts, whether they use the internet or any other digital means to obtain information and we tried to understand their relationships with STIHO.

It was interesting to notice that when we asked some employees at the STIHO establishment at Haarlem some questions about transferring knowledge and receiving questions they replied that having the knowledge was part of the job. They obtained knowledge by reading what kind of information the package material of a product contained. When asked about how they obtain knowledge the customers too replied that it was part of the job to have certain knowledge. For them it is a very natural process and they didn't seem to be aware of the process they had undergone to obtain this knowledge (interv. ref). The STIHO employees shared the conviction that the customers who worked in construction should have some basic knowledge about construction and that they only helped them if they needed some information about a new tool or technology (Interview, 7th of March 2013).

Survey Outcomes

All respondents visit STIHO bouwplein more than once a week to get supplies. Some of them go there to order materials or for help. This statistic and our observation allowed us to conclude that the customers share an amiable relationship with the employees. This fortifies

a fact we learnt as part of our desk research which emphasises the importance of such relationships.

When we asked them how they stay informed about new techniques and materials they said they spoke with colleagues, used the internet, took help from STIHO, workshops, fairs and from the suppliers. Six out of the eight respondents mentioned they use a smartphone and/or tablet. They use it to get more information about specific products or materials and email. They all (want to) share their knowledge and would like to do this face-to-face, again reiterating the necessity of personalized communication.

Our interview results regarding the use of technology were in tandem with statistics we found in the Communicatie Monitor 2011 of a company, BouwKennis. The paper contains information to understand what kind of media and other sources construction workers use.

We plotted the results in graphs which give us an idea of the distribution of the resources being used by construction workers and contractors.

CONTRACTORS

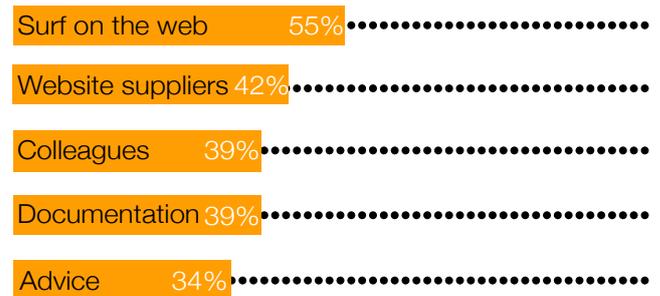


Figure 1. Top 5 resources used by contractors

CONSTRUCTION WORKERS

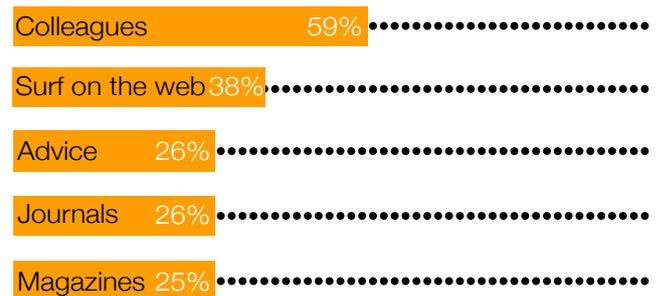


Figure 2. Top 5 resources used by construction workers

We created a journey map depicting the workday routine of a contractor based on our conversation with one (see appendix).

3.2 From the point of view of the dealers, the STIHO employees

How do STIHO employees get the information to help the customers and how do they help the customers? In what ways is information exchanged?

We interviewed about 5 employees. We asked them where they obtain their knowledge from and found while some have had a technical education, others have predominantly learned on the job. This indicates that there are differing levels of technical expertise among the employees. Although the employees are knowledgeable, their backgrounds may or may not be sufficient. Our design must ensure that the employees attain the necessary knowledge and/or add to their existing expertise.

We learned that the customer feedback is extremely valuable to the employees. They share their experiences with the use of a particular product and this enriches the knowledge base at STIHO.

“We say, ‘just try it!’ And they trust the brand they use. We say, “I will give you a proof sample, just try it and let me know. You won’t lose anything”. Sometimes, I don’t know about a product, I give it to a customer in exchange for that he will give me the explanation. I learn from that.”

(STIHO floor manager, about product sample)

Sometimes, when the customers need information, they contact STIHO who help them and in case of doubt reverts to them after consulting an expert or supplier. Such tailor-made responses and immediate attention are definitely well received. Also, trying to get the customers’ feedback about the product and trying to find out what kind of experiences they had builds the trust of the customer and also enhances the knowledge of the STIHO employees.

Interviewer: “Do you hear lots of customer stories? Feedback? Like how his work went?”

Respondent: “From the clients case itself? Yeah that’s the after-service you’re supposed to do. Like now, I’m working on a big delivery for tomorrow and it’s supposed to be delivered on different levels. And you’re a regular customer,

if he walks in, you ask him how it went or I give him a call and ask how it went. Like when it is a bit challenging like tomorrow then I’m curious how it works. I just call him and ask how it went, and if everything was fine.”

(STIHO Floor Manager, Interview, 28 February 2013)

Storytelling as a vehicle for knowledge transfer

From the talks with Bruno, and the conversations with employees and customers, we have found that people working in construction industry don’t like to be educated in a way that reminds them of school. Moreover, according to STIHO employees the construction workers are not always transparent about their degree of expertise. They feel independent and can be hesitant to show that they need help. This requires a delicate balance in tone of conversation that the STIHO employees understand well. If the end users get involved in a story or conversation about tools and their uses it will be easier to transfer information between these two stakeholders.

Two opposite views were gathered from the conversations with the employees and customers.

Customers on the kind of questions they ask STIHO employees:

Interviewer: “If you come here, at STIHO bouwplein, do you expect that they give you information if needed? Do you ask them certain questions?”

Respondent: “Sometimes we talk about things that has to do with construction, but I actually never really ask them questions.”

(Customer, Interview, 26 February 2013)

Interviewer: Do you also ask questions about the usage of techniques, or only about products?

Respondent: “No, actually not. I ask questions about material and product but not how to work with tools.

(Customer, Interview, 26 February 2013)

Employees on the kinds of questions they get from customers:

Interviewer: “If you are helping customers, what kind of questions do they have?”

Respondent: "That can be technical questions, specific questions about different techniques. How should I do this, or what do I need to do this. Technical questions about 'how to do things' and innovation in new products."

(STIHO Employee, Interview, 28 February 2013)

Interviewer: "Are there customers that come to you with specific questions?"

Respondent: "Yes, it happens. Customers that come in and tell something about the project they are working on. I'm busy making an attic, what kind of isolation do I need, what are the prescriptions?"

(STIHO Employee, Interview, 28 February 2013)

Knowledge transfer takes place as a casual exchange of experiences more than in a formal "I will teach you how to..." setting. In an informal exchange, the end users (or customers) are more comfortable to actively take part and speak freely. They will be more likely to ask for a solution when they encounter a problem. Storytelling can be seen as a very important vehicle for knowledge transfer in this setting. Learning is done in the form of exchange of experiences, telling a peer a story about your workday. Hence, storytelling is a way to get information from one person to the other in a way that doesn't make them feel like they're being taught (Kamara et al., 2002). The employees at STIHO recognize this very well and know how to find the right tone of voice in order to achieve this (STIHO Employee, Interview, 28 February 2013).

While asking the employees about the kind of questions they got, we find out that they are seeing a change in the customer type. There are more DIYers who have not had professional education and may not be as technically savvy as a construction worker. They have a lot of questions because of which the employees spend a lot of time on them and aren't left with enough time to spend on their regular customers, the professionals (contractors, freelancers and construction workers).

Employees on the different customers and the time they spend on them:

Interviewer: "What kind of customers asking those kind of questions? Are these people the contractors or more like hobbyists?"

Respondent: "Well, looking at the kind of questions we can see who are the 'bunglers'. I spend a lot of time with that, but the contractor that's in the back of the line and spend 2000 euro's everyday, yeah I mean why should I let him wait? He's having my priority. He knows what he needs"

(STIHO Employee, Interview, 28 February 2013)

Interviewer: "Do you see difference between customers?"

Respondent: "Contractors never know what they want, only the plasterers know what they need and want"

(STIHO Employee, Interview, 28 February 2013)

Interviewer: "Do you notice that there are less professionals and more DIYers?"

Respondent: "Yes, there are more DIYers that are not from this market, especially at this time when contractors are too expensive to hire"
(STIHO Employee, Interview, 28 February 2013)

It was interesting to note that one employee (STIHO Employee, Interview, 28 February 2013) started off working for the section that deals with wood and eventually switched to hardware and tools. This displays the versatility of the employees to learn about the various sections under the umbrella of STIHO, thus rendering our concept an asset to the company.

Workshops

We asked STIHO if they could arrange for us to attend a workshop. Unfortunately, this was not possible. Interestingly, we later found out, while interviewing the employees, that they do not have as many workshops as we first thought they did. So, the workshops that were supposed to be conducted, were not available and/ or scheduled. We hope to learn why in our subsequent meetings which might give us an added outlook or aspect to take into consideration when working on our concept.

Interviewer: "Do you have workshops at STIHO bouwplein?"

Respondent: "They say we do, but we actually never see it happen."

(STIHO Employee, Interview, 28 February 2013)

When talking to Bruno we found out that the reasons

for fewer workshops than two years ago are time and number of people. Two years ago STIHO had more employees and this meant more time for workshops and trainings but now the employees of STIHO are often too busy with the customers that come to STIHO and other proceedings.

Uses of technology

We discovered two opinions towards the use of technology by the employees. Some of the employees rely on the internet for their knowledge and when they wish to get questions answered, but there were a few who currently do not. This is an indication of the conservative nature of the construction industry. A digital media design will definitely bring about a renewal in the traditional structure. However, we must also keep in mind the ease of use to take into consideration the spectrum of technical adeptness and willingness to use these tools in the workplace.

“Because I’m not that skilled with a PC I say, I want to do this but for now just working with wood, maybe in a later stage I will have to learn it. I don’t work with a smartphone either.”

(STIHO Employee, Interview, 28 February 2013)

“If STIHO purchases company smart phones, I would use them yes, in the shape of a tablet. I use my own smart phone for work purposes. I make notes or search information for the customer.”

(STIHO Employee, Interview, 28 February 2013)

“No, just the PC, I’m a real fan of Google. No, the tablets will never show up here, I think there is no money for that. Or they really have to show off. But I don’t think so, if a tablet falls it immediately breaks.”

(STIHO Employee, Interview, 28 February 2013)

The journey map (see appendix) depicting the workday routine of two STIHO employees based on our interviews with them.

3.3 The suppliers’ role

How do the suppliers convey the information to their different users and what kind of feedback to they get?

We had an interview with Andries, account manager from Makita which enlightened us about the role of

a supplier in the whole knowledge loop between customers, supplier and STIHO, the dealer. Makita is a supplier of products at construction site. They deliver a very personal and trusted service for the dealer. They convey information through different touchpoints not only focussing on the dealer but also on the the end-user (customer of the dealer). These touchpoints can be separated into two groups. Physical touchpoints and digital touchpoints.

Digital touchpoints

On the Makita website customers can contact Ike, the trainer, to ask questions. These questions are mainly about product information and how to use these products. A second digital touchpoint is the Makita YouTube channel on which they offer a large amount of videos which provide product information and give work instructions. Also Makita uses monthly mailings in which they provide new products in their assortment.

Physical touchpoints

Makita has five people all over the country who have direct contact with end-users. Two of these persons are in contact with the larger construction companies. This contact is mainly focussed on efficiency and money matters. The other three people drive around in a mobile showroom which offers 100 - 150 products. It is possible that STIHO is unable to answer a question of a customer. In this situation STIHO will contact the supplier. The supplier, in this case, Makita, can choose to send a mobile showroom directly to the customer. A very important aspect of Makita is that they offer a large amount of trainings and educations. They have their own intern education centre in which they provide educations at four different levels:

1. Wood
2. Metal
3. Drilling and breaking
4. Gardening tools

These trainings are offered to dealers to get knowledge of new technologies and materials and learn how to use them. It is possible for a dealer to bring customers with them. These trainings can be customized. It is possible to deliver a training for 30 - 40 people but also smaller trainings on the shop floor level.

Besides these touchpoints Makita also delivers

brochures on construction sites which are sent by post and can be put on coffee tables and can be read during lunch or when having a break.

It was very evident that Makita is very keen on getting information to dealers (STIHO) and even to the end users (clients from STIHO). At the headquarters of Makita information about these different tools can be obtained through accessing different workshops or training programs offered by Makita.

“It happens that a company like STIHO comes over with their own employees but also with end-users to follow a training. The fun thing about that is you can really see the bonding between the dealer, in this case STIHO, the end-user, and of course us, Makita, the supplier. The triangle, if I may call it, is very close to each other”

(Makita account manager, Interview, 5 March 2013)

Although this one interview has given us a clear idea of the role of suppliers in the knowledge loop we would like to speak with another company so that we can get another point of view. We could know of other problems that a supplier might encounter. There may be other methods adopted for conveying information to the dealers and end users. The suppliers might use other touchpoints when getting in touch with the dealers and end users.

3.4 Current state: Knowledge transfer in the construction industry

What are the best means of knowledge transfer and more specifically for the construction industry?

Primarily, we tried to understand the perspective of the learner/ user. We wanted to understand what are the best methods of imparting education and how to sustain the interest of the learners and ensuring that they gain maximum benefit. We learned that, in the construction industry, the two most effective methods of learning are firstly, experience-sharing, which is a part of mentoring and peer-peer relationships, and secondly, practice (Hoffmeister, 676).

Mentoring is an important and very commonly stated effective method of knowledge transfer in the construction industry. A mentor, who is defined based on certain characteristics, is considered to be

a knowledge transmitter or as a person who can learn the art of craftsmanship (673). It is important to see and understand the role of the mentors while thinking of a new or different way of transferring knowledge. The effectiveness of mentoring cannot be ignored when conceptualizing as it is an indispensable part of knowledge transfer. Peer to peer relationships also play a significant role in one's learning. The exchange of experiences happen at an informal level with no inhibitions. In a group of peers there would be ideas and stories being discussed to a great extent. All this happens in a day to day setting where stories thus function as learning material. Considering this there needs to be a notion of time within a practical framework that functions as education tool (Styhre, 63). We now know that the mentor-mentee and peer-peer interactions are essential aspects and we must ensure the manifestation of these relationships in our concept.

The second effective method of learning was 'practice'. This indicates that people who learn will benefit the most when they are taught in a practical manner. The requirement of practical implementations highlights the possibility of the use of simulations, 3D modeling, and other such concepts. When using a digital construction scenario there is scope to make mistakes and learn from these mistakes without any adversities (Goulding, 104). Again, the emphasis lies on interaction and interactivity. Getting the construction workers involved in the act of teaching by handing them the tools and let them make mistakes will let them be an active part of the learning without losing focus. Such methods help to maintain the interest of the users. To summarize this point in a quote:

“Interest of the user is maintained throughout since they are forced to make choices and are provided with feedback as to decisions made ensuring misconceptions and user problems are answered immediately”

(Shelbourn, Aouad and Hoxley, 93)

Our research and discussion with Bruno Giebels, highlighted the possibility of experts/ specialists being reluctant to share their knowledge and skills. This directed us to think of incentives for them and we started to explore the subject of gamification. Gamification is a technique that has been adopted by number of companies to keep users continually

interested. The idea is to incorporate game elements like points, progress bars, badges, etc. and game design in a particular strategy. It has proven very effective as seen on numerous websites like stackoverflow.com, studentoffortune.com, linkedin.com, foursquare.com, etc. This is a concept which could be given a thorough thought.

3.5 Multimedia technologies and knowledge transfer

What are the existing multimedia technologies custom-built for the construction and related industries?

First of all there are the traditional brochures and manuals that manufacturers supply regularly. While these prove advantageous in that they are regularly updated, contain accurate information and can be trusted since they are delivered by the manufacturers themselves, they possess their share of drawbacks. The end users as we have concluded, prefer to learn by seeing and doing, thus reading pages of information may prove boring. Also, from our interviews we inferred that personalized attention is often preferred. Relying on printed media leave less room for immediate feedback from the customers.

We discovered various apps and websites that are specially designed for the construction industry which gave us an idea of what the current trends are and the extent to which digital media is being utilized in this industry.

Instructional videos

Bouwbox.nl and *constuctioninstruction.com* are some websites that provide online tutorials and instructional videos useful for people in the construction industry. The use of the internet is definitely a step forward for this industry which until recently focussed on conservative methods of knowledge management because they are visual. These websites are comprehensive and can be accessible to an audience that may be distributed over the globe. Despite these benefits, this medium does not encourage sufficient interactivity, personal interaction and live feedback. These videos are produced by professionals which makes them costly to make. Crowdsourcing the production of these could be an option but it is unsure how one could guarantee quality that way.

Supplier apps Weber and Cadenas

We found a number of interactive mobile and tablet apps like those of *Weber* and *CADENAS PARTsolutions* (*Weber* - iPhone app, Mobile Apps for Industrial Manufacturers; Youtube) which stores product details, data sheets, videos, contact details, etc. These apps give the user a comprehensive description of the product. The *Weber* iPhone App, for example, has a section called 'Problem Solutions' which has a list of common problems faced by applicators and selecting the problem provides a detailed solution. There is also a 'case study' section which gives details of the most recent projects. Almost every detail regarding the product is available. Interactivity is also incorporated wherein the user can play around with the color swatches and even email a desired pattern to a contractor. The drawback in such an app is that personal attention and feedback are missing.

Dictionary apps

Dictionary apps providing a quick reference to terms that are related to the particular industry. Such applications are time efficient and are convenient to use. These provide succinct descriptions but may not be useful for someone who needs information on how to use the product or any other details.

Forum apps

There are forum apps in which different users can discuss problems that they encounter and share their experiences. This is interesting and important given that experience-sharing and mentoring are integral to knowledge transfer in the construction industry. The information being circulated on such forums would be personalized. There would be discussions of problems that common people encounter and solutions given by experts or others who faced such problems before.

Magazine apps

We also discovered magazine apps which can keep the users updated on the various happenings in the industry. Such apps may be interesting and will keep the users informed. People might use these apps in their leisure time. These are interesting as well as informative.

Solutions not related to the construction industry

The concept of crowdsourcing is a very strong one which hasn't been widely used for the construction

industry. Crowdsourcing as seen in *Wikipedia* and on the *Instructables* channel exemplify the benefits that many people can add information, encouraging experience sharing and also distributes the workload of archiving information across a large number of people. A difficulty is that this solution requires a large number of people to participate and it's hard to tell if there's an audience for it. There's the issue of how quality of the materials can be maintained or controlled. We tried the *Instructables* channel and asked a question, after 20 minutes we got already two answers to the question already. Maybe if the user need an answer on demand it may not be useful when at the workplace.

Farnell is a leading global, service-and customer-oriented distributor of electronic, electrical, industrial and MRO Products (Maintenance, Repair & Operations). Their online support is inspiring. They provide technical documents and videos. They advertise direct access to engineers directly via 24 hour Live chat, email and phone and also to the industry manufacturers and legislative experts in their community. Although *Farnell* is not a player in the construction industry, their service incorporates interesting concepts to keep in mind.

Folksonomy or collaborative tagging is yet another interesting concept which is popular and could be one to consider in our concept. In this method the content is usually tagged with certain terms. This may help users when they search for information. How and whether such a concept can be incorporated is something we need to discuss and investigate.

All these applications address different aspects of education all of which are necessary. This encourages us to think in a direction which may incorporate one or more of these ideas.

By exploring the existing digital media, we have gathered some concepts which may be useful to think about during the concept phase. These include personal relationships(e.g. live chats), practical learning(simulations, virtual reality), interactivity, crowdsourcing, collaborative tagging, knowledge and experience sharing (in forums and some social media methods).

4 DISCUSSION

There are numerous insights we derived from our in depth research. Our field research was on most accounts in tandem with our desk research which has bolstered number of aspects that we must keep in mind during our next phase conceptualization.

Firstly, we should pay utmost attention to the presence of inter-personal relationships, experience sharing and human-human interaction. The importance of mentor-mentee and peer-peer relationships were encountered in our desk research as well as during our interviews.

The user's feedback is something that is very valuable and is integral to the feedback loop. Their experiences also contribute greatly to the knowledge pool. We must leave room for the possibility of including user feedback.

We have to consider the reasons why there are few or no workshops anymore i.e. the lack of time and people. We have to take a look at how we can tackle this problem.

Interactivity is another important aspect. A concept that incorporates interactivity may help maintain the user's interest. We know that people in the construction industry learn by practice and our concept might be inspired by the ideas of multimedia such as simulations, virtual reality, etc which involve more hands-on user participation.

As our assigner wishes and given that majority of our target audience use technology such as the internet via smart phones, tablets, PCs etc., we have the freedom to explore digital media to a great extent while conceptualizing. Our research showed that construction workers use technologies such as tablets, smart phones and/or computers with internet connection but it would be useful to know more about how and where they are used on the construction site. There's suggestions that the devices may get dirty, damaged or stolen. Moreover, since we have realized that not every user currently relies on digital technology for their information we must further investigate the statistics and accordingly define the ease of use.

We must take into account the different kinds of

customers that come to STIHO. The current trend shifting towards DIYers may give a certain direction to our thought process when developing a concept and we hope to discuss this further with the assigner.

Before we develop our concept we must understand how our purpose will benefit our various stakeholders People who will be contributing to the content/information base will be willing to share their experiences and knowledge only if they too are gaining something out of it. This aspect is something we may have to ponder and work on, one stakeholder at a time. For example experts and specialist may be threatened to give away their knowledge risking the reduction of people depending on them.

Limitations of the research

Although we have gone through a number of weeks of research, we may need to discuss the numerous concepts that new media offers us. Until now our focus has been the stakeholders and understanding their roles. We have spoken with a number of stakeholders, but the results would have been stronger with a higher quantity of respondents so we will continue the dialogue in order to obtain more information along the way. We now need to describe the benefits and find incentives for each stakeholder to want to be part of this project. Additionally we need to pay attention to the digital media aspect and reflect on the various concepts that it offers.

In summary, we have an overview on the stakeholder relationships and knowledge transfer in the construction industry. We are aware of some aspects of these relationships that we need to focus on and incorporate while developing a concept. Our ideas and insights have given us a direction for the next phase, conceptualization.

5 REFERENCES

- Goedert, James, et al. A Framework for Virtual Interactive Construction Education(VICE Automation in Construction 20.1, 2011: 76-87. Print.
- Goulding, Nadim, et al. Construction Industry Offsite Production: A Virtual Reality Interactive Training Environment Prototype. Advanced Engineering Informatics 26.1 (2012): 103-116.
- Howard, R. Using multimedia to link expert's views and derive common conclusions Automation in Construction 6, 1997: 3-9.
- Kamara, J. M., et al. "Knowledge Management in the Architecture, Engineering and Construction Industry." Construction Innovation (Sage Publications, Ltd.) 2.1 (2002): 53-67. Print.
- Mark Shelbourn, Ghassan Aouad, and Mike Hoxley. Multimedia in construction education: new dimensions. Automation in construction 10, 2001. 265-274
- McCullouch, B., R. Patty. An INDOT lessons learned constructability program and integrated multimedia system. JHRP. 1993.
- Styhre, Alexander. "Peer Learning in Construction Work: Virtuality and Time in Workplace Learning." Journal of Workplace Learning 18.2 : 93-105. Print.

Websites

- Cognitive Design Solutions. "Interactive design" . Web. 5 Mar 2013
<<http://www.cognitivedesignsolutions.com/Instruction/InteractiveDesign.htm>>
- Construction Instruction. Videos. 5 Mar 2013 <<http://www.constructioninstruction.com/>>
- Construction Glossary 1.1. 27 Feb 2013
<<http://appfinder.lissoft.com/app/construction-glossary.html>>
- De Bouwbox. Toolbox films voor de bouw. 5 Mar 2013 <<http://www.bouwbox.nl/>>
- International Construction - The magazine for the global construction industry 4.2.7. 27 Feb 2013 <<http://appfinder.lissoft.com/app/international-construction.html>>
- Mobile Apps for Industrial Manufacturers - iPad and Android [Video]. (2012). Retrieved 26 Feb 2013, from <http://www.youtube.com/watch?v=DwZi3dH_FnQ>
- Multimedia Focused Industrial Maintenance & Operator Training [Video]. (2009). Retrieved 26 Feb 2013, from <<http://www.youtube.com/watch?v=CUsPy3eEDQY>>
- Weber - iPhone app [Video]. (2012). Retrieved 26 Feb 2013, from <http://www.youtube.com/watch?v=Oa9georzL_w>

APPENDIX 1 JOURNEY MAPS

WAREHOUSE EMPLOYEE WORK DAY



SERVICE EMPLOYEE WORK DAY



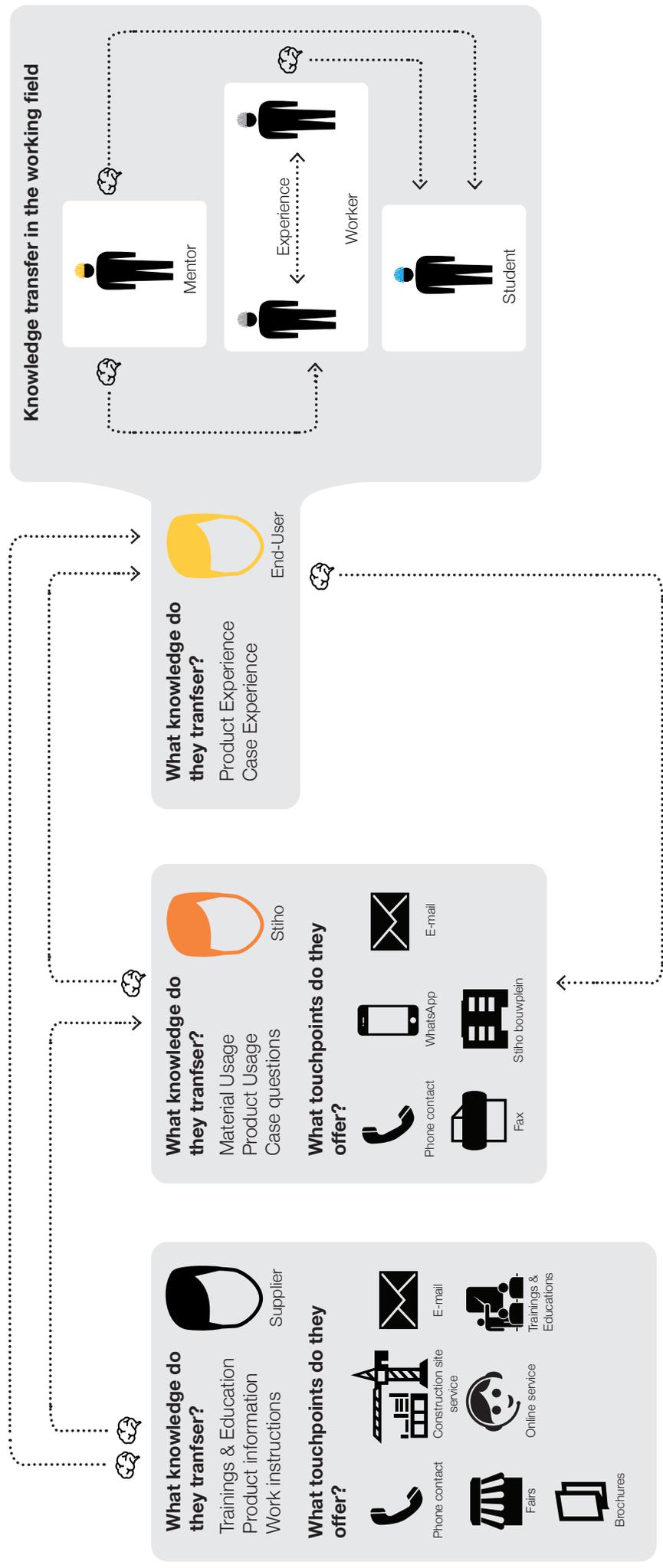
CONTRACTOR WORK DAY



APPENDIX 2 STAKEHOLDER & TOUCHPOINT MAP

We created a stakeholder & touchpoint map showing the knowledge loop within the construction work field. It shows what kind of knowledge is being transferred among the three stakeholders, how they offer their knowledge and who uses the knowledge. The right hand side section shows that within our end-user group there is a second level of knowledge transfer. This was based on product and case experience.

The goal of this map is to get a clear view on how the process works and helps us understand where our concept can add extra value to the existing loop.



BART VAN DEN AKKER



36 years old
Lives in Amsterdam
Warehouse employee
Floor manager

QUOTES

"Most of the time it's just googling. It's amazing what you can find. For example, on Youtube, there's constructing walls and all sorts of stuff. You can just watch them do it. It's so good, real production videos."

"We say, 'Just try it!', and they do. They trust the brand they use. We give them a proof sample and ask them to try it and give us feedback. If I don't know much about the product, I get valuable feedback from the customer from which I learn."

"We're only allowed to talk about what's on the bag description, but with our own experience we can give the customer tips and advice."

"We have a lot of face to face contact, but there are a lot of phone calls and e-mails as well."



QUICK BACKGROUND STORY

Bart is a hard working guy who likes to work with and for people. He studied at a technical school, and finished it when he was 19. As a technical engineer he worked alone, which he didn't like. He applied to STIHO when there was a vacancy. He started off as a warehouse employee and learned from the best. He has been the floor and communications manager since the last 6 years. Even at home, he likes to do things by himself. He made the bedrooms of his two young daughters.

When not working Bart likes to hang out with his family and friends. He plays football and tennis with his friends from high-school. Bart is into new technologies and gadgets and envisions a bright future.

SERVICE EMPLOYEE WORK DAY



WHAT DOES HE DO?

TALK WITH CLIENTS

HELP CUSTOMERS

CALL SUPPLIERS

ADMINISTRATION

TALK WITH EMPLOYEES

GOALS

Experience goals

Help the customers and employees and make them feel important and understood.

End goals

STIHO needs to be a nice place to visit and to work.

Life goals

Have a lot of fun/ be happy in everything he does, be helpful when needed and mainly live a good life.

PATRICK DE JAGER



31 years old
Lives in Amsterdam
Warehouse employee
Wood specialist

QUOTES

"It has to be a party around here."

"The work at STIHO is much bla bla. It's a lot of customer maintenance. Having a chat at the coffeemachine. I know on what cases they are working on, but also how many children they have, and in what age category their in, or what motorcycle they ride."

"I started with school, learning from the books. After my 18th birthday I got my carpenter certificate and worked in construction for two years, they taught me the whole thing. They said: forget what you learned in books, we don't do it that way anymore."

"Because I'm not that skilled with a PC I said: I want to do this but for now on just working with wood, maybe in a later stage I will have to learn it. I don't work with a smartphone either."



QUICK BACKGROUND STORY

Patrick can be briefly described as practical, diligent and curious. When he was 18, he finished his carpentry school and started working for a contractor. This lasted two years. After that Patrick started working for STIHO. He works as a warehouse employee, five days a week. His speciality is wood.

Apart from his day time job, Patrick loves to be outside. He loves riding his motorcycle when the weather is good. You can also find him on terraces in the city. Patrick has a girlfriend for about two years now.

WAREHOUSE EMPLOYEE WORK DAY



WHAT DOES HE DO?

CUSTOMER ASSISTING

LOADING WOOD

WOOD SAWING

INVENTORY CHECK

CUSTOMER CHAT

GOALS

Experience goals

Make sure the customer is at ease when he or she is walking in the store.

End goals

Get more knowledge on how to work with the computer.

Life goals

Seek for new adventures and keep your eyes open for new things.

MAURICE STEENHOEVEN



36 years old
Lives in Utrecht
Account Manager
at Makita

QUOTES

"It has to be a party around here."

"The work at STIHO is much bla bla. It's a lot of customer maintenance. Having a chat at the coffeemachine. I know on what cases they are working on, but also how many children they have, and in what age category their in, or what motorcycle they ride."

"I started with school, learning from the books. After my 18th birthday I got my carpenter certificate and worked in construction for two years, they taught me the whole thing. They said: forget what you learned in books, we don't do it that way anymore."

"Because I'm not that skilled with a PC I said: I want to do this but for now on just working with wood, maybe in a later stage I will have to learn it. I don't work with a smartphone either."



QUICK BACKGROUND STORY

Maurice works for Makita since he was 23 years old. He has experience as a sale representative in his past career and is now an account manager. Maurice is a easy going guy which has strong skills in telling stories to others and transferring knowledge in a very praticle and approachable way.

Maurice lives in Utrecht with his wife and two kids. He drives all over the country to visit different dealers and sometimes even construction sites to sell his product and convince the customer of Makita's expertise within the construction field, and eventually with his end goal to sell more products and get more customers.

ACCOUNT MANAGER WORKING DAY



WHAT DOES HE DO?

PRODUCT PROMOTION

PHONE CALLS WITH DEALER

END-USER VISITS

CHAT WITH DEALER

GOALS

Experience goals

Deliver a very trusted and personal service for the customer.

End goals

Try to convince more and more customers of Makita's expertise.

Life goals

Get the most out of your family and love them.

