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Modernizing the Supply Chain: Focus on the Organic Food Order Process

Sandro von Brandenburg

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Abstract

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Author
Sandro von Brandenburg

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Tuomo Ryynänen

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Organic agriculture has been gradually growing in popularity for decades. Sustainable farming has become more efficient through a multitude of innovations in environmentally healthy fertilizers and cultivation techniques. However, it seems like IT solutions are not as widely adopted to organic farming as to non-organic commercial agriculture. This work is part of a group effort to research the need for a replacement for the current ordering process carried out by organic producers and restaurants in Finland. The research focuses on the hypothesis that an online business to business (B2B) web service could augment or even replace the current ordering process through sustainable solutions. Special attention is paid to the current state of the organics ordering process, both from the perspective of the restaurants and also the producers. Currently orders are mostly carried out by telephone to meet the ingredient requirements of restaurant menus. The work analyses alternative and modernized electronic B2B methods of fulfilling current organics order process requirements. Furthermore, this study aims to highlight the potential value adding features that such a service could offer. The main methods used to carry out the study are: supporting the hypothesis with a project members survey results, analysing existing literature and interviews to understand the market sector, visualizing this derived information by modelling the core processes and actors with various techniques and finally translating them to requirements and potential value adding features for a B2B service. In addition, this study briefly covers the authors experiences with the chosen modelling software. The research has some influences from the Rational Unified Process (RUP) inception and elaboration phases. The current and proposed ordering process flows are broken down to tasks and decision points with a model first, describe after approach. The results of the research are discussed and analysed so that a developer can use them in a technical system implementation. The conclusion emphasizes on the value of the most significant results, limitations and suggestions for further research and personal ambitions related to the topic. The results indicate various friction points in the current, more traditional order process and that a modernized organic food process could be implemented through a web service to facilitate business operations.

Keywords
Organic food, order process, business to business, web service, sustainability

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1 Introduction

Communication and information technologies are developed fiercely to support the needs of the endlessly evolving industries. Sometimes traditional niche market sectors are left in the wake of the booming business. One such traditional form of commerce is that of organic food industry. Very far from common consumer food industry in terms of volume and environmental impact, but not so different in other aspects. What would happen if the organic food industry had modern communication and information technologies to support its evolving needs?

This research work and thesis as such is part of a development project that aims to create a business to business web service to connect restaurants and organic producers. The project team consists of three members: Tommi Järvinen, Ekaterina Shalkovskaya and the author of this study, Sandro von Brandenburg. This work makes use of Ekaterina Shalkovskaya's thesis: Collaboration between Finnish restaurants and organic food producers -questionnaire results to support the hypothesis that a business to business (B2B) web service is needed for the restaurant-organic producer order process. Furthermore, this thesis identifies requirements that Tommi Järvinen makes use of in his thesis: Technical implementation and deployment of a web application connecting restaurants and organics producers using Ruby on Rails, Angular.js and Chef. All thesis are evaluated separately.

This work begins by offering a brief background on the current situation of organics use in restaurants in Finland. The research looks in the nature of the supply chain with its challenges and innovations. General aspects of electronic commerce and the order process as well as more specific solutions from the organic food industry in Finland are covered. The formation of partnerships and product availability in the market sector is also studied in this thesis. The focus of the study is in modelling the current order process of organic food and its modernized version. The elements of both the current and proposed order processes are described in more detail and value adding functionality is discussed.

1.1 Research Problem

Use of organic raw materials in the Finnish catering industry in not uncommon and has grown in the last decade. Restaurants make orders from organic producers mainly by telephone and email, a process that can account for a few to tens of weekly hours spent (Vitikka 2014). This thesis work focuses on the restaurant - organic producer order process in its current form, and researches the possibility of an improved web service

based alternative. The organic food supply chain, specifically its order process, has to be modernized to satisfy supply and demand. What is the current status of the organics order process between restaurants and organic producers in Finland? How can modern web technologies be applied to facilitate the order process? What is the value added of a modernized process? This study looks into the afore mentioned questions by collecting information on the current situation in the organic food market sector and tries to fill the current research gap on the topic, specifically that of the current state of the order process.

1.2 Objectives and deliverables

In summary, the main objective of this thesis is to identify the requirements and value adding features for a B2B web service designed to facilitate organics orders between restaurants and producers in Finland. The objectives of this research can be divided into two parts. The first part aims to identify which are the elements that are required to successfully carry out the organic food process. The second parts objective is the translation of the current requirements into a web service, and covering the new requirements that such a service has. Value adding features are also studied in the second part. Logistics solutions are an important element in the supply chain, but are not included in this study other than in the description of the supply chain as a whole.

The main user roles in the organics order process are: restaurant chefs or employees in charge of procuring the organic products required in the menus, organic producers and finally the consumers that complete the supply chain.

More tangible deliverables of this research are process flowcharts and a use case model that are also described throughfully in text form. Intagible deliverables are the collected insight of the interviewed professionals on the topic of organic food orders and the indication of a need for the development of the processes. The results of this research can be useful for anyone interested in knowing more about the current state of the organic food supply chain and its requirements. In addition, the results can be possibly used as a direction pointer to those interested in modernizing processes such as food orders.

2 Research background

In order to answer the research question and map out the requirements of a modernized order process a brief background study was made. Here the current state of organic food production and the supply chain related to the restaurant industry is covered.

2.1 Organic food production in Finland

Organic production in Finland covers a significant portion in the food industry sector. According to Evira (2015), the Finnish Food Safety Authority, 9% of all cultivated farmland is organic, with over 4,300 organic producers.

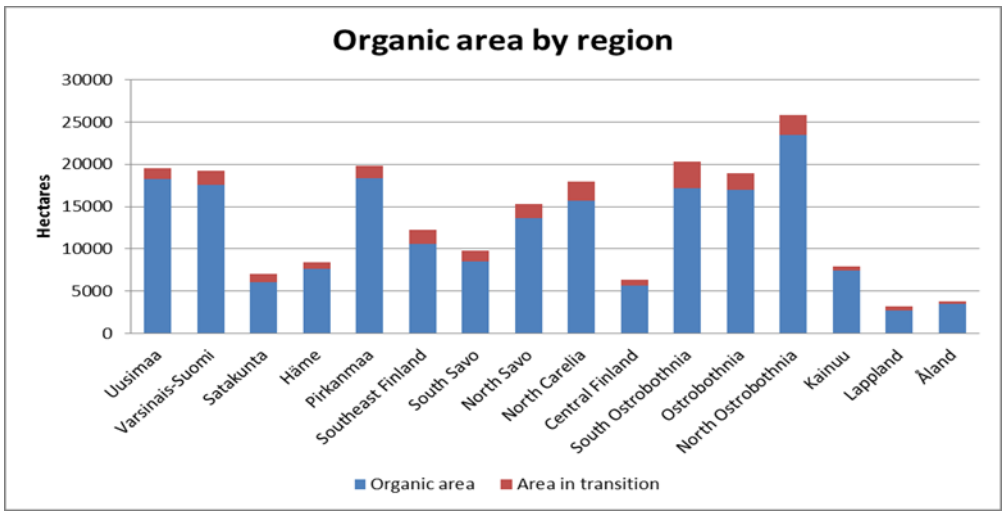

Figure 1. Amount of organic hectares by region 1.9.2014 (Evira 2014 & Shalkovskaya 2015, 11).

Figure 1 represents more precisely the size of organic production area by regions. The largest organic areas are North Ostrobothnia, Pirkanmaa, Uusimaa and Varsinais-Suomi. The red colour in the graph shows the area in transition. We can see that many of the regions have relatively large areas in transition to oganic production.

A Finnish organic producer must comply with the EU requirements if they want to label their products as organic with the green leaf certificate. To hold certification, the production environment must pass an annual inspection, which ensures that the farm is promoting environmental sustainability and that the consumer can trust its quality. (European Commission 2014a.) “Organic farming relies on a number of objectives and principles, as well as common practices designed to minimize the human impact on the environment, while ensuring the agricultural system operates as naturally as possible” (European Commission 2014b).

Consumers can purchase organic products from retailers such as Ruohonjuuri (2015) or as ingredients in their dish at a restaurant that purchases all or some of its raw materials from organic wholesale retailers or directly from the producers themselves.

The presence of organic raw materials in Finnish restaurant cuisine is common. Usually, the restaurant's master chef is in charge of ordering the organic raw materials required in the menu from the producers. Organic food producers and their farms are widely distributed around Finland and restaurants generally prefer to order from those closest to their premises, with some exceptions such as reindeer meat, which only comes from Lapland. Organic food served in restaurants is gaining popularity. Restaurant customers want to be served with the best ingredients that their money can buy and organic food ensures that it does not contain any harmful substances introduced during its growth cycle.

Substituting fertilizers with environmentally sustainable substances is something that we should all be happy about, but it is also very challenging. If chemical fertilizers did not offer a competitive advantage over natural alternatives in terms of crop yield, they would not exist. The fact that organic farming has smaller yields that its counterpart means that organic products have to be priced higher, which in turn makes it less appealing to the consumer (Jahanban & Davari 2013, 552).

2.2 Supply chain

Producers are spread all around Finland. The responsibility over how raw materials are transported and transformed before they reach the consumer is also distributed. This means that organic producers produce raw materials and can choose the most suitable method of transportation at a set time, sometimes sharing that logistics link with other producers to one or many restaurants.

Often producers gather multiple orders before they transport the products to their destinations. An example is the reindeer meat from Lapland. The meat is commonly used in restaurants all over Finland, but it is produced only in the Northern part of the country. Thus, the road logistics can extend a long way in many cases, especially when the meat has to reach the capital metropolitan area.

Producers, or in essence, the suppliers can choose multiple forms of transport. A simple, but resource demanding solution is to provide the logistics in-house.

This ensures that the product delivery is carried out exactly as the producer wants to. According to Minna Ahlberg (2014) a problem from the producers point of view is that, unless they are registered as a logistics company, they cannot, transport other producers products. From a producer profit and environmental sustainability point of view this is not good. Producers that are not registered as a logistics company are not allowed to transport the products of other producers. This reduces partnerships, but on the other hand encourages the producers to use existing logistics companies such as the state owned Posti, the Finnish post service. Other domestic logistics companies of varying sizes are also used.

The most important transportation criteria is hygiene and the correct temperature during the voyage. Evira and the Finnish Transport and Logistics publish their guide on foods' transport and storage that can be used as a reference to ensure the correct hygiene and temperature for a given product. A general introduction to storage and transportation best practices and a link to the guide can be found on the Evira website (2010).
A constant correct temperature is important and if not taken care of, the product can go bad. A good example would be the transportation of the reindeer meat from Northern Finland to restaurants in Helsinki. Posti has created a solution to maintain an adequate temperature during the transportation stage of the supply chain.
Posti's thermal storage boxes provide the right transport temperature for sensitive products like reindeer meat. The product is usually transported straight to the recipient restaurant. In some cases restaurant employees can pick up the product from an agreed location. (Posti 2014.) Restaurant Nokka and Posti's have created a promotion video for the new thermal storage boxes solution. The video can be found on Youtube (Posti 2013).

2.3 E-commerce and the order process

The basic definition of electronic commerce (e-commerce) is the process of shopping over the internet. Supply meets demand through a network and digital medium (Graham 2008). "Business-to-business (B2B) describes commerce transactions between businesses, such as between a manufacturer and a wholesaler, or between a wholesaler and a retailer. Contrasting terms are business-to-consumer (B2C) and business-to-government (B2G)".(Ganaga durga devi & Raja 2013, 107). Consumer-to-consumer (C2C) e-commerce is also very popular for example on platform such as Ebay.com and Tori.fi in Finland.

Entreprice resource planning (ERP) software packages often include an e-commerce module that has B2B capabilities built within it. However, individual restaurants and

organic producers would rarely need to procure and set up a complete, or even tailored ERP solution as they tend to be too large and expensive and require a trained user to interact with them constantly. Usually restaurants use ERP system that have a strong Point of Sale (PoS) integration, but do not include modules connecting the company to producers. Restaurant Foods product purchases are carried out by diverse methods, and the billing and logistics costs are entered into an accounting ERP module.

Globally the most widely known e-commerce platforms are the ones that focus on B2C. Probably the most famous e-commerce platform is Ebay. In addition to B2C, Ebay also offers C2C sales. Web solutions that cover e-commerce between businesses are more suited for organic producers and restaurants. Currently there are some web services in order to fulfill food orders in Finland. These services are either fully directed at serving the needs of the catering industry, consumers or a mix of both. Some services offer food of all backgrounds, whereas others focus solely on organic products.

Founded in 1899 Heinon Tukku Oy is one of the largest wholesale services used by the catering industry in Finland. Heinon Tukku offers all food, drink and even office equipment. The wholesale company does also offer organic products in its range. In 2013 the companys turnover was around 225 million euros employing 450. (Heinon Tukku Oy 2015.) Heinon Tukku uses SAP as its entreprice resource management system.
The company offers web services to its customers through a SAP module.
(Solteq 2014.)

Lähi- ja Luomuruokahakemisto is a website (www.lahijaluomuruoka.fi), which purpose is to develop the sales of local and organic food in Finland. The website servers both producers and consumers. The producers can promote and get more visibility for their products. (Lähi- ja luomuruoka 2015.) The consumer is able to search through for foods processors, fishers, bakers, farms, shops, pickers of food such as berries or mushrooms and restaurants. The location of each company is also presented on a customized Google maps application programming interface (API).

Aitojamakuja.fi is a website that offers and extensive catalog of local and organic food producers from all over Finland and is primarly directed towards the consumer. In addition the website is a hub for information related to local and organic food and related news.
The website is in Finnish, but also translated to Swedish, English and Russian.
The website has information and references to Finnish food tourism. (Aitoja makuja 2015.)

MakuMaku.fi was founded in 2010 and is a webshop offering local and organic food and delivery services to coordinated pickup points or directly to a customer address in the Helsinki city region. One of the goals of MakuMaku.fi is to expand its delivery services to all over Finland. Both Aalto University and Haaga-Helia University of Applied Sciences students have helped in the creation of the webshop. (Makumaku.)

The main building of the Svarfvars (2015a) farm in Karjaa is over 150 years old. Svarfvars focuses on the organic farming of vegetables. The Svarfsvars website is a wholesale hub of biodynamic and organic products. Sales are directed to the Finnish catering industry. Restaurant Nokka has been a partner of Svarfsvar for some time. Food delivery to consumers in the capital region and Western Uusimaa region (Svarfvars 2015b).

The author studied the afore mentioned websites and found that they all keep a catalogue of products, organic producers or both. Some sell these products while others just list them and offer producer contact details. The author's knowledge on the various web sites is limited in the sense that the author did not have authorization to use the corresponding systems fully and to study all the functionality offered. However, none of the websites offer true interactive B2B functionality designed exclusively for companies involved in the organic food market sector to facilitate the order process.

2.4 Partnerships and product availability

The current restaurant-organic producer order process is mostly carried out through telephone conversations between a restaurant employee and an organic farm owner or employee. Restaurants are also able to order some products through a wholesaler such as Heinon Tukku (2015), but in these cases identity of the producer could be unknown.

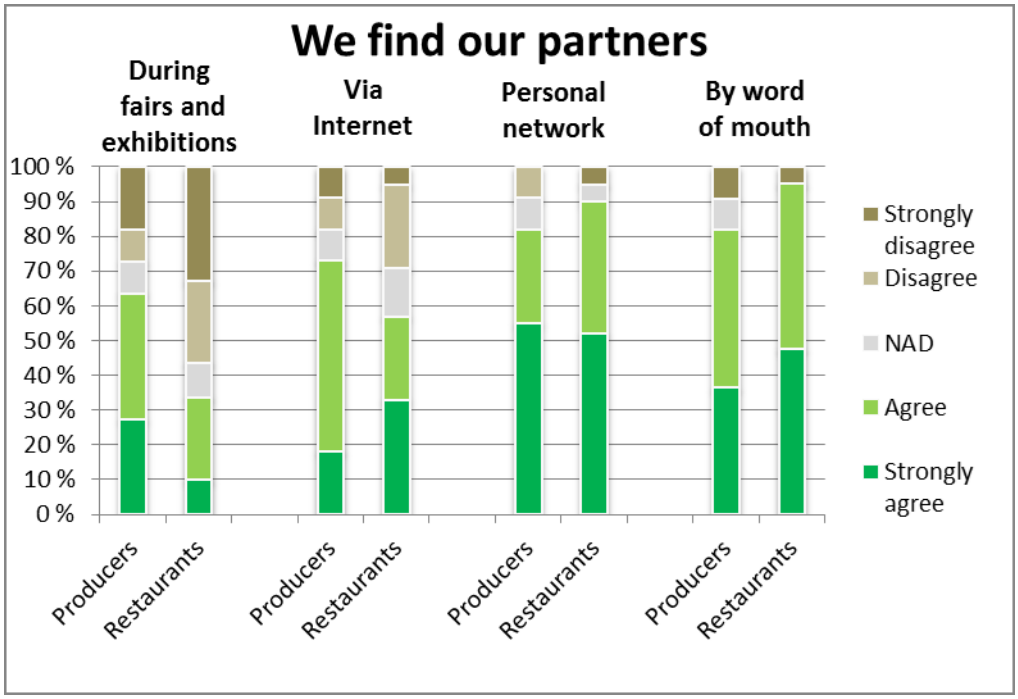

Figure 3. We find our partners to sell organics to/to buy organics from (Shalkovskaya 2015, 30).

Figure 3 indicates how much producers and restaurants use different channels for finding each other. For example many of both producers and restarants agree that they find their partners by word of mouth. Not as many feel that they find partners during fairs and exhibitions. There are various methods for how restaurants and organic producers find each other, but by far the most common way is through personal networks and word of mouth. Restaurant chefs and producers exchange each others contact details from one to another often in a casual friendly conversation.

Most of the time the restaurant contacts the producer and queries about the availableness of a product. If the product is ready to be ordered a deal is made. Often however, the product is not available at the time of the query. Availability of products such as reindeer meat, mushrooms or rhubarb are strictly seasonal. In fact, the availability of most products are seasonal. Naturally, restaurant chefs are aware of when certain products become available throughout the year. It is also important that the producer informs when their products can be ordered and then it is the responsibility of the restaurant to keep track of these times, in case the producer does not contact them (Rantanen 2015).

3 Research method

The material provided in this thesis consists of literature research, results from Shalkovskaya's survey and multiple interviews mostly with organic producers and restaurant employees. Literature and data are very important in order to understand the nature of the industry, processes involved and trends.

Interviews on the other hand provide fundamental understanding of the best practices and friction points within the organic food supply chain today. The survey data, literature and interview answers often support each other and only together do they provide a complete picture of the organics order process. Different modelling approaches commonly used in the information technology field were used to map out both general and complex process semantics.

The requirement analysis and modelling approach is loosely inherited from the inception and elaboration phases of the Rational Unified Process (RUP). The author is familiar with the Rational Unified Process from his studies and finds it to be a useful framework in software analysis and design and information technology projects in general. Instead of creating a large amount of paper documentation, the Rational Unified Process activities promote the creation and maintenance of models to describe the system under development (Rational 2001). The author agrees that models are often more valuable than text based documentation and if correctly created and maintained they enhance productivity in system development projects.

Two main modelling methods were used: UML use case diagrams and business process modelling and notation. “The unified modelling language (UML) takes an object-oriented approach to the modelling of applications, while the Business Process Modelling Notation (BPMN) takes a process-oriented approach to modelling of systems” (Object Management Group Business Process Model and Notation).

Use case diagrams are very often used in the inception phase of the Rational Unified Process to complement a business case. According to Cockburn (2011) the use case concept was created in the late 1960s by an Ericsson telephony employee named Ivar Jacobson. Use case diagrams were quickly adopted by the object oriented community after the method was introduced to it in the late 1980s.

“A use case captures a contract between the stakeholders of a system about its behaviour. The use case describes the system's behaviour under various conditions as the system responds to a request from one of the stakeholders, called the primary actor.” (Cockburn 2011.)

When we want to model and see associations between actors and use cases, we can create a use case diagram (Bittner & Spence 2003). The author saw that it was fundamental to visualize the organic order process by modelling it as well. The objective was to present to the reader two core process flows in the most informative way possible following the model oriented method from the Resource Unified Process. The author was familiar with the Business Process Modelling Notation and decided to use it to describe both the current organics order process and also a modernized alternative.

“The Business Process Modelling Notation (BPMN) is a graphical notation that depicts the steps in a business process. BPMN depicts the end to end flow of a business process. The notation has been specifically designed to coordinate the sequence of processes and the messages that flow between different process participants in a related set of activities.” (Bizagi 2015.)

Finally, all the generated models can be broken down to individual requirements. In fact, modelling aids a software developer to segment often very complex processes and relationships in order to analyse system requirements thoroughly and comprehensibly so that others understand what is described and repetition is avoided. “Requirements analysis in systems engineering and software engineering, encompasses those tasks that go into determining the needs or conditions to meet for a new or altered product, taking account of the possibly conflicting requirements of the various stakeholders, analysing, documenting, validating and managing software or system requirements” (Kotonya & Sommerville 1998).

All modelling was done with the yEd graph editor, a free application for all major platforms (yWorks 2015a). The author chose yEd because of the explicit availability of UML and BPMN tool-chains in the free software. The application value was measured in terms of ease of use, reliability and most importantly productivity compared to Microsoft Visio an Office suite application that the author is very familiar with. The unofficial and subjective conclusion was that version 3.14 of Yed was a generally a good modelling tool and the fact that it is free to use and runs on all major platforms really gives it a competitive advantage. Unfortunately, one malfunction often hindered productivity. Sometimes the

graphical relation line used to connect two tasks or gateways did not work while BPMN modelling. The solution was to select the relation line icon to activate and deactivate it multiple times and then try again to add it between two processes. Nevertheless, the author can recommend this application for anyone interested in UML or BPMN modelling and the functionality to export models in pdf or multiple image formats truly adds value. Hopefully the only malfunction found by the author is fixed soon. The release yEd release notes (yWorks 2015b) indicate that software is developed actively and multiple bug-fixes are released annually.

4 Current order process

The focus of this thesis was in the organic food orders process between farmers of organic food and restaurants. The author was interested in what is the current status of the organics order process in Finland and what are the requirements for its modernization. To understand the current ordering process the author interviewed farmers of organic food and restaurant professionals. In addition, one local food shop owner who also sells organic products was interviewed.

In October 2014 the author and two project team members had the opportunity to interview Terhi Vitikka, the restaurant manager of Ravintola Nokka. The general aspects of organic food orders to Ravintola Nokka and the viability of a modernized B2B web-service were discussed. Vitikka's insight in the business helped to picture the producer - restaurant relationship and she also saw a need for improvement in the current ordering process and potential in the B2B web-service proposed by the project team. According to Vitikka, most producer partners are found through word of mouth and order fulfilment reliability can be a challenge when unexpected mishaps occur in the supply chain. Vitikka also pointed the research team towards a partner producer of Ravintala Nokka called Ahbergin puutarha (Ahlberg & Ahlberg 2014).

In Novermber 2014, the author and another project team member interviewed Minna Tengvall and Kaijus Ahlberg, the owners of Ahlbergin puutarha, a company that specializes in the organic farming of herbs and vegetables (Ahlberg & Ahlberg 2014). In February 2015 the author interviewed Sami Rantanen (2015) at that moment the kitchen shift manager of the Nokka restaurant.

Two BPMN diagrams were made based on the information gathered from the various interviews that were carried out during the research. The complete diagrams can be found as attachments in the appendices of this study. The reader should study the complete diagrams before reading about the detailed description for each task and decision point described below.

The process model aims to depict the activities and decision points between restaurants and producers from the cumulative findings from the various interview carried out during the research. The model shows a simplified version of reality. For instance, other actors such as wholesale or other retailers are not present in the cross-functional flowchart nor is

any system or specific communication method. In practice, the process flow of the producer could, to some extent, represent that of any actor participating in retail or wholesale. And these afore mentioned, but not depicted actors could also follow many of the activities represented in the restaurant process flow.

4.1 Process flow

From the restaurants point of view the order process starts with the need for a new product. The chefs of the restaurant draft a menu and then try to procure the raw materials needed to prepare the dishes and to keep the current stock up to date.

When ordering a new product, the restaurant employee in charge of the process first starts by finding a producer. The person in charge of the ordering process often knows from who to order the products. However, many times and before a supply chain partnership can be formed both parties need to find each other. The restaurant has various ways of finding producers. Some methods like working through another retail actor and a website are fast, products are catalogued and ordering can be carried out through a website, but this is still rare. Most of the time, the restaurant has to find the producer by searching for the needed product on the internet, asking help from colleagues from other restaurants and going to expos and events. This searching process can take a long time, thus becoming a problem. The problem is that the restaurant cannot focus on their core business process, that of serving prepared food to customers and drives them to seek easier non-organic sources of raw materials.

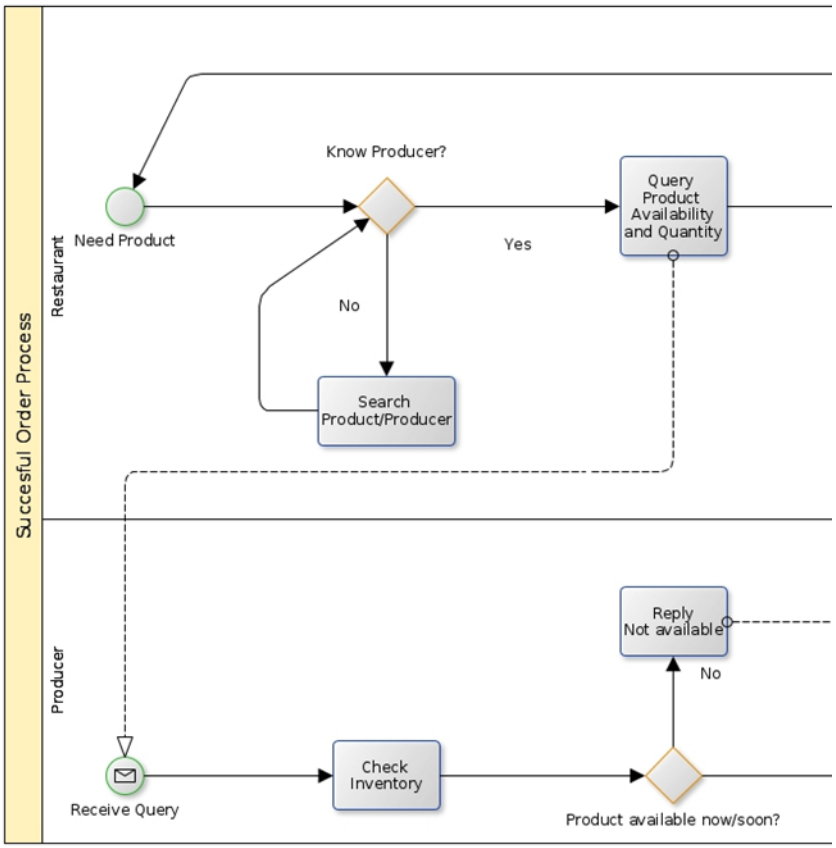

Figure 4. Initiation of the current order process

If a restaurant knows or has identified a potential producer for a product, they have to query about it. The contact between actors is mostly carried out by telephone and sometimes email. Product availability and desired quantity are queried. The method of contacting the producer can be critically important. Emails can clarify what is needed and what is available, but on the other hand the back and forth communication is much slower than with a telephone.

The producer receives an inquiry about the desired product and decides if the product is available or not. Producers are usually well aware of their stock with the help of an inventory management system, be it human memory based, paper format or software. The producer lets the restaurant employee know about the availability of the product. This decision point either means that the common order process continues or ends for the two actors involved.

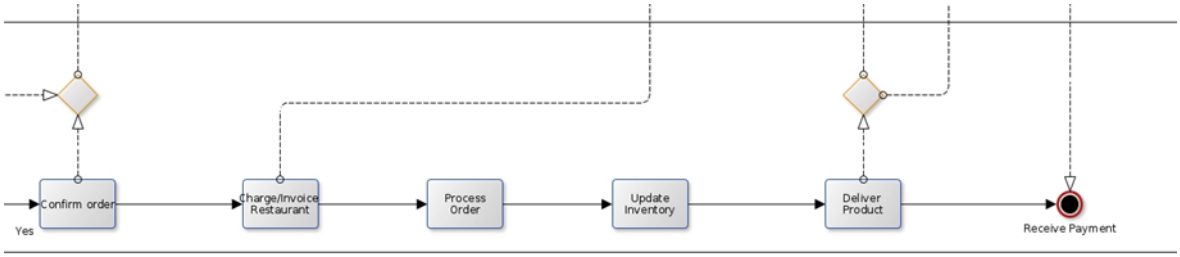

Figure 5. Current order process organic producer tasks

If the product is available and the producer confirms the order, multiple processes are initiated. The producer sends and invoice to the restaurant, either electronically or by post and begins to process the order.

Processing the order includes all the handling a product needs for it to be delivered. This could mean harvesting plants, butchering livestock, packaging and all other routine procedures. An important task that the producer should go through is updating their inventory to keep track of their stock and ensure well organized business operation. If all order processing is done and logistics conditions such as profitable delivery quantities are met, the product can be delivered to the restaurant. The process flow ends for the producer when they have received payment for the order.

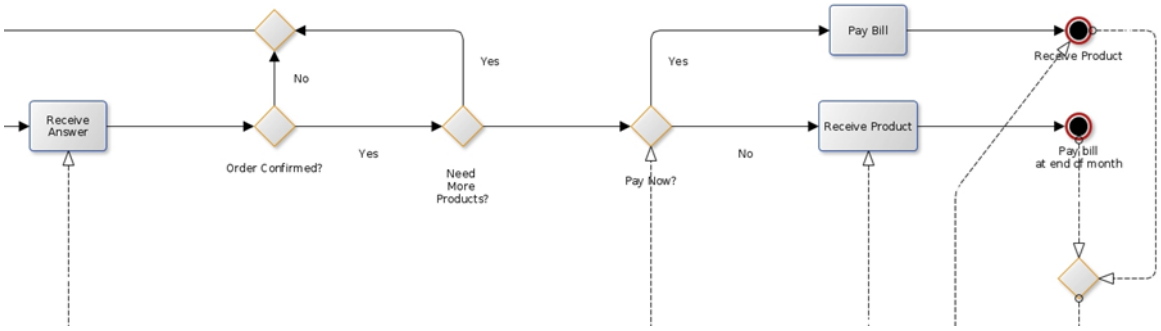

Figure 6. Current order process restaurant tasks

After receiving notice of a confirmed order the restaurant can try to order other products from the producer or find a new producer to query for other products or more of the previous one if more than what was deliverable is required. When there is no need for other products at the moment, the restaurant can choose to pay the producers immediately after they receive the invoice. The most common method is to pay all bills to all producers at the end of the month even if the product has already arrived before that date. Logistics related costs are also paid out at the end of the month. Some producers receive payment in cash upon delivery. Regardless of the form of payment, accounting and taxes have to be entered to appropriate systems manually.

The restaurant process flow ends either in the payment of a product that has been delivered already or when a product is received and has been paid for beforehand.

4.2 Current challenges

There are multiple challenges in the current order process between organic producers and restaurants. The main issue in the market sector is visibility. The businesses willing to benefit from each other by producing or processing organic raw materials have difficulties in finding each other. Poor visibility is mainly caused by the lack of internet presence from producers and the fact that consumer demand is not driving the modernization of the supply chain and potential systems related to it. Forming new partnerships is not possible when a potential partner exists, but cannot be found.

A big issue is order reliability. If an order process instance is interrupted, the restaurant suffers immediately, unless they can substitute the order rapidly with exactly the same product that their menu requires. An example of an interrupted order was when the Alhopakka duck farmhouse was burned due to a thunderstorm in 2014. As a result restaurant Nokka could get any more duck to fulfil its menu and a substitute producer was difficult to find quickly. (Rantala 2015.) Regardless of the reasons behind a hiccup in the supply chain, altering the order process, especially on short notice is difficult.

Almost all processes in the current order process are manually executed, they are not organized on a general inter-operational scale in terms of inventory management, communication, logistics and credit transfer. The order process often demands an inadequately large amount of time (Vitikka 2014).

The organic food supply chain requires modernization, possibly in the form of a web service so that it can be easily accessed from almost anywhere, any device and at any time while allowing the actors to focus on the core business processes of their field.

5 Modernized order process

The requirements of the current order process are analysed so that they can be met in a new system. The most important thing about any software system replacing a traditional model is that it not only introduces improvements and new features, but that it can fulfil the requirements of the existing method.

The first and foremost feature that an organic food B2B web service has to have is the possibility for users and companies to register onto the system. Once users are registered, they should be able to register their companies. The company identification number could be automatically verified by the system upon registration with an application programming interface (API) such as the one recently introduced by the Finnish patent and registration office (PRH 2015).

The B2B web service has to be able to ensure real-time communication. Personal messaging can be integrated into an online system, but telephone conversations cannot always be replaced and should be treated as a backup option. However, order and product details should always be stored in the system. The user should be able to order products without having to call or send emails. The system has to include the information of all companies so that they can find each other. A company profile, that can be updated by the user is a valid solution that reduces the amount of updating and maintenance required by the system owner. A profile can provide details on the company, products and services they might offer. The profiles should be stored in the system so that they can be searched for.

The producer adds products to their profile inventory. The restaurant has to be able to select products, order and pay for them. The system will automatically update the public profile product stock and the status of the order for those involved.

5.1 Use cases

A use case diagram represents different actors and their relationships to functionality. The central 'bubbles' in model represent use cases involving the system's actors. These tasks form the basis for drafting system requirements. A software developer makes use of the generated requirements by fulfilling them in the technical implementation phase of system project. Tommi Järvinen, the project team member in charge of the technical implementation of the B2B web-service, used the requirements that are identified in this study.

As mentioned earlier, the Rational Unified Process encourages the use of modelling and the author agrees with this approach. The author has good experiences and results from the method of first creating a use case diagram and then breaking each use case into its requirements. However, a use case diagram by definition does not solely represent requirements of a system. This distinction is important for the reader to bear in mind.

> "In our experience, we have found that a fully specified set of use cases for a system often does a great job of stating many of the requirements for that system. But just as often there are also a significant number of requirements that do not fit well within this modelling technique. Especially for non-functional requirements (e.g., specifications for usability, reliability, performance, maintainability, supportability), it is usually best to use the good-ol' tried-and-true traditional method for stating requirements." (Probasco & Leffingwell, 1.)

In this study the author describes all depicted use cases and highlights requirements in a liberal format and does not comply with any official templates for writing system requirements. CRUD is an acronym for create, read, update and delete. PM translates to personal message.

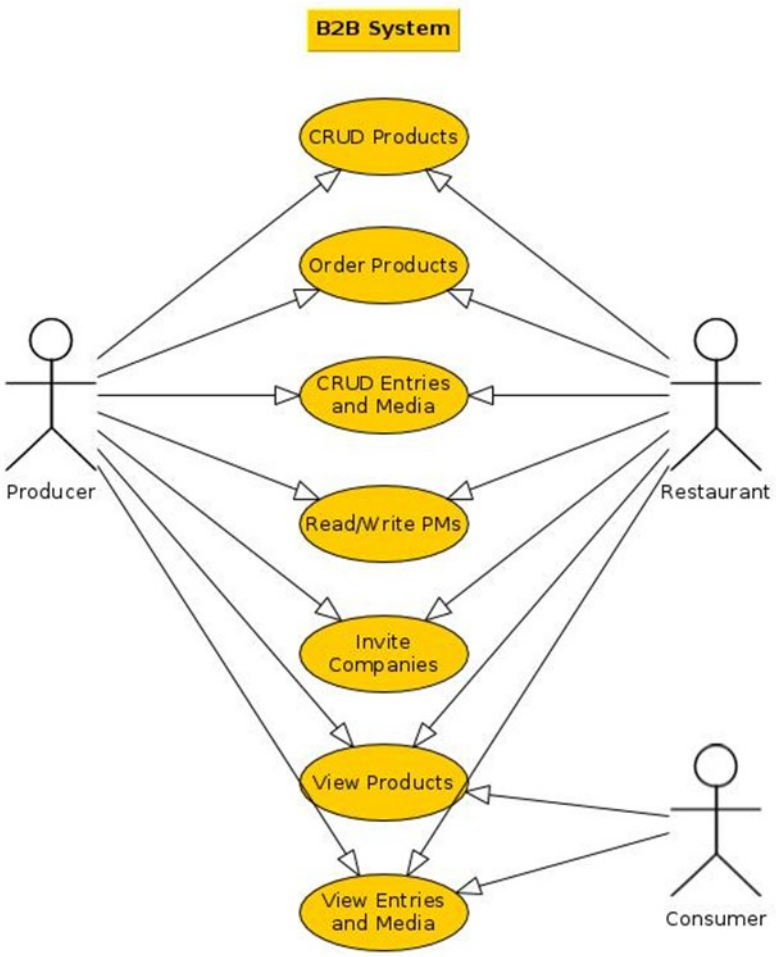

Figure 7. Use case model

Figure 7 is a use case model designed for a potential B2B web service to cover the organic food order process. The model can be divided into seven general use cases. Three actors, the producer, restaurant and consumer are presented. The presence of the consumer is not required for the successful execution of an order between the producer and restaurant.

The producer has to be able to create, read, update and delete their own profiles products. To make the web service more generic, the restaurant also has the possibility of adding, updating and deleting products to their profile, for instance if in addition to their food serving, they are also selling their own or their partners organic products. Naturally the restaurant can also see the products offered by other companies. The actors should be able to attach a corresponding image to each product on their inventory.

Both the producer and restaurant should be able to order products through the system. Again, from a system design point of view, it is easier to implement a generic model where

the restaurant and also the producer can order. This way the producer can also work as a retailer, perhaps selling the products of his or her neighbours.

The restaurant and producer actors can create, read and delete text entries and media content on profiles. Media and entries enable the profiles to be unique identity and can help to tell the story of a company.

In order to facilitate the order process between producers and restaurants, both actors need to be able to communicate with each other. Therefore, a personal messaging layer is needed on the system. The personal messaging system is used mainly to agree on logistics and payment, unless and online payment module is implemented.

The company actors should be able and encouraged to invite other companies to use the platform. A company that invites a new one onto the B2B web service should be rewarded. The web service needs many active companies, in this case to have more product availability in a wider geographical area.

All actors should be able to search for producer and products. Search should work so that if an actor knows the company they are looking for, that company can be found fast. Furthermore, if the company has a product in mind, all the companies listing that product in their inventory should be found. Advanced search criteria such as location, method of delivery and price should also be available.

The main users: restaurants and producers, should be able to view the media and entries of other registered users. The consumer should also be introduced to the system by allowing them to also view the entries and media of registered users. Limited visibility for the unregistered consumer is fundamental. Both the system owners and the registered users can benefit from the presence of the consumer in terms of advertising.

5.2 Process flow

The reader should study attachment number one before reading on. The attachment depicts the whole modernized process, what is described hereafter are more detailed descriptions of the model. The figure shows a proposed order process. The actors in the cross-functional process flows are the restaurant and producer. All the tasks and decision points occur on the B2B Web Service. The process starts with the need to procure a product.

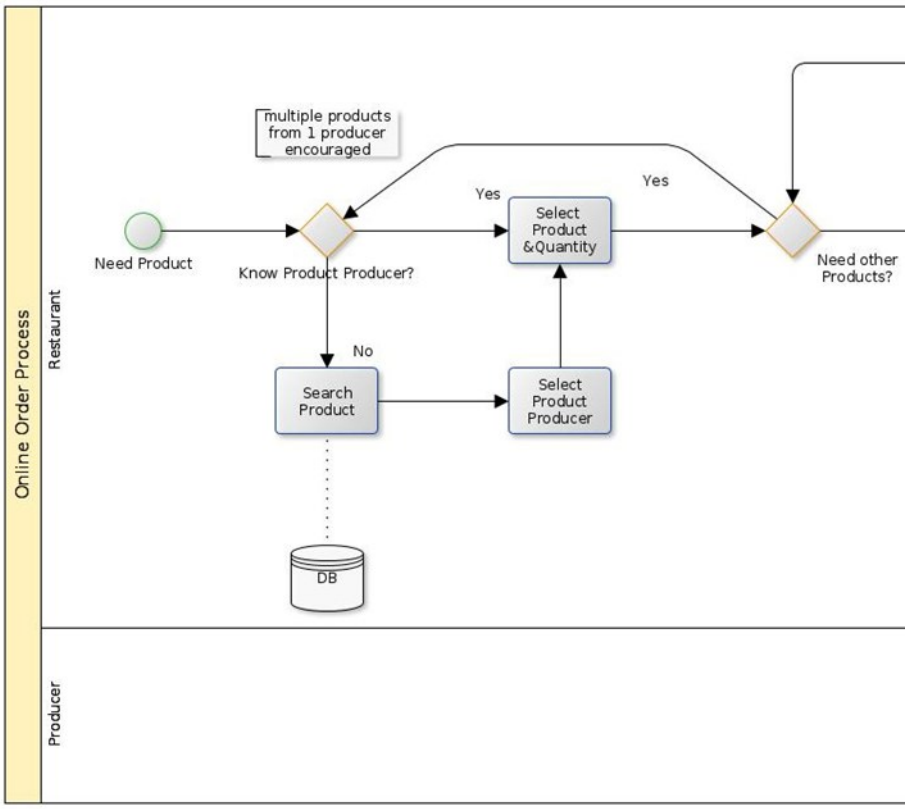

Figure 8. Modernized order process initiation

Just like in the current organic food ordering process, the restaurant can search for a known producer or find new one by looking for a specific product. The companies and their corresponding products are listed on a database. If the restaurant queries for a product term such as “Apple” all the producers who currently offer that product on the inventory are listed. The system should offer various sorting options, for example by location and price. The restaurant employee can then select a producer by clicking their name on the search result list.

Once the restaurant employee has clicked on the producer name, that producer's profile page is loaded. On that page the user can find out more details about the producer and see the products they offer, including the one that they searched for. The user can select what quantity of a product they want to order. The product and chosen quantity are updated to a grand total list where it will remain until the user pays for his or her purchases or removes the product from the list.

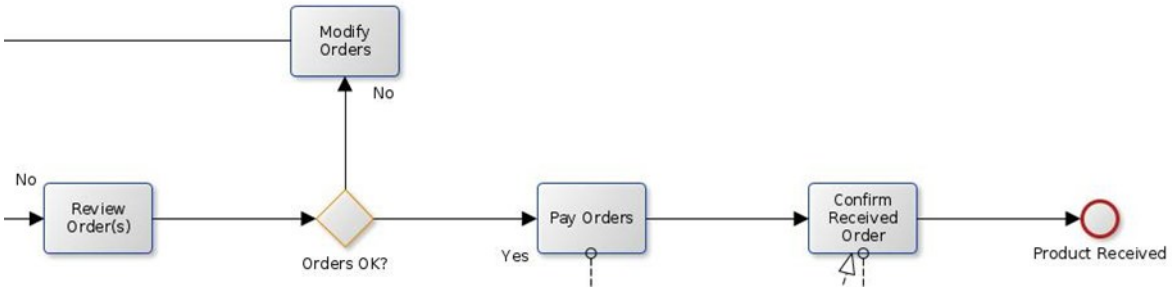

Figure 9. Modernized order process restaurant tasks

The user can now continue to select products from the same or different producer. Once the user has selected all the required products they need to review all the orders from one or multiple producers. This is the point when the user can still modify their orders if something is missing, or needs to be adjusted. If everything is correct, the user proceeds to pay for the orders. The user is presented with online payment options and he or she enters the bank account details from where the total sum of all collective orders is transferred to the system owners bank account. The system is aware of how much credit belongs to each producer that an order was made from.

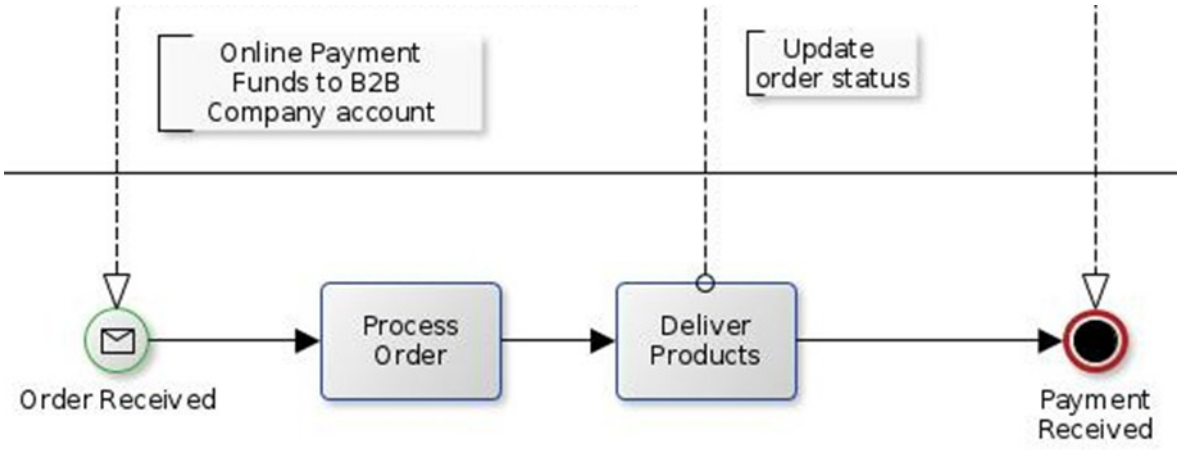

Figure 10. Modernized order process producer tasks

Once the restaurant employee pays for a product, the producer receives an order notification on the B2B web service. The producer user knows that the restaurant has paid for the order and can begin to process the order according to required products and quantities. The producer the delivers the product with the method of their choice.

Once the product arrives at the agreed pick-up location or the restaurant, the restaurant has to confirm that the order is indeed correct. After confirming the order the restaurant process ends as the product is received. The producer process also ends as the system transfers the corresponding order payment to their account after the order confirmation.

5.3 Benefits of a B2B web service

There are various benefits from using a web service to carry out the organic food order process. Many of the benefits are also immediate solutions to the challenges in the current existing order process.

The most important benefit is amount of time that an online implementation of the order process can save. Simply by comparing the current and proposed BPMN process models one can see that the querying time for products is immensely reduced. Since the availability of products is listed and updated on the producer profile, the restaurant employee does not need to query these details by telephone and the producer doesn't need to answer related calls. The restaurant employee knows who has the product, and doesn't need to bother anyone who doesn't. More time can be saved by the inventory organized on the web service, and that all the product once and it will be updated automatically with each order. Much of the time is saved directly, but part of it, like the amount saved by having a way to organize the stock is intangible. The information is updated in real time and reliably.

Processes are digitalized made clearer and secure. In case of a distributed order process, alternative solutions can be offered and selected to fulfil the needs of the user.
If a producer supply chain is interrupted, the incident should reported and all the funds paid for orders from that producer will be transferred back to their corresponding accounts. The users whose order processes were interrupted can then selected alternatives provided by the system if such are available.

Since every actor within the system uses the same payment method, transactions are easy to understand and troubleshoot. Payment plans should implemented and they should offer system users and companies a reocurring invoice cycle and reporting which facilitate book keeping. Furthermore, support effectiveness is increased as various processes are simplfied and conducted the same way for everyone.
The with clear roles and processes on the web service, the restaurant and producer can focus on their main forms of business, producing and serving organic food to consumers.

5.4 B2B web service challenges

The most important elements on a B2B service are the users the presence of user generated content. In a B2B webservice connecting producers of organic food and restaurants enough active actors representing all both forms of company are required, primarly so that the actors benefit from a business platform with enough partners to carry out orders and also for the upkeep benefits to be viable for the owner of the system. This means that the system owner cannot be only a specialist in IT or business, but they also need to understand the market sectors and be able to promote the B2B web service within it, maintain customer relations, find new prospects and continue development through innovation. The responsabilities and tasks of a system owner that aims to alter and improve traditional methods are big and often very challenging.

In the current model of organic food orders, usually two companies are involved. In essence these two parties are the only ones responsible for the order process.
In the case of a B2B service, one more party is added to the model, the system itself and its owners. Ideally no problems should occur during an order process.
However, in case something doesn't go according to plan, the responsabilities have to be clearly defined. Defining responsabilities and for what each actors is liable for is a challenge and the task of the system owner. The system owner has to also ensure that the service is as secure as possible at all times.

Online security is of paramount importance and a challenge for any web service system owner. When the system hosts client profiles and also private credentials, they must be kept safe and accessible by only the authorized actors. The secure sockets layer (SSL) protocol should be enforced on all the B2B web service. All sensitive information should be stored encrypted. User account control should also be strictly managed so that only actors with confirmed identities are allowed on the platform.

Having to scale up a web service is usually a good thing. However, with inproper planning from the ground up, scaling can become extremely challenging. Also, ensuring 100 percent uptime is not easy when traffic levels rise. For the owner of a B2B web service, it is probably a good idea to outsource its servers from the very beginning. Alternatively, if the owner of the system is uncapable of estimating rapid growth and responding to it with appropriate server data plans, problems may ensue. Another challenge is to monitor and predict the changes in traffic and data volumes on a B2B web service, this means that the system should not only scale up, but also down in order to optimize costs.

Finally, one of the biggest challenges for a B2B web service connecting organic producers and restaurant, is documentation. Documentation is vital, it allows for growth, testing and maintanance, troubleshooting and faster innovation. System documentation starts when the need for a system is born, it continues thoughout the planning, modelling, programming and testing, and hopefully never ends.

6 Discussion

What would happen if the organic food industry had modern communication and information technologies to support its evolving needs? The aim of this research was to find the requirements of the current organic food order process in Finland and offer a modernized solution into which the identified requirements are translated into. Perhaps the best way to understand the problems of the current model is by visualizing and then comparing the current and proposed models.

It is clear that the current order process undertakes many time consuming tasks and decisions. These processes and decisions can be simplified. The order of operations such as listing and querying for products can be changed so that they do not need to be repeated multiple times over the phone and inventory management, reports and payment transactions can be automatised.

From a software development perspective the most important element of the system are the database relations and the business logic. Understanding the core processes involved in the market sector and between the actors is fundamental. The entities involved and their relations should be well defined in a database. If the database architecture is sound, the system processes run smoothly by having the right data accessible, the data can be easily created, defined and linked together where ever needed. If the database is modelled carefully from the ground up, it can extend and scale up easily regardless of the front end technology. Since real world entities such as products and their handling are the central element in the database, a relational database architecture that takes advantage of a logically defined schema should be used.

The system should be developed with whatever the developer is most comfortable with. However, since the aim is to modernize the current order process, modern technologies are also in order. From a continuous development perspective and respecting the afore mentioned importance of a logically mapped back end database architecture, a logical application design is encouraged. Making use of a modern, robust application development framework is a novel way of implementing an B2B web service. Some important aspects to take into account are: client platform independence, mobile device compatibility, security, front end responsiveness and performance.

One of the most important findings of this research was the notion of how much more can be done to help the organic food sector from a system development point of view in addition to translating the current requirements. A web application with active users could offer additional value in the form of various business intelligence tools. By studying the organic food order data and the actors involved market supply and demand can be mapped. For example, a producer could use the analytical business intelligence to better understand, which new product they should grow on their farmland to best meet the market demand. In fact, this information could potentially help new start-ups, both producer and restaurant, to find niche products to produce or use as an ingredient in the menu.

Market forecasting functionality can be also implemented through a well designed system. The seasonal nature of the availability of products can be described and made use of on a B2B web service where producers are restaurants interact. Producers can predict when their products are available according to season. The restaurant chefs can then make use of this information when they are designing their menus.

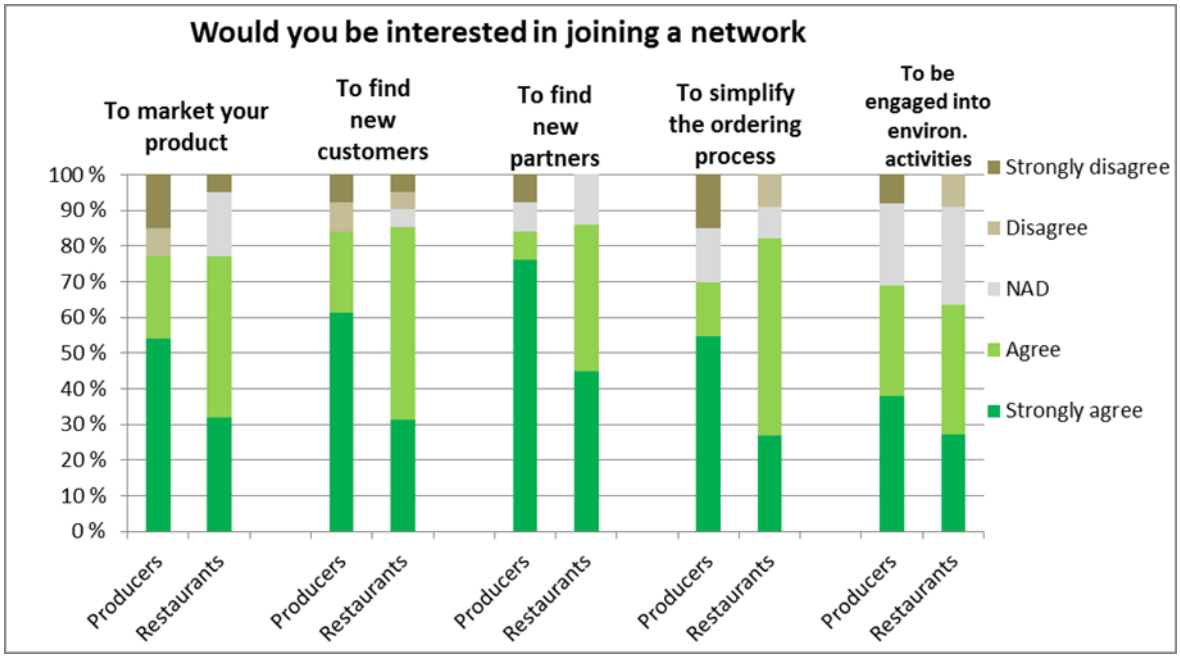

Figure 11. The reasons why respondents would join the network (Shalkovskaya 2015, 31)

Ekaterina Shalkovskaya's questioneer results support the hypothesis that a need for a web service connecting organic producers and restaurants truly exists. Figure 10 is a good indicator of these results. The figure projects a big interest or even a need to join a network in the form of a web service.

The results show that restaurants and producers are mostly interested in joining a network specifically to support business to business processes like the ordering process and to find partners. Producers and restaurants are also interested in a web service network to market their products and to find new customers.

What should be researched more? This research has only covered a minute portion of the entire organic food supply chain in Finland. A narrow scope is very important during any research and this was no exception. This thesis only covers the order process and its modernization. A study on the organic food logistics chain would be very interesting, in fact it is in big need of restructuring (Ryynänen 2013). A study on the current and future development of organic certification, monitoring and related legislation would also be valuable. Another interesting study topic would be the use and marketing of the organic products at the end of the supply chain. For information technology and finance students alike research on the best practices and available online payments architectures could be very rewarding. It is a topic that is becoming a fundamental part business today, but it is by no means easy to implement.

Finally, one of the most important findings of this study is how much potential the organic food market sector has for creating jobs in the future. The Finnish state has set as its goal to increase the amount of organic farmland to 20 percent of all farmland by 2020 (Maa- ja metsätalousministeriö 2014).

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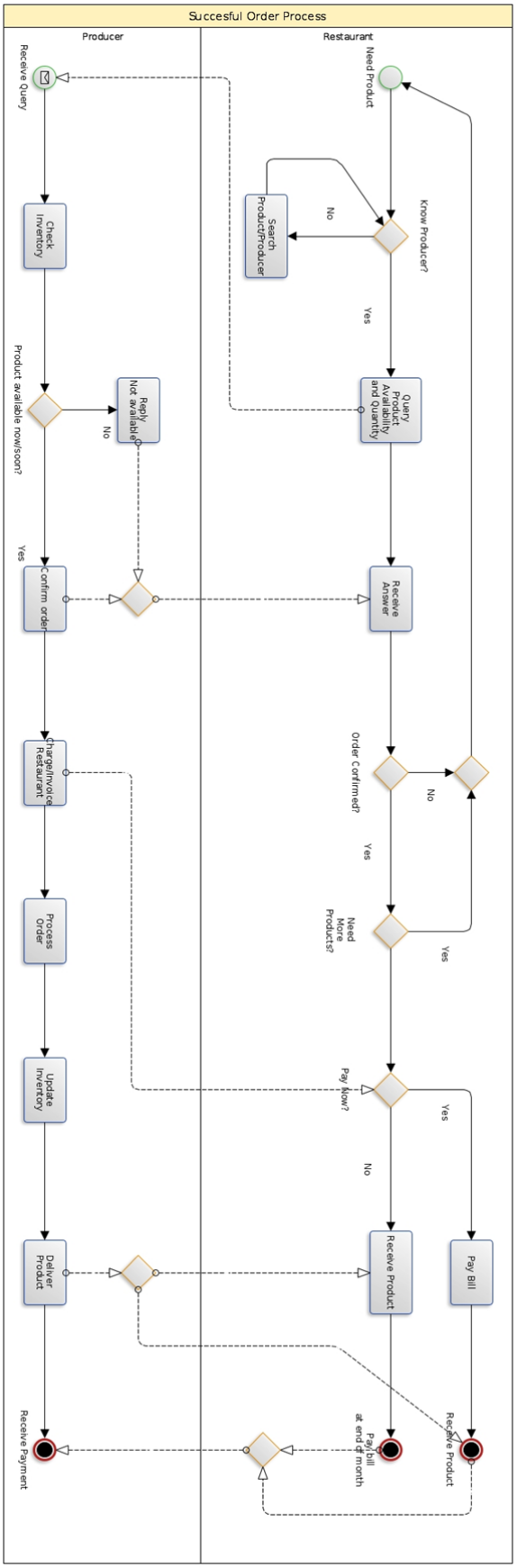
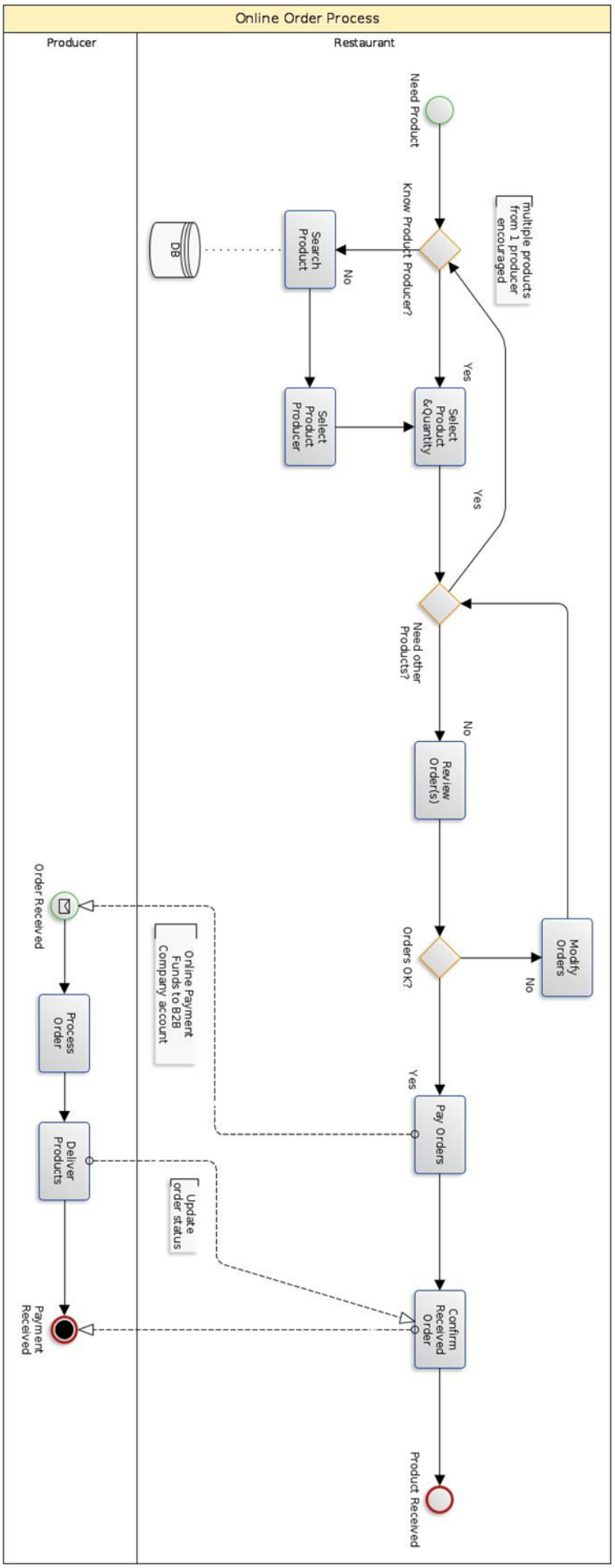
Attachments




Online Order Process
Producer
Restaurant
Need Product
Know Product Producer?
multiple products from 1 producer encouraged
DB
Search Product
No
Yes
Select Product Producer
Select Product &Quantity
Yes
Need other Products?
No
Review Order(s)
Modify Orders
No
Orders OK?
Yes
Pay Orders
Online Payment Funds to B2B Company account
Update order status
Confirm Received Order
Product Received
Order Received
Process Order
Deliver Products
Payment Received