

PLM Software from SCM Perspective

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ABSTRACT

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This thesis was made on request of the Raisio corporation. The objective was to find challenges and figure out improvement ideas for Agile PLM for Process - program. The focus was on the product data management in supply chain management from user's point of view. PLM is used as a data bank for product data and to support product development. Program hasn't been very user friendly so far and therefore improvement ideas were necessary. Research was based on a questionnaire that revealed user experiences of application users. These experiences were taken into account when finding out development ideas for the program. Research method was qualitative, because all the questions were open questions without numerical options.

Generally the program users had negative user experiences of PLM Agile. It was considered complicated and inconsistent to use. Many procedures in the program could have been done simpler. User interface was seen unclear and uncomfortable for a longer use. However some users had positive experiences as well. PLM Agile was seen as a good tool for product data management.

The recommendations included the simplification of application in several steps in PLM Agile. Many features could be removed and replaced with new procedures. Raisio should organize a new training for PLM users, which would improve their skills and increase attractiveness to use the program. System improvements are delivered to the vendor of the program, Oracle, who hopefully takes the feedback into account in forthcoming version updates.

Key words: PDM, PLM, product data, SCM

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ABBREVIATIONS AND TERMS

BOM	Bill of Material
CAD	Computer Aided Design
CIM	Computer Integrated Manufacturing
EDM	Electronic Data Management
ERP	Enterprise Resource Planning
GSM	Global Specifications Management
PDM	Product Data Management
PLM	Product Lifecycle Management
SAP	ERP system
SINFOS	Product database for suppliers

INTRODUCTION

Product Lifecycle Management is used in companies more and more these days. Companies need a system to control the product data in many different situations. Raisio has hundreds of different products. New products need to be pushed to the markets faster than before and product lifecycles are getting shorter. A global company needs this kind of system to cope with product data and as well as to face challenges that markets, governments and customers are setting to products. For many people the term PLM is strange, but it is managed one way or another in all companies. Hopefully this thesis brings PLM systems a step closer to people who have passed it before.

1.1 Background of the thesis

Raisio is a Finnish company known for its plant-based nutrition products. Product portfolio includes foods, feeds and feed derivatives. Best-known brands in Finland are Elovena, Sunnuntai and Benecol, which is also very popular globally. Raisio's operations are aimed to support the needs of customers with tasty, ecological, healthy and safe products. Raisio has production in many countries in Europe, but this thesis concentrates on actions in Finland.

Raisio has acquired PLM Agile system from Oracle two years ago. Nowadays it is used through the company, mostly in new product development and supply chain management. Though the acquiring of the system had the best intentions, the present situation is not the most optimal one. The system is not user friendly and it does not have the best possible level of utilization at the moment. It should be easier to use, clearer and some features could be removed. People in supply chain management use PLM quite often and when it happens, the necessary information should be found immediately. Because of this early phase of PLM Agile at Raisio, the daily usage of PLM has been the adding of product data to system. In the future that phase should be in a minor role, but not totally abolished. The idea is to use PLM as a database in the future.

1.2 Objective

The objective for this thesis is to find challenges in using PLM Agile and development ideas to improve its user-friendliness. Focus is in SCM's point of view and especially in product data management. It is already known that some problems in PLM Agile are caused by pure bugs, but most problems are system's own features or procedures which should function better. Improvements will help Raisio to save time in daily operations with user-friendlier user interface. All the development ideas are forwarded to Oracle, the vendor of PLM Agile. Development ideas are proposals for Oracle to use them in forthcoming version updates.

1.3 Research methods

PLM users are interviewed at Raisio by an e-mail survey. Responses and my own experiences of the program are the data for the analysis. All the questions are open questions without any numerical options. Research method is qualitative, because the amount of respondents is rather small and concrete opinions are more convenient than numerical responses in this case. PLM is also used in product development, but user experiences are mostly from users of supply chain management. My own expertise is also in SCM, therefore the research is implemented from the supply chain management's point of view.

The theory part will be based on literature and articles of Product Lifecycle Management. The basics of Product Lifecycle Management will be covered; basic features, characteristics and what is it used for basically. Theory part will help to understand the big picture of PLM before the concrete research part begins. The research part will find out the data, which will be processed at later parts for improvements.

2 Theory of Product Lifecycle Management

Product lifecycle management is a medium for companies to cope with the challenges in global business. Nowadays you cannot cope globally without PLM system if you have thousands of different products in your product range. Competitiveness is in the key position when market shares and economic growth are in spotlight. As a manager you just cannot deny the importance of PLM systems in your company especially in manufacturing, high technology and service industries. Companies are not offering only products anymore, but more and more flexible entities in which customers' needs are in the center. PLM system ensures comprehensive entity to meet the growing needs of customers. Nowadays business requires faster moves from companies to bring new products to markets at the same time when the lifecycle of products is shorter than ever before. The product data itself doesn't help the company if its information is scattered in company's IT systems. When product data is in one place can be used to support decision-making. Product-related-data needs to be accessible for people who need it at anytime and anywhere. (Business Wire: Siemens PLM Software Significantly Enhances Decision Making with New Active Workspace 2012.)

The term PLM does not refer to any individual computer software or method. It is an ensemble of different functions that are able to control product information. It can be physical – dimensions, weight, colour, texture – or functional as well determining the functions of the product. Product data includes also the lifecycle of the product. A lifecycle consists of research, design, production, use, maintenance, recycling and disposal. These are the basic product lifecycle phases, which are found in PLM systems. (Sääksvuori & Immonen 2008, 9.) PLM can be described as a business approach of a product's configuration from its birth through its disposal with the smallest possible costs (Industrial Engineer: Product lifecycle management and you 2010).

2.1 Product

For the most of us a product is a tangible thing that you can hold in your hand. It is designed and manufactured by a company who has made millions of them or just one unique piece. From PLM's point of view an important feature of a product is the complexity of it. A product is rarely made from one piece like nuts and bolts. But even

those nuts and bolts are made from chemical compounds that characterize the complexity of even the simplest products. Not to mention the complexity of a car made from thousands of components. A product can be also intangible such as software or a service. A common ability for any kind of products is to be managed by PLM. It manages the independent part, the product and the product portfolio altogether.

2.2 Product Lifecycle Management background

Product data has been saved in companies many years before the term PLM saw daylight. Before computers came common every piece of information was stored in folders in some chalky closet or archive. Now all the data is in electronic form in some server or hard drive. PLM systems appeared in companies first time in the late 1980s. At that time the term PLM was not invented yet so people talked about Product Data Management and Engineering Data Management. Starting points were more or less in the technical field of business and especially in component industry. (Grieves, 2006, 55-56.) Computer Aided Design was an impulse for PLM, because the growth of the amount of files created by computers raised a need for a place to store files in a rational way by classifying different versions of documents and viewing relationships to other products. So PLM was not the first player in this field. Following terms are ancestors for PLM what we know today. (Mechanical Engineering: Why care about PLM 2011.)

2.2.1 CAD

CAD must be the best-known term of the ancestor terms of PLM. It refers to math-based descriptions of the physical product. These descriptions are shown in two-dimensional or three-dimensional space. (Grieves, 2006, 46.) CAD programs are widely used by engineers who use them to design products. CAD program can be integrated to PLM for direct flow of data between programs.

2.2.2 EDM

EDM (Electronic data management) is a tool for engineers to use math-based specifications that describe the product's features. Product's characteristics include tolerances, tensile strengths, weight restrictions, adhesives and conductivity requirements. Listed characteristics are important in engineering, but also for other parts in company. Coating, painting and testing need the data from which the product is composed of. Problem was that all engineer groups had their own ways to process and store data in different forms as well as in different applications. The most common database for these EDM files was Microsoft Excel, which is a very good program itself, but rarely easy to use by the whole organization. (Grieves, 2006, 49-52.)

2.2.3 PDM

PDM systems were in the markets before PLM systems. These terms get easily mixed up, but they are not the same. PDM was created for saving and controlling the data that CAD applications produced. PDM systems replaced paper and microfiche archives with a more reliable electronic archive. Old physical archives were inefficient and costly with the feature that all information was stored in one location. Electronic archives were better in many ways, especially financially. PDM expanded the standardization of saving the data to companies across the world. Firstly PDM was only used among engineers, but it expanded to other parts of the companies also, for example supply chain management. PDM offered the possibility to save different types of product information in digital form. It can be said that where PDM ended PLM began. PDM created the basis for the PLM's functions that could be utilized in almost every part of the company. PLM covers all processes that occur in product's lifecycle. Nowadays PDM systems are superseded by PLM systems. (Grieves, 2006, 53.)

2.2.4 CIM

CIM (Computer Integrated Manufacturing) bears the idea that data and information in design, engineering and manufacturing could be integrated. In many companies these departments are using different applications and methods, which complicates sharing

the data. Manufacturing did not always know what engineers and designers thought when they designed the product. Some products were not even buildable. And on the other hand consumers can share the same feeling when handling the product that is not suitable for hand or it is inconsequent to use. CIM is a cross-functional term, which attempts to reduce duplication of work and drive productivity to more efficient level. (Grieves, 2006, 54-55.)

2.2.5 PLM's starting point

PLM did not arise from nothing in one night. It required years of development of all the previous ideas to grow together. Without those programs there would not be PLM as it is today. Luckily PLM created a smart way to process data and to find the needed information promptly. The need for PLM systems developed when companies started computer aided design, but the term has been present only a while. From that point of view the amount of different PLM systems and the variety of purposes for what they are used for has expanded in an enormous scale as well as the business world has developed around us.

2.3 PLM versus ERP

PLM can get easily mixed with ERP systems. PLM and ERP are both very broad concepts so it is reasonable to do a little comparison. The idea of ERP is to address all core functions of an enterprise. ERP systems integrate information across an entire organization embracing finance, manufacturing, sales, H&R, purchasing etc. Companies use ERP systems in daily operations. It concentrates on functions, when PLM concentrates to knowledge. ERP system supports different departments in companies by automated method for order fulfilment or providing human resources a way to standardize their information (Tooling and production: PLM's changing role, 2007).

Knowledge is common to all above-mentioned functional areas. A company holds a vast amount of knowledge about products, customers, employees, suppliers etc. ERP systems are presenting the current situation whereas PLM has a wider time frame. Product lifecycle management holds the knowledge of products at all points of

lifecycle; design and development, engineering, production, sales and service, and disposal and recycling. This idea strengthens the image of PLM as a company-through concept of the product lifecycle. (Grieves, 2006, 56-60.)

PLM and ERP are designed for different purposes. They are not competitive with each other even though some features can be mixed up easily. One significant similarity is the product data that both systems have. It can cause duplication of data, which is not necessary. The best solution would be a total integration of the systems when the data is updated to ERP, it will be updated to PLM system automatically or the other way around.

2.4 PLM characteristics

PLM characteristics include singularity, correspondence, cohesion, traceability, reflectivity and cued availability (Grieves 2006, 65). PLM systems need to have these aspects to ensure that every piece of information in PLM is delivered to the end user. Reliability is the key principle in product data. It is a necessity for PLM system to function with reliable data, because without it all these characteristics the whole PLM concept is useless.

2.4.1 Singularity

Singularity is the most important characteristic of PLM, but it is still the most difficult to explain. Basically it means that PLM system is having the singular version of controlling product data (Grieves 2006, 78). The original product data is always the correct one, but the copied one can always have false information. At computer age this copying is a real problem, because everyone can make a copy of everything. When using a PLM system it is crucial to know what product data is the original and singular one that every user should refer to. It is not wrong to make copies of product data, but it should be remembered that when duplicate data exists in various systems it is a waste of time and energy when somebody is working with the wrong data.

2.4.2 Correspondence

Correspondence is a quite simple characteristic to assimilate. The data and information of a product need to be corresponding. Product's dimensions, weight, material etc. need to be the same in physical product as well as in the system where the data is described. If this characteristic is not fulfilled the whole PLM system needs to be questioned. PLM users do not have time to find out every time if the data is accurate or not. For companies who manufacture the product completely it is easy to find product measures and have accurate information of the product. But for companies who use semi-finished products from suppliers there is a dilemma who is taking care of the data accuracy, whether it is the supplier or the manufacturing company. (Grieves, 2006, 81-83.)

2.4.3 Cohesion

Cohesion means that every piece of information in PLM should be uniformly marked. Different functions of a company can use variable ways for example to measure dimensions of a cardboard box. Purchasing department is interested in how many products can fit inside the box so they find the internal dimensions of the box more relevant. But the people who are working in warehouse are more interested in the external dimensions so they can calculate how many boxes can fit to one pallet. Difference in the objects of interest can lead to a poor cohesion. Everything can happen when people are responsible for the marking methods of the product. For that reason the ground rules need to be specified and communication needs to be clear. (Grieves, 2006, 83-86.)

2.4.4 Traceability

Traceability enables to trace the product's path to its origin. There are several reasons why this is important. A product may need to be traced because of the success or the fault in it. Sometimes when a product is so good, the company wants to find out all phases of its path in company. If a customer finds out a lack of safety in the electrical wire of a product, it is obligatory to trace the history of the product so that the defect can be found and prevent it happening again. PLM systems save the development

phases and processing steps in order to trace the product to its origins. (Grieves, 2006, 86-89.)

2.4.5 Reflectiveness

Reflectiveness means describing reflectivity between the real world and virtual space. PLM is a tool for changing the state of product in virtual space. When a product gets a new painting or its layout changes it is done in the real world, but not in the virtual world of PLM. Reflectiveness ensures the similarity of products between tangible version and the virtual one. Ideal situation of PLM is instant reflectiveness with products. (Grieves, 2006, 89.)

2.4.6 Cued availability

The needed information needs to be available in PLM when we happen to need it. It is important to emphasize that information must always be available and easily accessible. The Internet has helped us with various search engines that almost anyone is capable to use. PLM systems have applied same kind of methods to find unstructured data what the Internet search engines also have. In the future we will have much better PLM systems that will serve users when products are facing the disposal phase of their lifecycle. Cued availability affects to this also in order to the information should be available in future as well. (Grieves, 2006, 91-93.)

2.5 PLM systems

If a company is considering buying a PLM system there will be tens of different systems in the markets. That is why it is important to figure out what are the needs for the program, because you do not do anything with a too heavy application or vice versa. PLM systems are based on more or less for controlling the information of items. Usually these items are products, but they can be also semi-finished products, raw materials, ingredients, components, software, algorithms, services, documents, packaging materials etc.

PLM system can include only product data features, which can keep the application very light. This kind of system is useful for a company, which is dealing with many products, but does not need accessions to ERP system or feature for quality management. This kind of system is more like a PDM application than a PLM system. On the other hand a PLM system can be comprehensive from an early-stage development to manufacturing, sourcing and service (PTC: Investing In a Single PLM System Pays Off, 2012). Company's needs are determining what kind of program PLM is in every case.

2.5.1 PLM system architecture

There are various PLM systems in the markets, but still few functional entities are found in every system. Three functional entities that are present in every system are file vault, meta-database and application. File vault is centralized storage for all file typed product information. For example documents, specifications and CAD drawings. Meta-database maintains the structure of system. It takes care of independent relationships between products, sets rules and organizes procedures. The most visible of these three is application. It is the user interface, which enables the usage of program. (Sääksvuori & Immonen 2002, 24.)

2.5.2 PLM system structure

Figure 1 describes the basic functions of PLM systems. These features are not in every PLM system, but they are the most common ones that you may find from different PLM applications.



FIGURE 1. PLM system structure

1. Creating an item

A new item is created when a company puts a new product, ingredient, component or material to the PLM system.

2. Managing the status of files

This function includes processes and workflows, which control the status of an item. The status can be for example draft, review, approved/not approved, update or obsolete. It ensures also that only one person can modify an item at the same time.

3. Distribution management

Information needs to be distributed in the company. PLM is delivering items to persons who are responsible of the next work phase, for example a new component item comes from R&D person who accepts the component and sends it to production personnel who links it to BOM.

4. Searching and browsing information

Searching is an essential function in the PLM system. Companies use enormous amounts of time for searching different information from several systems. PLM applications try to decrease the time for searching and emphasize the instant finding.

5. Management and maintenance of products structures

This is the most important function of all, because it creates the basis for other functions. All information in PLM is more or less linked to product/product structure. Different versions of products, product structures, BOM's and different views of product structures to different users describe the objects of this function.

6. Change management

Documents, items and structures are facing changes at some point of their lifecycle. PLM system informs relevant parts of an organization when a change takes place and saves up relationships between old and new product data. Some changes can occur immediately or when the old component runs out of stock. Changes are also traceable in case of product recalls.

7. Transferring files and file type conversions

PLM system converts the files to standardized format so that every user can find and open it.

8. Connecting people

Relevant information needs to be shared to people who need it. For example PLM system can send an e-mail to a person who is responsible to add certain documents to the new product.

9. Image management

PLM system can have storage for blueprints or product pictures, which used to be filed in physical archives.

2.5.3 Workflow

A workflow of an item consists of sequential steps in PLM system. When an item is under progress the status varies. Different persons may have various rights to work with items and the workflow helps with that. The workflow guides users to understand the status of a file at given moment, which clarifies what can be done.

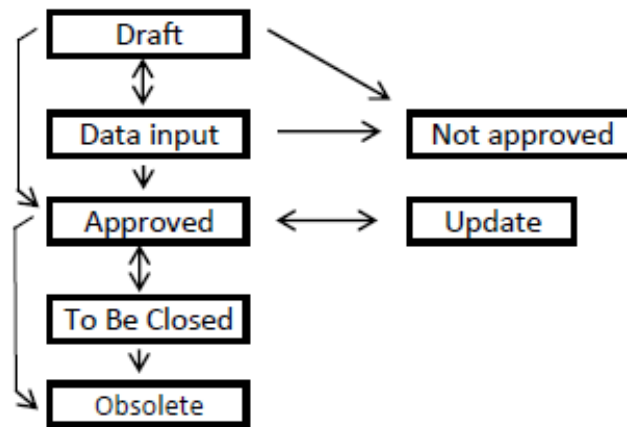


FIGURE 2. Workflow

Workflow in Figure 2 presents the status of trade specification in a PLM system. At the beginning when specification is established the status is automatically draft. The simplest workflow for trade specification goes from draft to approved and to obsolete. In many cases the data input phase is present and data is obviously added to the specification. All in all these workflows are very variable in different systems. The basic idea of workflow is to present the formal description of a process and to maintain the state of executions done by users (PTC. The State of Workflow, 2004).

2.5.4 PLM benefits

Does a company get added value after implementation of a PLM system? Obviously there are numerous benefits for companies who are using PLM. Benefits are not necessarily arising in the functional area where PLM is used. As well the benefits can come later or even before the actions are made. These benefits can also become overlapping. Benefits of PLM are quite normal improvements such as increasing revenues, cutting costs, managing the data better and basically doing everything better. (Stark 2006, 45-46.)

At first it is necessary to find out whether a company needs a PLM system or not. Increasing competition, globalization, shorter delivery times, increased product range, standardization and faster lifecycles of products are all reasons for considering PLM

system. In principle all large companies who have a wide product range, complex product structures and a want to succeed globally should think why not to purchase a PLM system. For many companies it is hard to determine requirements collection because in many individual cases there likely are many stakeholders with contradictory needs and objectives (Industry Week: How to Choose a PLM Provider 2009).

Companies have various IT-systems that compile very heterogenic IT-environment. Most companies have ERP system, CAD system and in addition some kind of product database. Every company have their own ways to handle the data in programs, but more or less all users are facing the fact that searching information takes a lot of time. Cooper & Lybrand's survey from 1994 points out that engineers are using 30% of their work time for searching, sharing or maintaining information. Times have changed and applications have developed after that survey, but I think that the amount of product data has increased and maintaining that information requires still a lot of time. In worst cases users have to log in to several systems to find out some piece of information and update it. (Sääksvuori & Immonen 2002, 99.)

PLM systems are trying to decrease the work time that is used to find product information. PLM system gathers product information to one application that can be used in internally or externally. In this way PLM really connects people and information. A change in product data can be updated from supplier and that information flows directly to the sales department who can share it with the customer. PLM system does not need to function separately from ERP or CAD systems. Applications can be linked together and create a whole new IT-environment where the data is shared freely between systems and users. Maybe the most important benefits appear in time saving when expended time for searching information decreases a lot.

PLM systems are not creating added value by itself. At the beginning it can be frustrating to input data to a system that might appear useless at that point. However that information can be useful in the future when the company is going to new markets where that document or product feature is crucial. Over time the information in PLM system grows and brings more and more benefits to the company. The information from PLM system can be used for making reports to support company's decision making. Also the input of data gets easier time by time when old items can be copied and there is no need for new data input for similar products.

Companies are always looking for savings. PLM can save money in many ways. Direct financial benefits accrues in operative activities where time savings and efficiency increases and quality costs decrease. Indirect benefits appear in faster product to market – times, quicker responses to market changes and better product margins. Product structure tells exactly what components are needed for production, which decreases the value of warehouse. These savings are not self-evident, because PLM system can be used in different ways in companies. The responsible manager has to reach objectives by a good leadership, training and exemplary acts. (Sääksvuori & Immonen 2002, 99-105.)

2.6 PLM in SCM

PLM systems are used by supply chain management in many companies. Several vendors of PLM systems announce that their PLM system does it all, from A to Z. It happens rarely, because the needs of SCM varies from A to Z as well. Companies who have a strong SCM with visible processes can get the best out by acquiring a PLM system. (Apparel Magazine: After PLM: What comes next? 2012).

Suppliers, purchasing, production, product management, sales department and customer service are users of PLM in SCM. Product data flows through the supply chain and all the necessary parties get involved. Next example outlines how SCM processes benefit from PLM system.

R&D would like to use new components to decrease the electricity consumption of device. Purchasing department gets the information from PLM system and starts to look for new components. Supplier puts component specifications to PLM, so that the company finds out specific information of the component's features. Purchasing will find out this information and consider placing an order. False component orders would increase the value of warehouse, but tight communication with departments ensures up to date information, which saves company's resources. Production will find BOM's for manufacturing and find out the new component. Sales persons benefit the PLM in the bidding process when the needed product data is found from PLM system. Product has finally reached customer who unluckily makes a claim of the product. Customer service

traces the components that are used in that specific product and informs the production or other relevant departments who are checking the reason for failure.

This is only one example how PLM can be used in SCM, but it covers the basic idea that PLM is used to control the product data in supply chain's different phases. Other users are for example product managers who are responsible of product data that is in PLM and also have the admin rights. They are controlling the whole system and are responsible of training, support and maintenance.

3 Background information

3.1 Raisio Oyj

Raisio group is a specialist in plant-based nutrition. Product range covers foods, feeds, feed protein, vegetable oils, plant stanol ester and bioenergy. Best-known brands are Elovena, Sunnuntai, Benecol, Honey Monster, Fox's, Dormen and Nordic. Only few consumers in Finland know that Raisio is a global company; the main market areas are Finland, Great Britain, Sweden, Ukraine, Russia, Poland and Estonia. All in all Raisio has actions in 12 countries. Raisio Oyj is listed in NASDAQ OMX Helsinki. (Raisio Annual Report 2011, 1.)

Raisio employs 1400 persons globally and 500 of them work in Finland. Biggest milling plant is situated in Raisio, where the head office is also located. Corporation is divided in two sections; Brands and Raisioagro. As you can guess from the name, Brands is focused on previously named brands and Raisioagro deals with feed business. (Raisio Annual Report 2011, 1.)

Raisio is a traditional Finnish food product company. Ingredients and raw materials are mostly from fields of Finland, because the quality and reputation of Finnish grain is on a high level. In fact Raisio is Finland's largest grain user. History began in 1939 when Finnish wheat farmers founded a mill to grind the wheat and to market the flour. After the Second World War the food supply was at a low level and therefore it was a good moment for Raisio to grow. At the same time Raisio started to utilize by-products from milling operations for animal feed. Later Raisio started to process rapeseed to margarine and rapeseed oil. Raisio's chemical production has been producing for example starch, fatty acids and amines. The greatest invention so far was the Benecol invention in 1995. Today Benecol is the best-known brand for cholesterol lowering foods in the world. Over the years many parts of the corporation have either been sold, joined or reorganized. The basics are still in plant-based nutrition. (Raisio: Konserni, Historia. 2012)

As a global company Raisio has acquired different companies to Raisio group. The most significant acquisitions were Glisten group in 2010 and Big Bear group in 2011.

Both purchases were UK companies, which strengthens Raisio's position in Europe. This year's acquisitions are Polish pasta factory and a candy factory from Czech. (Kauppalehti. Raisio osti makeisyhtiön Tsekistä 2012.)

Raisio has been a forerunner in environmental issues in the global level. In 2008 Raisio equipped Elovena oatflakes parcel with CO2 emissions label. In 2009 Raisio added a H2O – label to products, which describes the water consumption of the product, as a first company in the world. Today's vision is to grow to a biggest supplier of healthy and ecological snacks in Northern Europe. (Raisio: Konserni, Historia. 2012). Ecologically Raisio is ahead of competitors, but competition is intense in global nutrition business, because trends are changing both good and bad together with the changes of grain's raw material price.

3.2 Oracle Agile PLM

US Software provider Oracle is the Vendor of Raisio's PLM application. 1500 companies rely on Agile PLM applications globally. Agile PLM belongs to Oracle's Product Value Chain Solutions, which are covering processes and data management in design chain, supply chain and demand chain. (Oracle: Agile Product Lifecycle Management, 2012.)

Agile PLM applications manage the enterprise product record, the single source of truth for all product information. It helps companies accelerate product innovation and maximize product profitability through the robust management of the information, processes and decisions about their products enterprise-wide and across the global product network. (Oracle: Agile Product Lifecycle Management, 2012.)

Application is called Agile Product Lifecycle Management (PLM) for Process. Raisio chose Agile Product Data Management for Process and Agile New Product Development and Introduction for Process. These applications are covering product development and product data management in Raisio's operations. The main focus is now on Product data Management for Process' subtitle Global Specification Management, which provides a wide range of tools to support product development and control product data. (Oracle: Agile Product Portfolio Management, 2012.)

3.2.1 Oracle Agile PLM at Raisio

As a global company Raisio manages wide range of products. Because the field of business is nutrition and foods business, there are really strict rules for products. Directives for food products are tight, which requires different certificates, strict hygiene, traceability methods and constant quality management. Therefore Raisio needs an application that can handle this complex entity reliably and efficiently.

In 2010 Raisio bought software from Oracle with Logica as its implementation partner. Objective for Raisio was to increase visibility in product development processes and fasten launching schedules for new products. Aim was also to improve the accuracy and exactness of product data, which was stored in multiple locations. For example all specifications, different certificates and declarations were stored in common network drive called common data, which had a poor user interface. There really was a need for new solution in product data management, which could transfer the product data to retailers' Sinfos database in future. Before all product data was added to Sinfos manually.

Agile PLM is a browser-based application, which can be used with common web browsers. Certain address is typed to address bar, which opens the login page of PLM. User needs to have a private username and password to enter the network. Application starts after login in same window and user is able to use the program immediately. PLM works only in Raisio's own Rynet network. Because PLM Agile is a web-based program it is possible to add product data to program from multiple locations supporting collaborative development between sites. It is very important for Raisio, which has different production sites and warehouses. (International Journal of CIM: A hierarchical deployment... 2011)

3.2.2 System structure

Agile PLM's Project and Portfolio Management consists of features shown in figure 3. Projects and products are integrated under the same application. All specifications, formulations and product data is connected so that development processes can be

carried through rapidly and efficiently. (Oracle: Agile Product Portfolio Management, 2012.)



FIGURE 3. Agile PLM – structure (Oracle, The PLM Journey at Raisio)

Specification Management is controlling the single version of the product data. It allows to rollup data from ingredients to finished products as Figure 4 presents. Specifications are presenting the ingredients, raw materials, product, retail product, traded unit of the product and packaging materials. They are the players in a big game called PLM and specifications management controls them. Controlling specifications describes the control of products and product structures in PLM systems. Workflow feature enables different status for specifications like review and approval.

Formulation and BOM Management allows flexible product development processes with formulation and re-formulation of products. When a formulation is changed, application shows real-time impacts on cost, compliance, nutrient data and labeling of product. R&D department benefits from fast product development processes and instant view of effects.

Packaging and Labeling management enables to control packaging material specifications with labeling data. All packaging materials and artwork are in the same place where to find relevant information at a given time. Data can be shared with internal and external users.

Compliance and Quality management ensures quality, safety and compliance by observance through the supply chain. Quality conformance is achieved with product information that is chopped to pieces in Compliance and Quality Management through specifications.

Data Syndications connects PLM to different systems. The most common connectivity is to ERP systems or Sinfos. Raisio is using the connectivity with Sinfos at the moment, but not with ERP. Data syndication is the key feature for a program like this, because sharing the data to external partners is sometimes the main idea for acquisition of PLM system.

Supplier Management helps supply chain to control the field of suppliers. It can be seen as a database for suppliers where they are listed. Product data can be shared with supplier, which serves both parties. All kind of supplier related data can be put to the system, for example audition reports or self-evaluation reports. Tight linkage with suppliers reduces delivery times and strengthens collaboration.

3.2.3 Specification relationships

Figure 4 presents how trade specifications are formed in PLM Agile's Global Specification Management section. At the beginning R&D establishes an ingredient spec for each ingredient. Formulation spec consists of these ingredients forming the semi-finished product. The idea for the semi-finished product is that several products can be made from that semi-finished product by adding different ingredients as the Figure 4 outlines. Formulation spec tells the recipe of the product and it is one kind of a bill of material. Production processes the ingredients with the information from formulation spec to a ready product, for example a drink, which is formula's output. This drink has its own trade spec, which is the ready-made product what is sold to customers. Trade spec has a link to nutrient profile, which tells the nutrient information for customers and another link to packaging material spec, which describes the correct packaging material. Trade spec or traded unit is on the top level. Traded unit has in this case 10 products in cardboard tray and pallet has 224 traded units, in total 2240 products.

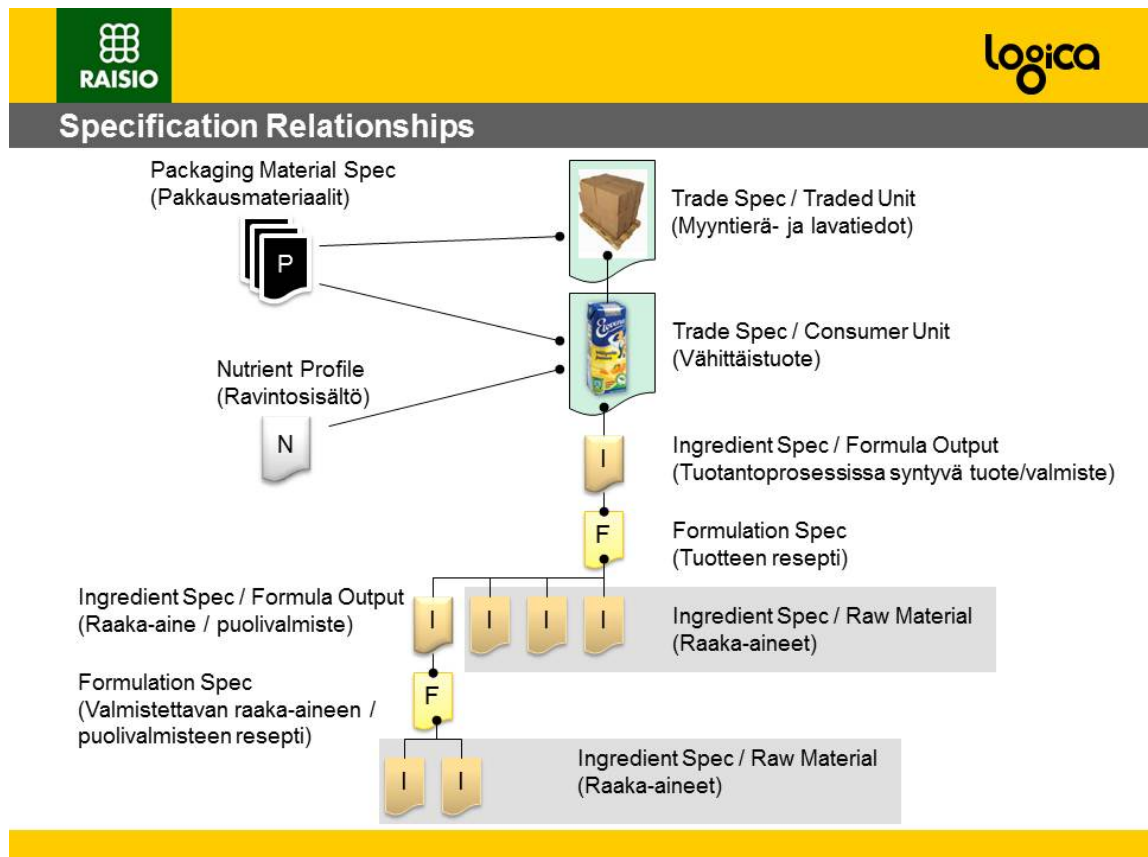


FIGURE 4. Specification Relationships (Logica)

These kinds of specification relationships are found from PLM's Global Specification Management application for all Raisio's products. The system includes different ingredients, packaging materials, domestic products and export products, which demonstrates the scope of PLM system in Raisio. We must remember of course that this is only the PDM application of the whole PLM system and only one product from product range.

GSM Action Items				
Spec.#	Title	Type	Status	RAG
5002511-001	Sunnuntai 20kg gluten free flour mix	Trade Specifications	Data Input Purchasing	🟢
5003300-001	Sunnuntai 20kg gluten free flour mix TU	Trade Specifications	Data Input Purchasing	🟢
5003306-001	Sunnuntai 20kg extra gross whole grain rye flour TU	Trade Specifications	Data Input Purchasing	🟢
5003374-001	Sunnuntai 20kg doughnutmix TU	Trade Specifications	Data Input Purchasing	🟢
5003194-001	Sunnuntai 20kg dusting rye flour TU	Trade Specifications	Data Input Purchasing	🟢
5003307-001	Sunnuntai 20kg heat treated rye groat TU	Trade Specifications	Data Input Purchasing	🟢
5003361-001	Sunnuntai 20kg rye pre mix TU	Trade Specifications	Data Input Purchasing	🟢
5003256-001	Sunnuntai 20kg sifted rye flour TU	Trade Specifications	Data Input Purchasing	🟢
5003250-001	Sunnuntai 20kg rye flour for malt pudding TU	Trade Specifications	Data Input Purchasing	🟢
5003193-001	Sunnuntai 20kg oat groat TU	Trade Specifications	Data Input Purchasing	🟢
5003318-001	Sunnuntai 20kg organic oat groat TU	Trade Specifications	Data Input Purchasing	🟢
5003279-001	Sunnuntai 20kg barley groat TU	Trade Specifications	Data Input Purchasing	🟢

PICTURE 1. Action Items – list

Agile PLM's GSM-section uses workflow of specifications to move them between users. Every user has action items list, which shows what specifications need your actions. For example when R&D department sends a specification to purchasing department, an e-mail is sent to buyer who is responsible to add data to that specification. That e-mail has a link, which opens certain specification in PLM. Action items list (Picture 1) is showing every action item that requires your actions.

4 Research and results

Research was done by a questionnaire (Appendix 1), which was sent by e-mail to PLM users at Raisio. Questionnaire was sent to 27 persons and 13 send an answer. Answer percentage was 48%, which was rather poor, but I included to the target group all the persons who had the rights to use PLM. Therefore target group had users who had used PLM only few times and therefore did not have relevant experience to answer the questionnaire.

I used also my own experiences of PLM Agile, but I did not include them to the figures. My own experience of Agile PLM is approximately 130 hours of using. My task with the application was to feed products' physical dimensions, weight, labeling, and necessary documents to the system. I had to establish also new packaging material specifications for new materials that were not in the program yet. I have used PLM Agile quite a lot, but rather briefly regarding to great extent of application. Anyway my use covered basic features broadly giving practical angle to application.

Respondents had quite strong opinions of the application. Almost all answers had useful comments instead 'quite ok' answers. General opinion of the program was more negative than positive. Next I will go through the responses briefly trying to find the main threads from people's feedback.

4.1 Benefits of PLM

Some respondents did not find any benefits from using PLM, but still many are considering PLM Agile as a good tool for data management. All product-related information, specifications, formulas and documents can be found in one place quite easily. New employees benefit more from PLM, because they have not used common data and they can start using PLM at the beginning. Old habit was to find the specification or document from common data with next address for example:

*SRV4123\CommonData\RN\SCM\Pakkausmateriaalit\PLM\Pakkausmateriaalitoimittaj
at\Suominen Flexible Packaging Ltd*

This kind of address path is not necessary to remember, but the saving logic is hard to adopt. Without any tips it is time consuming to find what you are looking for. Searching from PLM is nearly every time faster than using old common data.

Product data syndication from PLM to Sinfos is a big benefit for Raisio. Syndication ensures that product data is correct, because there is no room for false information in Sinfos system. 'One version of the truth' is a regarded feature. Now users can be sure that there is only one specification of a product, which can have the approved status simultaneously. Only people who have the rights to manage the product data can add data to PLM. This reduces the risk of false and duplicate information.

4.2 Disadvantages of PLM

The questionnaire had more negative answers, which helped me to find weaknesses from PLM. Some of the answers had already known features that could be implemented better. Because of the extension of PLM there were many problems that I have not heard before. On the other hand it was good that so many disadvantages were found in order for my research to have relevant data to work with.

General opinion of respondents was that the usage of PLM is too laborious affecting the desire to use the application. Many told that it looks too complicated and strange decreasing the threshold to start the application. Poor visual appearance gathered consensus that it hampers the use and makes reading difficult. As you can see from the Appendix 2 and 3 that text is just one big mass with a small font size, which makes it hard to find a specific spot from the text. Eyes get tired easily and rows get mixed up after watching the program for many hours. Symbols are not logical in every situation. Sometimes approving happens with a green check mark and sometimes with a done-button.

Search browser gathered also negative feedback. Key word must be precise in order to find what you want. Only one method for searching is available, searching with the keyword that must be in search results. It is impossible to search with two key words without them being in sequential order in result. For example, finding a trade specification for Torino rye pasta is possible only with Torino, rye or pasta, but typing

the whole product name to search field does not give any results. If I use only Torino or rye, the search results include all Torino trade specifications or all trade specifications that have the word rye included. I am not surprised if people get frustrated with PLM search browser. You just have to know precisely how the specification is named and the best situation is if you have created the specification yourself. Then you have nobody else to blame for it.

Because PLM's operational language is English, there are difficulties for many users to understand and translate the program's texts. Added product data needs to be in English as well, which causes translation mistakes. Users have different naming habits and the naming happens in a foreign language, there is a high probability that the data is not accurate. Some specifications' names include both Finnish and English, which confuses the reader. Data input practices are changing between users, which causes duplicate and confusing information. Product data in SAP can be named with different logic than in PLM. User is not always sure which naming method is the correct one. In addition it feels futile to have the same data in different systems. Although it should be impossible to have duplicate data in PLM system it can happen quite easily. For example users can establish several packaging specifications for the same packaging material. They can be shown as different specifications because the names are written with a different logic.

Because this PLM application is purposed for process industry and it is not a tailored version, there are useless fields and pages for Raisio's needs. PLM system structure is too stiff without a possibility to modify it for Raisio. Stiffness appears in normal using over and over again. The most frequently mentioned disadvantage is logout what happens after 30 minutes if you have not used the program. Working simultaneously with many PLM windows is rather difficult. You can open new window only in certain situations. In some situations opening a new window closes the old one causing loss of not saved data. It complicates the use when you cannot check the needed information from another window.

Users are annoyed to constant clicking in program. Several actions can be done only by several clicks. For example finding a specification requires a lot of clicks. The editing of product data occurs by clicking different points and PLM sends even an e-mail for you when the specification is in edit mode and another one when the specification is saved. I think it is not relevant to have an info message of the procedure you have just

made by yourself. Usually PLM is used in addition to daily routines, which causes delay to other tasks, because the application is so hard to use.

Admin users are not allowed to see what action items users have at that moment. That complicates the control of specifications. Some specifications might be forgotten to user's action items if the user does not use PLM regularly. Transferring these specifications could also be easier, because only admin users can transfer these items to all PLM users. A normal user can send a specification only to entitled persons who are next in the acceptance process.

Output of data from PLM is not working well. It is hard to get a print of specification that might be useful for interest groups. A screenshot from application is the only method, but it is not the most informative and visually clear to present things. It does not give very professional image for customers if corporate's materials are not presentable.

5 Recommendations

User experiences of PLM were rather negative. PLM system needs obviously improvements to make it better for Raisio's needs. Unfortunately it is a fact that Agile PLM was bought as a non-tailored version. Therefore many improvements cannot be done and the system will have certain features the in future also. Anyway these recommendations are hopefully taking into consideration when the next versions are designed.

First and the most important improvement should be the simplification of the program. This way user-friendliness could step into a new level. Processes should be done without useless clicks and unnecessary confirmations at each step. Appendix 4 shows how laborious it is to change specification data. Those kinds of normal processes in PLM should be done with three steps. The first step is to put the specification to edit-mode, the second is for making change and the third is to put edit-mode off. Moving from specification to another is made too difficult. The web browser's previous button does not work either and it logs you out of PLM after pressing it. In some cases it is possible to move to previous specifications with history feature, but only when you have specification already open. That feature must be improved so that the previous pages/specifications button could be available everywhere. The best solution would be of course making the previous button of web browser working.

A good starting point for better utilization of PLM is training for users. Situation has changed a lot after the program was implemented two years ago. Now there are massive amount of product data, which could be exploited better. Training should be available for old users as a repetition and also new ones who could benefit from PLM. New users who would be using PLM only as a data bank could learn only the basic features. That way training would not be loaded with new information, which could confuse people and cause lack of interest at the beginning. An ideal situation would be a program that is so easy to use that there is no need for training. If users use more PLM they will be better users and get more out of it. Using of PLM should be distributed to all departments and business areas. Training of employees requires resources, but when people use program efficiently and finds the needed information, it will improve the efficiency of company in the long run.

But what to do with the old common data network drive? There is no need for common data anymore in the same extent. It can be used as a backup, because there is so much data that can remain there. Updates and new data input will continue in PLM as before.

PLM has almost all data in text form besides specification documents that have figures. Raisio could add palletising pictures or product pictures to PLM. Those would help users to get the visual picture of products that they normally do not see when working all day long in office. Palletising pictures are now stored in common data, but they could be moved to PLM, which has already a place for them. Also a sitemap of application would show the big picture and the relationships between functions. Visualisation is an efficient method for people to understand new entities. It would also increase the user-comfort of PLM.

When a company is considering a PLM system it is important to remember that a new system may have overlapping information with old applications. Raisio has at the moment SAP, which is used as an ERP system, Brand Bank is used for saving product artwork and old common data is still used in some cases. All these programs have overlapping information with PLM. SAP is having the most of the product data that PLM stores. Integration of systems decreases possible manual data entry errors and enables instant view of changes in both systems (Tooling and production: PLM's changing role, 2007). It is possible to create a link between PLM and SAP, but it is rather expensive to implement. It is easy to be wise afterwards and therefore we should look into the future.

6 Conclusions

This thesis concentrated on Agile PLM software's development to fulfil Raisio's needs better. The questionnaire indicated what kind of opinions and feelings PLM aroused in users. Most of the answers were negative expressing the current situation, but also positive issues appeared, especially when looking things at long range.

Theoretical background covered explanation of PLM concept especially in product data management. It showed what PLM is in today's business world. PLM is a pretty broad concept that can be implemented in different ways. The idea was to give basic view of what PLM consists of and for what purposes it is used in companies.

My opinion is that Agile PLM covers the idea what PLM is about, but it is a too comprehensive application to Raisio for only product data management and new product development, but a smart program for a company that is using it for wider purposes. Current version does not cover all necessary features of PLM, but hopefully next versions succeed better in practice.

The source material was basically covered by books, which gave a basic view to PLM concept. Articles supported the theory part by giving the latest information of topic. Interesting fact was the terminology of Product Lifecycle Management and its comparison to Product Data Management. I had two identical books from same authors Antti Sääksvuori and Anselmi Immonen. The only difference with the books was written language. The Finnish version was talking about PDM and English version used the term PLM. I did not really find a reason why the terms were comprehended equals because they are not. From the page 10 you can see my comparison between terms PDM and PLM.

Agile PLM is software with great possibilities. This autumn's updating hassle has increased the amount of product data, should be used for its purpose, to ease daily operations, help decision-making and improve quality. Anyway it is already helping daily processes with product data information.

The two biggest problems in this case are the users and the program itself. Training for new and old users must be done as soon as possible. The idea is to spread PLM to a

company-wide program that would be broadly used. Hopefully next versions of PLM are better in user-friendliness, because that feature is not covered at all in present version. Hopes are high for PLM to succeed in the future, but it will happen only if Agile PLM's next version is much better and Raisio takes out all the benefits from Agile PLM.

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APPENDICES

Appendix 1. Questionnaire

- 1. Has the use of PLM helped you with your work? Where?**
- 2. Why you believe that the use of PLM is still limited and how it could be more used?**
- 3. Things that are slowing doing the use PLM?**
- 4. Features that could be added to PLM?**
- 5. Features that can be remove from PLM?**
- 6. Own opinion of PLM**

Appendix 2. Screenshot from Agile PLM's Compliance tab

Summary Packaging Compliance Related Specs CSS Supporting Documents References Approval/Audit Trail

Extended Attributes

Extended Attributes	Notes

Consumer Unit Product Information (Custom Section)

Attribute	Value	Value 2	Validate
Syndicate to Sinfos		---	0
Sinfos Action Request/Sinfos toimenpide	Change	---	0
Start Validity Date/Voimaantulopäivä *	Monday, September 10, 2012	---	0
Trade Item Unit Descriptor/Tuotteen hierarkiataso/tyyppi *	BASE_UNIT_OR_EACH	---	0
Target Market Country *	FINLAND	---	0
Sinfos Target Market Country/Kohdemarkkina *	FINLAND (FI)	---	0
Private Label *	No	---	0
Start Date/Kausisaatavuus alkaa		---	0
End Date/Kausisaatavuus päättyy		---	0
Number of Base Units Contained/Sisältyvien vähittäistuotteiden lukumäärä *	1	---	0
Product Name in Finnish/Tuotenimi suomeksi (max. 35) *	Elovena 10x30g tumma suklaa keksi	---	2
Product Name in Swedish/Tuotenimi ruotsiksi (max. 35) *	Elovena 10x30g mörk choklad kex	---	4
Product Name in English/Tuotenimi englanniksi (max. 35) *	Elovena 10x30g dark choc. biscuit	---	2
Item Name in Finnish/Täydellinen tuotenimi suomeksi (max. 105) *	Elovena 10x30g tumma suklaa välipalakeksi	---	63
Item Name in Swedish/Täydellinen tuotenimi ruotsiksi (max. 105) *	Elovena 10x30g mörk choklad mellanmålsex	---	64
Item Name in English/Täydellinen tuotenimi englanniksi (max. 105) *	Elovena 10x30g dark chocolate snack biscuit	---	62
Despatch Unit/Kuljetusyksikkö *	No	---	0
Invoice Unit/Laskutusyksikkö *	Yes	---	0
Ordering Unit/Tilausyksikkö *	No	---	0
Product Type Horeca Product *	No	---	0
Consumer Unit/Kulutustuote *	Yes	---	0
GTIN of Item Substituted for/Korvattavan EAN		---	0
Manufacturer's Name/Valmistajan nimi (max. 35) *	RAVINTORAISIO OY	---	19
Net Content/Nettosisältö	10	Piece (PCE)	0
Base Price Declaration Relevant/Vertailuhinta ilmoitettava *	Yes	---	0
Base Price Relevant Content/Vertailuhinnan peruste *	0.300	---	0
UOM for Base Price/Vertailuhinnan mittayksikkö *	Kilogram (KGM)	---	0
Functional Name in Finnish/Toiminnallinen nimi suomeksi (max. 35) *	välipalakeksi	---	22
Functional Name in Swedish/Toiminnallinen nimi ruotsiksi (max. 35) *	mellanmålsex	---	22
Functional Name in English/Toiminnallinen nimi englanniksi (max. 35) *	snack biscuit	---	22
Package Language/Vieraskielinen teksti tuotteessa		---	0
Item Info in Finnish/Tuotteen kuvaus suomeksi (max. 350)		---	0
Item Info in Swedish/Tuotteen kuvaus ruotsiksi (max. 350)		---	0
Product Classification/Tavararyhmä *	0672 Muut keksit	---	0
GPC Brick Code *	10000161 - Pikkuleivät/Keksit (Huoneenlämmössä Säilyvä)	---	0
GPC Attribute Type and Value/GPC Attribuutin nimi ja arvo	20000056 - Diabeetikoille	30002960 - EI	0
GPC Attribute Type and Value/GPC Attribuutin nimi ja arvo	20000079 - Merkintä gluteenittomuuden tyypistä	30002960 - EI	0
GPC Attribute Type and Value/GPC Attribuutin nimi ja arvo	20000123 - Merkintä rasvapiitoisuudesta	30002515 - LUOKITTELEMATON	0
GPC Attribute Type and Value/GPC Attribuutin nimi ja arvo	20000159 - Suolainen/Makea	30002373 - MAKEA	0
GPC Attribute Type and Value/GPC Attribuutin nimi ja arvo	20000018 - Pikkuleipien/Keksien Tyyppi	30002515 - LUOKITTELEMATON	0
GPC Attribute Type and Value/GPC Attribuutin nimi ja arvo	20000191 - Viljan/Jyvien tyyppi	30001712 - KAURAHUUTALEET	0
GPC Attribute Type and Value/GPC Attribuutin nimi ja arvo	20000194 - Kuorutuksen/Täytteen Tyyppi	30002515 - LUOKITTELEMATON	0

Appendix 3. Screenshot from Agile PLM's Global Supply Management – application

Agile PLM for Process

GSM - Global Specification Management

[Home](#)
[Applications](#)
[Profile and Preferences](#)

[Run Previous Search](#)
Login Name Hannes Salminen

[Create Copy](#)
[Print](#)
[Item History](#)
[Workflow](#)

▼

(trd) 5000863-002 - Elovena 10x30g dark chocolate snack biscuit (Approved)

[Summary](#)
[Packaging](#)
[Compliance](#)
[Related Specs](#)
[CSS](#)
[Supporting Documents](#)
[References](#)
[Approval/Audit Trail](#)

Summary Information

Spec Name:

Elovena 10x30g dark chocolate snack biscuit

Short Name:

Elovena 10x30g tumma sukkaa välipalakeksi

Spec Status:

Approved - This item has been approved.

Category:

Food Northern Europe

Sub Category:

Retail

Group:

Retail

Originator:

Finland

Supersedes:

5000863-001 - Elovena 10x30g dark chocolate snack biscuit

Reason for Change:

Spec #:

5000863

Issue #:

002

Status:

Approved

Effective:

Friday, June 08, 2012

Available Date:

End Available Date:

Last Edit:

Monday, September 10, 2012

Product Identification

Item Type:

Consumer Unit

GTIN/UPC/EAN:

6411200107286

Description:

Välipalakeksi, sopii laktoosi-intolerantikoille sekä yleiseen käyttöön.

PLU Description:

POS Description:

Next Lower Level Items

Spec #	Spec Name	GTIN/UPC/EAN	Quantity

Parent Items (Calculated)

Spec #	Spec Name	GTIN/UPC/EAN
5000932-002	Elovena 6x10x30g dark chocolate snack biscuit	6411200207283

Brand Information

Trading Company:

Brand:

Elovena

Sub Brand:

Product Name:

Brand Description:

Label Owner:

Appendix 4. Changing packaging material spec data in Agile PLM

1. Open packaging material specification
2. Press workflow
3. Insert compulsory comment
4. Press arrow to send it with workflow
5. Choose person who will do the changes (PLM sends “a specification is now on your action items list - e-mail” to person in question)
6. Status is now update and you are able to do changes to specification (e.g. update new material specification document)
7. Steps 2-5 needs to be done again to send specification with workflow to change the status from update to approved.

