Alfa Laval's OnePLM

Björn Wilhelmsson

Abstract This case study looks at the benefits and lessons learned resulting from Alfa Laval's OnePLM program. Alfa Laval AB is a €3.6B provider of products and solutions based on its three key technologies of heat transfer, separation and fluid handling. The drivers for OnePLM go back to 2012, when a "pain point hunt" identified some 300–400 pain points related to product data management. Company management understood the problems were impacting the business, and the OnePLM program was launched. By 2018, OnePLM had been rolled out in 3 of Alfa Laval's Business Units. Benefits have been achieved in many areas, including a rationalisation of the product portfolio, better insight of customer needs, and introduction of standardised business processes. A key benefit of the approach taken in OnePLM is that it has enabled a practically self-financing PLM program. Among the lessons learned have been the importance of: top management commitment; key stakeholder involvement; change management; focusing first on information; and having the right implementation team and partners.

Keywords PLM program · Product architecture · Product portfolio management · Lessons Learned · Configure to order

1 Company Background

Alfa Laval AB is a leading global provider of specialised products and engineering solutions based on its three key technologies of heat transfer, separation and fluid handling. Alfa Laval's heat exchangers transfer heat from, for example, one liquid to another. Separation technology is used to separate liquids from other liquids, and to separate solid particles from liquids or gases. The Separation offering includes separators, decanter centrifuges, filters, strainers and membranes. The fluid handling offering includes pumps, valves, and tank cleaning equipment.

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J. Stark (ed.), *Product Lifecycle Management (Volume 4): The Case Studies*,
Decision Engineering, https://doi.org/10.1007/978-3-030-16134-7_6

Alfa Laval serves customers in many industries, including: food and beverage; chemical and petrochemical; pharmaceutical; marine and diesel; machinery; mining; and wastewater treatment. Alfa Laval's business is divided into three Business Divisions: "Energy"; "Food and Water"; and "Marine" that sell to external customers, and one division, "Operations" covering procurement, production and logistics.

The Business Divisions (BDs) are split into a total of twelve Business Units (BUs). Each Business Unit is very much oriented towards one, or a few, core products.

Three different internal operating models meet the different needs of customers. The "Standard" model applies to the sale of standardised components through channels and online. This model is for products and spare parts which are 100% predefined and can be purchased with a single item number in, for example, a web shop. "Configure-To-Order" (CTO) applies to standardised components with standard configuration formats for adaptation to specific applications, capacities, etc. This model has been applied successfully for several decades. The "Engineer-To-Order" (ETO) model is for customised systems and solutions for customers with specific, order-unique requirements. This approach has grown substantially in recent years due to many relatively recent acquisitions.

Alfa Laval invests about 2.5% of its sales in research and development launching between 35 and 40 new products every year.

Alfa Laval has over 300 products in its three major product lines. Many of these have thousands of variants, resulting in several million unique part numbers.

The aftermarket is a significant part of the company's business. Alfa Laval's products have a long service life, which leads to a large installed base that—to varying degrees and with varying frequency—requires both spare parts and service. Alfa Laval has thousands of products installed throughout the world. As a part of service contracts, it maintains an inventory of spares to support these products, some of which have hundreds of spare parts, for up to 40 years.

In 2017, Alfa Laval had annual sales of about 3.6 billion Euros. The company had 29 production sites worldwide, and about 16,400 employees, most of whom were in Sweden, Denmark, India, China, the US and France.

2 OnePLM: The Starting Situation

The drivers for OnePLM go back to 2012, although the OnePLM program itself wasn't launched until 2014. In 2012, business processes weren't standardised, each Business Unit having its own set of loosely defined processes. R&D and Operations often worked together cross-functionally, but Service/Aftermarket didn't. There weren't enterprise standards for some important concepts and terms such as lifecycle states. There wasn't a central repository for parts and products. Much of the product information management was handled in a combination of Excel and ERP. Only two BUs used a Product Data Management (PDM) system. There wasn't a common ERP system. There wasn't a common CAD system.

The launch of an eBusiness solution in 2011 highlighted that there was a lot of incomplete and incorrect product data in the company. In response, a "pain point hunt" was launched. It identified some 300–400 pain points around the company, all related to product data management in one way or another. These included: low product data quality; a lack of engineering change control; unclear ownership of product data; product configurators that weren't easy to use; finding reliable data was often time-consuming; insufficient Master Data Management; no proper product portfolio management, for instance, no phase-out culture; the roles and responsibilities of BUs and Operations weren't clear and defined; and customer complaints about late deliveries and incorrect information.

The root causes were identified. Among them were: unclear governance of data; local approaches to global problems; multiple and manual entry of data into a multitude of systems; poorly-defined product models that were often inflexible and designed to meet R&D and Production needs, but not those of Sales and Service. Many activities were very dependent on the knowledge of particular individuals.

Company management understood that the problems were impacting the business. In 2014, they launched the OnePLM program with clear instructions to strive for one solution for the entire company, hence OnePLM.

PLM was defined as the process of managing the entire lifecycle of a product from its conception, through design and manufacture, to service and disposal. Product information was seen as vital: throughout the value chain; throughout the product lifecycle.

The objectives of OnePLM are to: provide high quality product information for products and spare parts; accelerate response to customers and changing markets using modularised products; reduce waste in core business processes; and provide a platform for digital descriptions of products, production processes and equipment.

Soon after the program was launched, the enormous assortment (product offering) in Alfa Laval was highlighted. This results from on-going innovation, acquisitions and meeting customer requirements. However, a large part of it appeared to be dormant—and incurring significant costs. In response, management added a fifth objective for OnePLM, "Drive professional assortment control". They also set "assortment wash-out" as a pre-requisite for a BU to join the OnePLM program.

The scope of OnePLM was defined as the processes, standards and tools for the creation, maintenance and distribution of product information during the entire product lifecycle. The scope included a common modular product architecture and a standard product information model. The product architecture addresses products, modules, module variants, module sets, parts, etc. The product information model includes BOMs, CAD models, technical documents, material standard documents, engineering configuration rules, etc. The processes in the scope of OnePLM include New Product Development (NPD), Engineering Change, Design to Order (DTO); Document review and approval; and Assortment Control. The tools include Configurators, CAD, PDM, Business Intelligence, and manufacturing ERP systems.

3 The Approach

The OnePLM program has a full-time Core Team and part-time representatives from Business Units. In addition to the Program Director, the Core Team includes PLM Business Analysts and Architects, an Information Manager, a PLM Solution Owner, a PLM Solution Architect, and an Organisational Change Management (OCM) Lead.

The OnePLM program reports to Alfa Laval Group Management, and is sponsored by the Chief Financial Officer (CFO).

OnePLM works in three streams: Development; Roll-Out; and Production as illustrated in Fig. 1. All are based on a common "OnePLM template". A new version of this package is released every four months. It contains: standards and definitions for product and product information architecture and objects; support for business processes; the latest versions of the tools; and support for these tools. The template contains many PLM capabilities, not only the basic ones such as parts and BOM management, but also document and content management. The template will continue to grow with more PLM capabilities in the future.

OnePLM is rolled out on a Business Unit by Business Unit basis, starting with BU Gasketed Plate Heat Exchangers, BU Hygienic Fluid Handling, and BU Decanter.

During roll-out to a particular BU, implementation of the basic PLM capabilities is mandatory, but add-ons such as document management are voluntary.

The Core Team's role in roll-out includes: ensuring that the solution is fit for the BU's business; guiding the BU through the rollout of OnePLM; leading the change management effort in the BU; providing training; and cleansing and enhancing product data (Fig. 2).

One of the main responsibilities of the BU representatives in the program is to adapt products to the new standard Product Architecture. The BU representatives also perform massive data cleansing and enhancement to ensure high quality data from

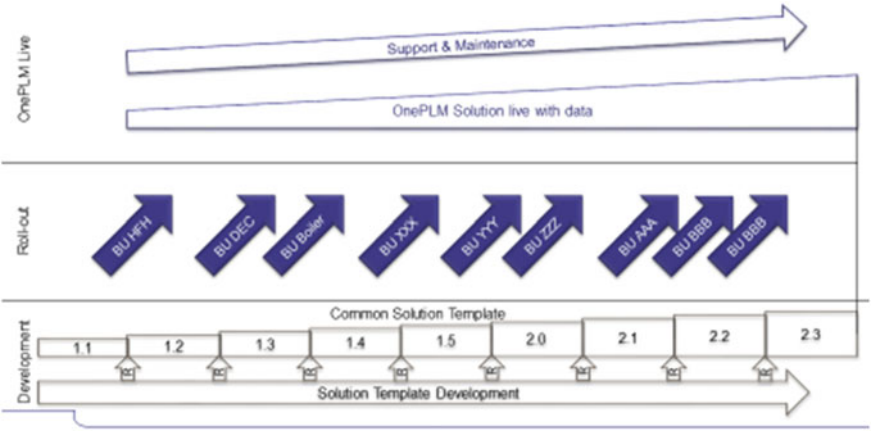

Fig. 1 The three streams of OnePLM: development, roll-out and production (OnePLM live)

Fig. 2 The core team has one mission and set of deliverables for development, left, and another mission and set of deliverables for roll-out, right

Day 1. They also, supported by the Core Team, drive the BU change management activities.

4 The Implementation

The first development of the OnePLM template addressed the CTO area. From the beginning it had been clear that a modular Product Architecture (PA) would have to be defined. And that it should be common across the different CTO product groups in the company. It took close to 18 months and two failed attempts to develop the PA concept. However, the third attempt succeeded, showing that the PA actually worked on 4 completely different products.

The PA is the common language in Alfa Laval's Digital Trinity, so it must be kept very clear and clean, otherwise automation of CTO business would be very difficult if not impossible. The common Product Architecture is at the heart of the Digital Trinity which is made up of: a Configurator (single source for producible product configurations); OnePLM (common product information standards, processes and tools); and standardised supply chain tools and processes, as illustrated in Fig. 3. The Trinity includes or interfaces to other capabilities: Configurator interfaces to Customer Relationship Management (CRM) and Sales ERP systems; OnePLM includes an Engineering configurator, CAD and PDM; supply chain tools interface to supplier and Manufacturing ERP systems.

Another activity has been the implementation and management of the PA from a Master Data Management (MDM) perspective.

In parallel to defining the PA, the necessary standards for the objects making up the PA, such as modules, module variants and parts were defined. Lifecycle states were standardised. From the beginning, an information-centric approach was taken. It has been maintained, tools must come later.

A third parallel activity was definition of standardised business processes, such as the Engineering Change process. It had been thought that alignment of many BUs, each with its own way of working, would be tough. However, a combination

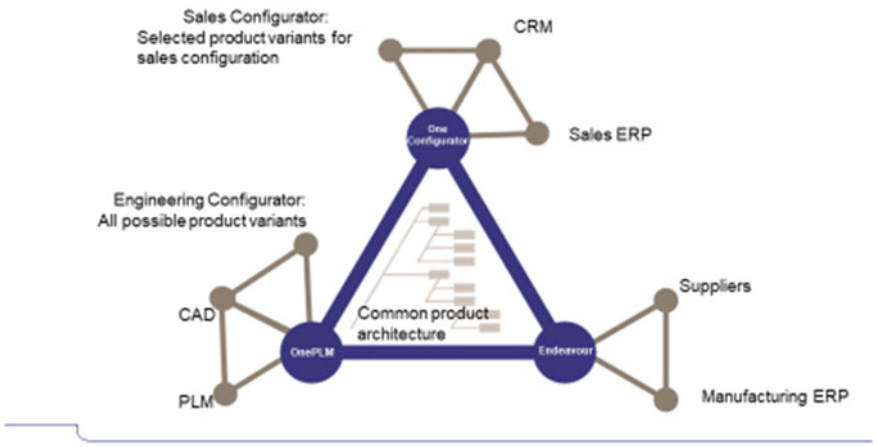

Fig. 3 The "digital trinity" with the modular and standardised product architecture in its very centre

of many common pain points, a common and accepted PA, and a clear vision of how CTO should work in the future made this work quite smooth in the end. In addition, processes were developed for Wash-Out and Annual Assortment Review.

Another activity was to take fundamental decisions about "what will be done where" from a system point of view. One such example was where to manage variation. The candidates were the configurator, the PDM system and the various ERP systems. In the end, the decision fell on the configurator. The PDM system is "just" a repository of objects, having no logic as to what goes into which BOM or product. Another fundamental decision that was made was to manage eBOMs in the PDM system, and mBOMs in the ERP systems. (However, in 2018 a pilot was started with the mBOM also managed in the PDM system.)

5 The Result, Benefits

The pre-requisite of performing an assortment wash-out has resulted in a number of benefits and customer insights, both expected and unexpected.

Analysis of data for one product group showed 15% of product variants and 48% of spares hadn't been sold for more than 15 years but were still being maintained. Furthermore, that data revealed that 96% of all orders used only 50% of the available variants. Similar patterns were found for other product groups. This is graphically illustrated in Fig. 4.

Using the reports that the analysis tool provided, Product Managers decided to reduce the number of variants for new sales by some 20% and the number of parts, many of them, but far from all, almost dormant, by over 60%. These reductions led to significant cost savings by not having to maintain them with prices, costs, operations,

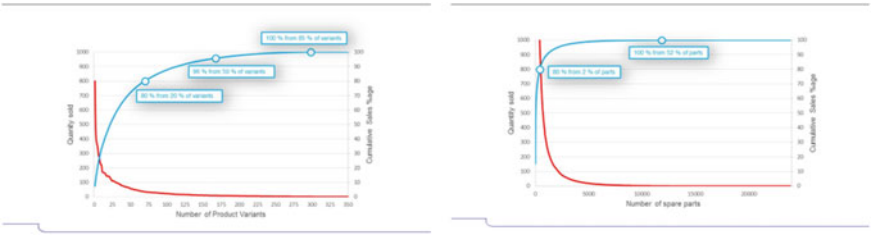

Fig. 4 Graphs for product group "A" showing number of sold product variants, left, and number of sold spare parts, right. Note the very long tails

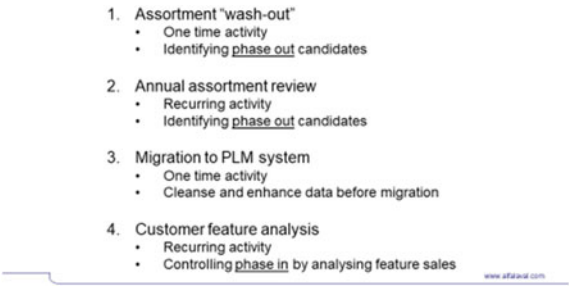

Fig. 5 Four different use cases for the assortment analysis tool

suppliers, compliance and so on. This is the first use case of the analysis tool, called assortment "wash-out", in Fig. 5.

To ensure that focus is not lost on product portfolio management/assortment, Group Management also decided that the efforts need to be sustainable. Consequently, there's now a standardised, mandatory process for annual assortment review and phase-out, which is use case number 2 in Fig. 5.

A positive side effect of the wash-out is that the number of parts to be "dressed up" (cleansed and enhanced) to the new OnePLM standard was significantly reduced. This is use case 3 in Fig. 5. This provided an opportunity to increase the ambition for quality of the migrated data. In the design phase of the analysis tool, a lot of time was spent to get a better understanding of data structures in the legacy systems, and this makes the subsequent data migration to OnePLM easier.

Another very useful aspect of the analysed data is the customer insights that help to better specify new products. This is use case 4 in Fig. 5. By analysing which customer features have sold and which have not sold, it is now possible to better scope the desired buyable features in the CTO business in order to reduce time to market and streamline the supply chains. Some features that were previously offered as CTO for older products will now be available only as Design to Order (DTO).

Understanding the true nature of the product assortment and performing the massive wash-outs have enabled a self-financing PLM program.

Many of the "classical" PLM benefits are also visible, but as the starting point or baseline was not quantified (as a result of not having to provide a traditional business case), these benefits are more difficult to measure.

Key benefits include: a common language to define products; single data entry; consistent data quality; better and faster search for information; improved business processes which now have clear roles and responsibilities. The involved IT systems "talk to each other" and are becoming the digital backbone for connectivity. The analysis tool helps to optimise the product assortment. The modularisation inherent in the PA means more product variants with fewer components; better product differentiation; and faster time to market for new variants. Furthermore, OnePLM allows full control of releases to sales and the supply chain so that product launches can be optimised. This all leads to: more re-use of designs; better decision-taking; more efficient compliance; and more time for value added work.

6 Next Steps

At the end of 2018, OnePLM had been rolled out in 3 BUs, and many more BUs were interested in taking the entire OnePLM offering.

In parallel to the rollouts to the BUs, new capabilities were built and added to the common solution template. In 2019, capabilities for more efficient spare part management will be added in order to support that very important business. Other plans are to create capabilities for external compliance requirements in general, with a particular focus on export control. Many compliance requirements need more stringent substance management in order to be able to roll up the chemical composition of a complete product from its constituent parts.

Approaching roll-out for the next BU, there's a need to move towards "Engineer-To-Order" (ETO). The first steps are taken by a hybrid between CTO and ETO called DTO (Design-To-Order). This process can be applied to CTO products using the new Product Architecture. Just like the CTO process, the DTO process starts in the configurator. It applies when the customer cannot find there exactly what is needed. A "best-fit" configuration is made with a free-text remark about the true need. This "best-fit" is the starting point for the DTO design engineer, who then designs whatever needs to be designed, and either replaces something or adds to the "best fit" BOM which then becomes the true BOM for that particular order.

Another concept about to be launched is the creation of parts, part BOMs and 3D assemblies "on the fly", i.e. in the order process. Instead of the historical CTO approach which dictates creation of all variants (parts and part BOMs) before a product is released for sale, the new approach will only require creation up-front of the variants that are sure to be sold. Thanks to design automation and an automated order flow, OnePLM will create the needed parts, part BOMs and 3D models "on the fly". This activity will be governed by the engineering rules that have been pre-defined for that particular product class. With this approach, there will be no creation of "waste" variants that are never sold, and each variant will have at least

one customer. By tracking which variants are created "on the fly", it is hoped to be able to identify very early some market trends that otherwise would be difficult to detect before everyone else also sees them.

A sister program to OnePLM has started to look at how Industry 4.0 can be applied at Alfa Laval in order to help the business as well as the customers of the equipment. It's still early days, but it's clear that OnePLM will be the backbone for digital twins not only of the products, but also of the manufacturing processes and equipment.

7 Lessons Learned

The OnePLM program team has identified a few "key success factors" for PLM.

Top Management commitment is essential. The pain points and their consequences were explained to the CEO and Group Management. They gave their approval to proceed. The CFO has been the Program Sponsor since its launch and that has been a major success factor as that role is "neutral" to the different stakeholders in the PLM context.

Another key success factor is Change Management. For most people who are "hit" by PLM, it means a new way of working. Often, a bit of the flexibility which many enjoyed in the past is lost, something that is perceived as negative by some people. Some roles, for instance in R&D, are expected to provide more information than in the past, not for their own benefit, but for the benefit of downstream data consumers. That is often a hard sell for which the support of first and second line management is absolutely key. The OnePLM program has worked consistently with a large change management toolbox, including a psychometric tool for assessing change readiness.

The approach to justification of the OnePLM program has been to focus on the pain points in the business, not on the monetary benefits. It has been found that, by focusing on the pain points, which nobody can deny, it is far easier to get the attention of the key stakeholders as opposed to building a traditional business case which can easily be shot down. It was found that calculating the precise expected monetary benefits was an impossible task. The "reduce waste" aspect can perhaps be answered, although with great uncertainty, but the "impact for customers" aspect is impossible to trace back to PLM efforts. It is a matter of faith and belief in the cause!

The OnePLM approach has been to focus first on the information, and above all, the information that needs to be exchanged in the business processes. It was known from the start that, to automate the processes, the information that was sent needed to be 100% consistent across the system landscape. The common PA is the very foundation upon which first the processes were built and, eventually, the IT systems participating in the business processes. One eye has been kept on the Master Data Management aspects of information management, in order to avoid duplicating or creating redundant data.

It's been important to take a holistic view for OnePLM. The program has included work on improving business processes, product information, and information systems, even on improving the way some products are modularised. A very positive side effect of the latter is that the BUs in question are now able to offer a larger variation than before to the market without having to develop new parts.

It's been important to have a strong Core Team and to keep it stable over the long term. The core team is relatively small and consists of people with both business and IT backgrounds and, in many cases, also many years of experience within Alfa Laval. The core team is firmly anchored in the business organisation and operates as a proxy for the entire business when it comes to functional requirements for the IT solutions. Effectively, the core team has its own IT department, which is run using agile methods, so the time from decision until having something in the systems is usually very short.

Another key success factor is having the right IT implementation partners. This wasn't easy, it took three attempts to get it right. Naturally, the partner has to be very knowledgeable about the chosen IT systems, but that's not enough. They must also have a structured approach for knowledge transfer between their clients (as well as between their own employees, on-site as well as off-shore), a continuous training program for their employees, an ability to scale up and scale down when needed, and general business acumen.

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Björn Wilhelmsson received his Ph.D. in Chemical Engineering from Lund University, Sweden in 1995. He has been with Alfa Laval for over 20 years, and held positions in marketing, R&D and product management, including 10 years as Global Head of Product Development for some of the organisation's largest product lines. With his experience, he understands the importance of data sharing across the entire product lifecycle and he brings this insight, along with a very strong focus on "sales-driven PLM", into his current role as OnePLM Program Director, responsible for the enterprise-wide implementation of product lifecycle management standards, processes and systems within Alfa Laval.