52 Mawson Road
Cambridge CB1 2HY
United Kingdom

Tel: +44 (0) 1223 460 439

www.cambashi.com
info@cambashi.com

Fax: +44 (0) 1223 461 055

Cambashi Limited

Commonization and Re-use

- a strategy to reduce cost and improve responsiveness

Author: Peter Thorne, Cambashi

Registered in England and Wales No. 1360554. Registered office as above. VAT No. 393 1001 82

CONTENTS

Cambashi researches the use of Information and Communication Technology (ICT). Our goal is to understand

- the business reasons that drive ICT investment decisions,
- the technology that addresses these issues,
- the market mechanisms that bring users and vendors together, and
- the impact of deployment of applications and infrastructure.

Our work in the Manufacturing Industry sector has grown from a focus on design engineering to include industrial automation and business systems. The ideas and opinions expressed in this white paper are Cambashi's own, based on our continuous programme of independent research and monitoring of the Manufacturing Industry sector. We wish to thank Siemens PLM Software for sponsorship of production of this document, enabling us to communicate our analysis in this format.

1 Introduction

> To do the right thing at the right season is a great art.
>
> *- Moral of Aesop's fable 'The Fisherman Piping'*

The business value of commonization and re-use[1] is growing. This is being driven in part by the systematic approaches made possible by integrated design, engineering and database capabilities in modern Product Lifecycle Management (PLM) solutions. With roots in computer aided design (CAD) and computer aided manufacturing (CAM), these integrated PLM technologies facilitate not only re-use of parts and manufacturing processes, but also sharing and re-use of the rules, guidelines and procedures that define engineering know-how.

This document supports management teams in design and manufacturing companies in assessing and planning commonization and re-use initiatives. It examines the business and engineering issues, and the role of integrated PLM technology.

Commonization

- Find and develop components, sub-assemblies, production assets, process steps and engineering knowledge with potential for more re-use, for example, by introduction of common platforms.
- Refine items to optimize re-usability, for example, through standardization and modularization.
- Add classification, search and access capabilities - make it easy to find and use re-usable elements.
- Develop design rules and working practices to maintain and grow the resource of re-usable parts, processes, and know-how.

Re-use

- Integrate re-usable elements into current and future projects, products and manufacturing process plans.
- Act on opportunities to apply existing – or variants of existing - techniques, design rules, specifications, plans, compliance principles, documentation templates, parts, processes etc.
- Develop procedures to encourage appropriate re-use of existing items first time, every time.
- Achieve target carry-over of parts, processes and specifications from one project to another.
- Control capital expenditure on new production facilities by re-use of machinery and fixtures from existing lines and workcells.

[1] In this document, "re-use" is about information and physical assets used for more than one product – both simultaneously across product lines, and from one product generation to another. Information re-use facilitates re-use of physical items (as in the environmental strategy "reduce, re-use, recycle"), but the focus for this document is other business benefits.

2 Summary

Words may be deeds.

- Moral of Aesop's fable 'The Trumpeter taken Prisoner'

Companies run commonization and re-use initiatives to cut costs, improve quality, reduce lead times and drive efficient conversion of investment into new revenue streams and profit. A commonization and re-use initiative delivers more shared, standard parts, more common platforms, and more modularity in products and manufacturing processes. In addition to operational benefits, these simplifications and standardizations deliver wider strategic impact, for example global sourcing and distribution become more feasible, and there is greater incentive for partners to invest in related products and services.

Scope of commonization and re-use strategies

Physical items - components, assemblies, and production assets such as machine tools

Information items – specifications, service manuals, test procedures, NC programs and PLC software

Architectures - common platform, workcell layout, replenishment strategies, and shopfloor system integration

Knowledge - design rules, operating parameters, module interactions, cost/performance trade-offs, check-lists for problem solving, simulation schemes etc.

Contrary to many perceptions, commonization and re-use does not conflict with performance optimization. A good commonization and re-use strategy identifies sources of differentiated value – from architectures and design rules to parts, materials, and manufacturing processes. This helps focus engineering strategies and resource allocation into the right areas for competitive advantage.

A solid foundation of re-use enables a company to reduce time-to-market and achieve profit from short product lifecycles. For example, by using established manufacturing processes, the risk inherent in dramatic product changes is reduced. Or, a common platform for a product or manufacturing process can be used to define layouts and module integrations. The result is many aspects of a previous project - from engineering workflows to performance simulation techniques - will be both suitable and predictable, even when individual modules are largely new.

But neither commonization nor re-use happens automatically. PLM technology provides the essential visibility, communication and management of technical information – including the definitions of physical items, information items, architectures, and the multiple constituents of engineering knowledge – to support commonization and re-use initiatives. PLM can help integrate commonization and re-use criteria into everyday working practices and decision making.

Sometimes, commonization and re-use strategies depend on deep technical insights, perhaps coupled with significant change. But in all cases, since costs may be incurred

in one area to achieve savings in another, responsibility for commonization and re-use initiatives must be held at the level in the management team that is responsible for end-to-end performance of design and production, not just for local productivity of a particular group.

The benefits of making the right investments in this area are substantial. Companies with strong capabilities gain operational cost, quality and lead time benefits. They also gain strategic advantage not only through better recognition of the sources of their differentiators, but also through stronger capabilities to guide and drive partners across design, production, distribution and service.

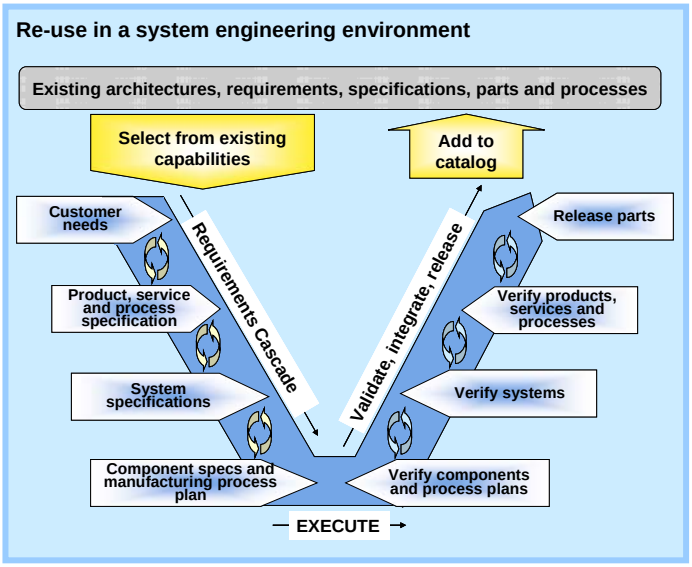
3 The value of commonization and re-use

> The value is in the worth, not the number.
>
> *- Moral of Aesop's fable 'The Lioness'*

The number of concepts, parts and process steps tends to increase

Without specific attention, the levels of commonization and re-use tend to fall, and one-off special solutions tend to increase. The reasons for this include local performance optimization, powerful product and process development tools, limited communication between groups, and market demand for customizations. For example, when faced with a specific customer requirement, it is no surprise that creative product and process designers choose to develop a new part and a new process specification to satisfy the requirement. In many situations this is the quickest way of getting a job done.

Even systematic development methodologies do not guarantee optimum commonization and re-use. Many approaches define a cascade or decomposition of high-level requirements into structured lists of functional requirements, component specifications and process parameters. But how are requirements for re-use handled? Overall project and business goals of time, cost, value, return on investment and so on are hard to apply to day-to-day decisions. Re-use may not be the optimum way to achieve these goals.



Limited communication between groups also tends to drive an increase in the count of concepts, parts and processes. In most companies, time pressures are such that a proportion of decisions are made on the basis of immediate, local issues. Naturally, no-one wants to stop a skilled individual anywhere from shopfloor to boardroom identifying ways to improve quality, costs and timescales. Indeed it is quite usual for individuals at every level to develop better ways of doing things. What is much more difficult is to capture this knowledge of a better approach, and make it accessible to other people. The widely accepted objective to share know-how, and create and use re-usable assets, modules, components and processes, is too difficult and gets sidelined.

Commonization and re-use

The case for more commonization and re-use is growing stronger every day. As product lifecycles shorten, re-use of parts, processes, equipment, tools and engineering know-how from one product to another, and one product generation to another, has a vital role in minimizing time to market and controlling costs. Global competition, including companies from newly industrialized countries with new approaches and lower cost structures, means that every company wants to:

- achieve more from every engineer
- invest less in production equipment and tooling, and
- obtain every possible price advantage on purchased materials and components.

Failure to achieve optimum levels of commonization and re-use results in immediate extra costs of duplication, and also a long trail of additional costs (see panel 'The not-so-hidden costs of limited re-use').

The not-so-hidden costs of limited re-use

Each additional unique part and process triggers a set of connected costs. These costs start in the engineering organizations across the supply chain, with direct development costs. There are also indirect costs such as delays in finding information, and the overheads of people, systems and space to store and manage part and process details. The procurement group may be maintaining unnecessary relationships and contracts with material, tool and service suppliers. In production, there may be assets, storage capacity, personnel and management resources assigned to maintain a capability that is rarely used. Capital expenditure goes on new machines while existing similar equipment is under-utilized, sold or scrapped. There are idle inventories of materials and intermediate products. Personnel need to be familiar with more process steps, increasing training costs, documentation maintenance and staff scheduling complexity.

Unique parts need their own technical and marketing documentation, and may have higher warranty costs. Distributors and service organizations need to be familiar with more procedures and stock a longer list of spares. Planning, ordering and replenishment of their stocks is more complicated and more expensive. Flexibility is reduced.

***Complexity has negative impact on strategies*.** For example, proliferation of unique parts means lower volumes of each part. This makes it more difficult to justify in-house investment for critical parts, and achieve optimum sourcing contracts for less significant parts. Similarly, rarely used processes can distort capital investment, factory layout and outsourcing decisions as well as being sources of quality problems.

Re-invention of know-how – for example, design rules, architectures, operating principles, and engineering processes - involves direct costs of duplication and creates multiple similar solutions. The unnecessary complexity leads to delay and confusion, and makes it difficult to share best practice. Opportunities to streamline and simplify are lost.

Material, energy, recycling and re-use benefits of standardized parts and processes will become increasingly important as environmental considerations and green credentials gain priority. The cost and complexity of recycling procedures for products will depend to a degree on the number of different parts. Standard manufacturing processes will make it simpler to re-use production equipment. Fluency in commonization will simplify investment to create product and production modules that can be re-purposed.

Design and manufacturing management can use commonization and re-use initiatives to identify the technical sources of their company's differentiators and competitive

advantage. Assessment of concepts, methods, parts and processes in this way guides outsourcing strategies and helps create a focus on strategically important areas.

There is no reason to limit initiatives to just one aspect, but assignment of senior people to think through and compare the likely value of

- part and manufacturing process re-use, and
- sharing and re-use of know-how

is a good way to get issues on the table and develop consensus on priorities.

See the big picture

The costs and benefits of commonization and re-use accrue across multiple departments. This makes it more difficult to launch and manage an initiative but ultimately makes the business impact greater. For example, a design initiative to standardize materials or size ranges of components may allow manufacturing process engineers to achieve higher performance and utilization of a smaller set of production resources.

Similarly, 'downstream' initiatives can create guidelines for 'upstream' activities. For example, manufacturing might report that tight tolerances on large flat parts force use of non-standard jigs and fixtures, resulting in slow changeover times. Designers may be able to review tolerances, or perhaps even the need for a large flat part.

This means approaches, goals and initiatives for commonization and re-use must be owned at the level in the management team responsible for end-to-end performance. This is the vantage point that can see the value of a way of working that creates and uses re-usable parts and processes, even when it involves effort and change in one area to achieve savings in another. End-to-end performance metrics must be used in, or at least be visible to, each group involved. Otherwise, natural focus on local metrics can lead each group away from optimum levels of re-use.

What must be done

The core issue is one of information handling and communication. To improve commonization and re-use, groups across the extended value chain must find it easy to define, communicate and use relevant architectures, standards, rules, procedures, documentation, processes and parts. This means creating a 'place' for these items, and an access scheme that gives people confidence they can find all relevant information quickly. Projects must be defined, and requirements must be framed, to enable decisions about commonization and re-use to be made, communicated and actioned at every level from whole-product architecture to individual component.

4 Trade-off decisions

> Every truth has two sides
>
> *- Moral of Aesop's fable 'The Mule'*

Simple principles, but complex situations

Trade-off decisions for commonization and re-use are based on a simple principle – eliminate duplication and waste – yet real situations are complex. A re-usable architecture, method, part or process is conceived, developed, documented and tested once, then used in many products and situations. This spreads its development costs over a broader base, eliminates wasted development effort for equivalent items, and minimizes management effort keeping track of all the alternatives. The principle applies across a very broad range, from service manuals and analysis techniques to factory layouts and maintenance strategies.

So is re-use always right? Obviously not – a bicycle made mainly from lawnmower parts may satisfy a manufacturer's re-use targets but will only sell in the 'novelty' market. An installation and commissioning process for custom built packaging machines is not suitable for portable equipment sold by the same manufacturer.

However, away from extreme examples, judgement is more difficult. Perhaps an existing standard part is heavy, because it handles higher loads than specified for the current requirement. Is it worth creating a lighter version of the part, or does the principle of re-use mean accepting the weight penalty? Or perhaps an existing process was specified with volume production in mind, and the new product line is likely to involve small or medium size batch production. Does the fact that the existing process can be deployed quickly justify building it into a workcell for the new product?

Pragmatic decision making

Unfortunately, there is no general answer to these questions. Even scoping the range of factors to consider is not easy. But if every decision requires an extensive spreadsheet to model and analyze the variables, this creates a new source of cost and delay - a paralysis by analysis.

A more useful approach is to address the source of the problem, which is the accumulation, probably over many years, of hundreds of decisions to solve a problem from first principles, generate a new document, make a new plan, or create a new part when refinements of existing versions would have made them re-usable. Why was this not recognized at the time? Or if it was recognized, why was there no adequate response?

There are probably at least two parts to any answer to this question. Firstly, the excessive time and cost of finding appropriate information to be confident about re-use; secondly, few working guidelines or procedures beyond "re-use where you can".

One of the most successful strategies that addresses these issues is the use of common platforms. This concept, applied to products, is straightforward – create a skeleton, backbone or framework unit that is the starting point for many product

variants. Manufacturers of goods from cars to industrial sewing machines and consumer electronics have improved business performance this way. A common platform strategy is not limited to products; it can apply to items as diverse as production processes, maintenance documentation and service delivery workflows. The success of a common platform strategy depends on deep insights to specify the core platform with the right mixture of fixed definitions, sets of principles, criteria and standards.

A common platform provides a framework for commonization and re-use. It provides a divide-and-conquer simplification by structuring the item into elements, and, for each element, providing reference points – such as a standard interface – from which to define or search for compatible, re-usable concepts, information, parts and processes.

Using the right tools

Imagine new capabilities to:

- Systematize definition and maintenance of specific, quantified guidelines for standard, re-usable concepts, parts and processes
- Make it easier to find all the information about a potentially re-usable item
- Improve communication between groups, and provide visibility of their requirements.

These types of capability make it possible for engineering managers to shift the balance of daily decision making away from local issues and provide structures – such as a common platform - within which commonization and re-use become a systematic, controlled, natural way of working. Future developments not only make more use of existing architectures, parts and processes, but also create more re-usable items for the future.

It is no surprise that the tools most able to improve the situation are information access, communication and management tools.

Product Lifecycle Management (PLM) is the information technology that focuses on parts and production processes. PLM is the technology used by engineers to gather, create, analyze, change, communicate and manage product and process information. PLM is the place to look for the tools that will deliver improvements in commonization and re-use.

5 The levers of change

> Prepare today for what may be needed tomorrow
>
> *- Moral of Aesop's fable 'The Ants and the Grasshopper'*

Making a difference

Finding the resource to implement in-house change is not easy. In some environments, it may be possible to launch a standalone commonization and re-use initiative. In many cases, it will be more appropriate to build commonization and re-use methods, objectives, and goals into other initiatives.

The panel lists a few examples of design and manufacturing initiatives into which PLM enabled commonization and re-use strategies can be integrated. Management teams must look for every opportunity for synergies, and avoid any clash or duplication that standalone initiatives could trigger.

Commonization and re-use can be part of many design and manufacturing initiatives

Standardization – the methods used to support national and international part, tooling and process standards can often be extended to handle company and product line standards and shared parts. The difference is that there is no external definition of the parts, tools and processes.

Development of families of parts – reworking a number of unique parts into a family involves parameterized re-use of basic design and process information to generate information for each family member.

Modularity – achieving modular designs for both products and production machinery involves establishing certain parameters (size, weight, power, interface and attachment methods etc.). These fixed elements create opportunities to achieve commonization of parts used in each of the modules.

Converting ETO to ATO – creation of common platforms with modular, configurable add-ons is one way of converting expensive, slow engineer-to-order (ETO) into repetitive, manageable assemble-to-order (ATO). However, commonization and re-use applied at the level of architectures, design guidelines and standard methods can enhance ETO and may be an alternative approach.

Inventory reduction – a procurement or production initiative may be based on review of part numbers and alternative parts specified in process plans. Identified parts will often require engineering review, which may be a starting point for commonization.

Design for X – design for assembly, design for manufacturability and design for service initiatives may achieve some of their objectives through commonization and re-use. For example, development of design rules for manufacturability will include standard feature dimensions.

Lean – lean initiatives address all sources of waste. Like commonization and re-use, lean strategies require communication, collaboration and consensus across multiple groups in the value chain.

Six Sigma – development of standard tooling and processes, then focusing on those processes, can be a very direct way of achieving six-sigma targets in production.

Breakthrough initiatives

Development of the 'next generation' of a product line, and investment in new production facilities, are both events that create important opportunities for leaders in design and manufacturing to propose breakthrough initiatives.

Scoping and specifying a breakthrough initiative needs engineering and business insight. Commonization and re-use principles can help guide decisions. In particular, assessment of the areas where commonization and re-use will provide payback provides useful indications of new and better ways of working. In some environments, a focus on re-use of standard parts may be appropriate. But in many cases, the complexity of products and the rate of change demanded by the market make it equally critical to achieve re-use of know-how, methods and architectures. Perhaps a common platform is the foundation. Perhaps large, modular assemblies with standard interfaces will be the best way to give suppliers the freedom they need to drive down cost and also share project risk.

What gets measured gets managed

There are many metrics with potential value in managing commonization and re-use. In some environments, the "carry-over" from one product or manufacturing project to the next provides relevant insight – 60% carry-over may be appropriate in some situations, 100% in others. In other cases, it is the growth of part numbers in a product line, or tools in the tool store, or process plans, that measure the re-use level being achieved.

Visibility of the relevant metrics is essential. Building use of the metric into everyday working practices can also help. For example, in situations where 100% carry-over is a realistic target, perhaps use of a new component or process step should trigger a different review process.

Formal review procedures help. A standard agenda for a review meeting can contain assessment of commonization and re-use. Targets for commonization and re-use can be built into the criteria for stage gate review.

6 Aiming for and achieving the right targets

> Little by little gets results
>
> *- Moral of Aesop's fable 'The Crow and the Pitcher'*

Inventory reduction

Enterprise Resource Planning (ERP) and Enterprise Asset Management (EAM) systems may contain part and tooling databases that support a basic commonization and re-use initiative (see panel 'Database analysis'). Part information held by a PLM system is richer, and may enable better results using a similar approach.

This remedy treats the symptoms. To address the source of opportunities for commonization and re-use, it is necessary to make use of PLM solutions with integrated design capabilities.

Database analysis

One technique for inventory reduction is to scan ERP databases for 'similar' parts. The same approach works for asset and tooling information held in EAM databases. The approach is to search for similarities in any aspect of available information – part number, material or classification data, free text descriptions and so on. Text parsing and substitution of standard words can improve the success rate of this method, which needs manual review to identify candidate 'similar' parts.

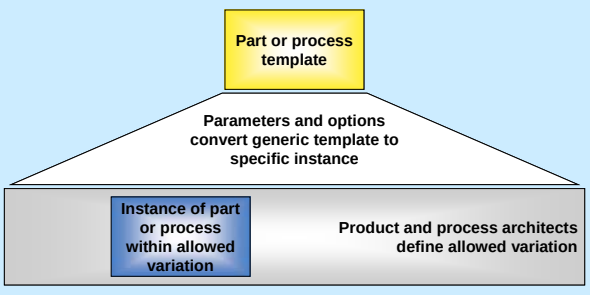
The same approach applied to a PLM database has potential for better results, because PLM typically stores more information about each part. The 'high-end' of PLM searching can examine the geometric shape of each part.

Commonization and re-use using PLM

From the earliest days of computer aided design (CAD) and computer aided manufacturing (CAM), the use of data libraries has been a key to productivity and effectiveness. The optimum structures, naming conventions, content and ways of using libraries depend on the products, processes and working practices of each individual company. The engineering skills and know how used for creation of product architectures and manufacturing process strategies are the same skills and know how needed to define digital library configuration and use – this requires insight into the way engineering problems are solved.

PLM technology supports libraries and much, much more. For example, consider support for parameterized library items, with control of allowed parameter values. This enables creation of templates that generate only 'approved' instances of parts or process (see panel 'Defining allowed variation'). In creating the parameterization, the calculations and the logic to control the allowed values, senior

Defining allowed variation



engineers are embedding design rules which contain their know-how. Every use of the template means these design rules are being applied.

Templates do not have to define whole parts or processes. Often, it is template definitions of individual features that drive improvements in commonization and re-use. For example, a design feature such as a hole will usually relate to purchased parts such as bolts, and also production facilities such as tools and test procedures. By defining templates for such features in ways that link to standards, companies help ensure new designs are likely to maximise re-use of established, approved and standard parts and manufacturing procedures.

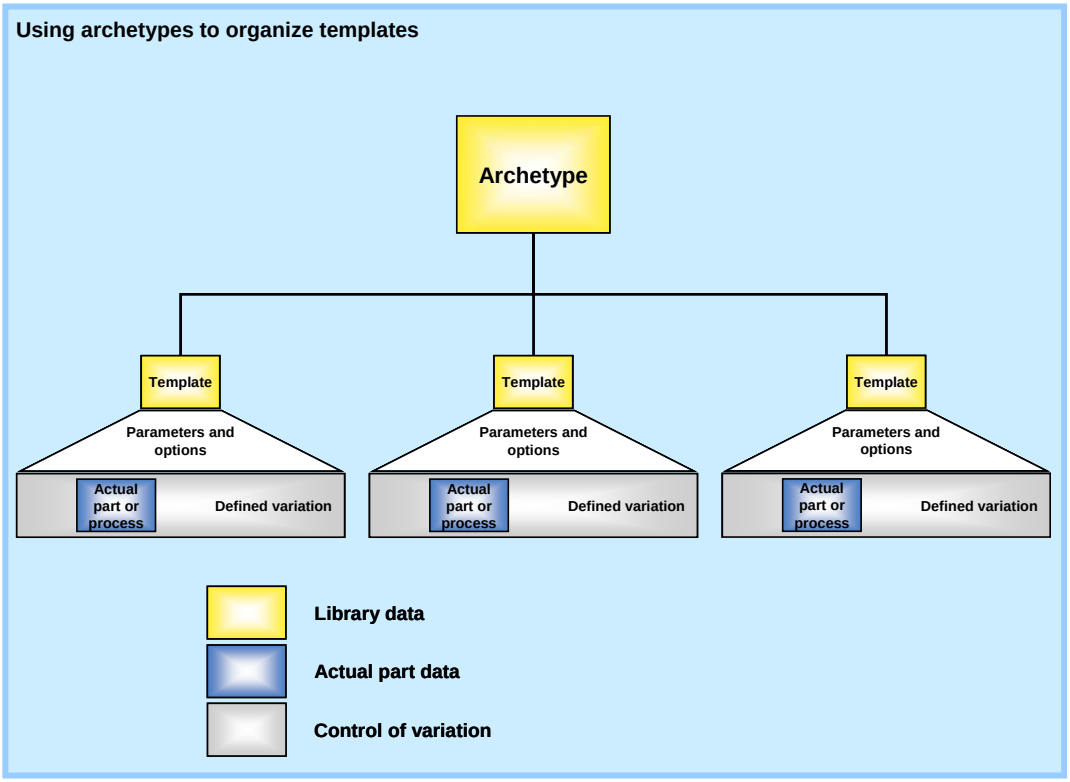
Templates may be able to handle a broad range of data relevant to commonization and re-use initiatives, such as specifications, test procedures, interfacing rules, tolerances and so on. Coupled with support for parameterization, constraints, other calculations and conditional logic, templates offer power and versatility in capturing know-how to define and develop repeatable engineering processes. This type of template opens the door for commonization and re-use initiatives that go beyond standard parts and features. But PLM offers still more.

Beyond templates

One of the absolute imperatives for successful commonization and re-use relates to finding information – it must be easy to find and access a part, process or template for re-use. If this is slow or difficult, then too many design decisions will lead to creation of a new unique item.

To ensure easy access, PLM can provide structures within which templates can be organized, and can potentially provide more efficient access than ‘search’. The term ‘archetype’ is used in this area to describe a level of information that can act as the index to and wrapper around, a set of templates (see panel ‘Using archetypes to organize templates’). The role of a structure, such as an archetype, is to capture, in a re-usable format, abstract, higher level information such as knowledge about the information, engineering process steps, and relationships required to develop a product. This can encompass attributes and knowledge relating to requirements, layout, detail geometry, product structure, performance, manufacturing processes (including software for production machinery), embedded software, regulatory compliance and so on. In some ways, the archetype is like a recipe – it contains the knowledge that guides the process of creating the end product or process specification.

So, in a simple case, outline product or process requirements recorded in an archetype would link to a range of templates that generate possible solutions to that type of requirement. To solve any specific new requirement, the first action is to find an archetype that contains a similar, equivalent or related requirement. The templates linked to this archetype all offer possible solutions, and, depending on the way they have been created, will offer solutions that make best use of standard parts, tools and processes.



The effectiveness of this type of PLM environment depends on the way it is set up. Achieving dramatic increase in the use of standard parts and processes depends on the engineering insights, analysis, data and criteria built into archetypes and templates. For example, to achieve re-use, product and process developers must be able to find all the information they need to be confident that a standard item really does meet a requirement. Archetypes and templates can be set up to hold or link to this information.

PLM solutions typically enable managed, shared access to the information they hold, including remote access. This means that multiple departments can maintain and share their information – perhaps co-operating to create templates and archetypes, and enabling access by authorized users to implement project procedures.

Step-by-step

For most companies, it is important to be able to introduce this approach step-by-step. One way of achieving this is to select a product or process area, and aim to automate creation of designs, specifications or plans. The objective of 'automation' will force deep thinking about the aspects of product and process development that can be based

on templates, and the extent to which existing or future re-usable parts and processes will be referenced in the templates. By focusing on a specific area, the team involved will build up understanding of the scope of variables that can be considered, and how the rules can be formulated in a way that reflects their company's way of working.

The experience gained from each selected product or process area will feed into the next, ultimately enabling the insights to identify the sources of differentiated customer value in products and processes, and the sources of greatest return from commonization and re-use.

7 Maximizing the benefits

Industry sometimes pays unexpected dividends

- Moral of Aesop's fable 'The Farmer and his sons'

New product development

Commonization and re-use opportunities can be driven by review of product or production strategies, but a major new product development, or investment in a new factory can accelerate a commonization and re-use initiative.

A strategy to base a new generation of products on a common platform will almost certainly achieve more modular, configurable products and manufacturing processes, with standard interfaces that encourage commonization and re-use. Initiatives with commonization and re-use as their core purpose also deliver substantial benefits (see panel 'Hirotec America').

Hirotec America

Jim Toeniskoetter, President and COO Hirotec America, uses the example of clamps developed for use in roller hemming machines to explain the value of commonization and re-use. In the automotive industry, roller hemming machines are used to manufacture doors. Formed sheet metal parts are clamped in position, and the roller hemming head folds the outer panel over the inner and any reinforcement panels. The clamps may need to move to give the head access to the components. In some designs, clamping can require multiple different complex clamping units to be integrated into the machine.

"We recognized a real opportunity to drive out cost. We found an approach which, for certain machines, allowed us to use an identical clamping unit at every clamping location. This allowed us to concentrate engineering resource on the performance and manufacturing process for this one design of clamp. To get this into production, we had to carry a lot of information with the clamp template – each time it is used, the designer must follow some very specific design rules, and on the shop floor, we need to be sure specific geometric dimensions and tolerances are observed not only to manufacture the clamp, but also to integrate it into the machine. But the effort was worthwhile, we saved 60% in manufacturing costs, and got simplification, and standardization savings as well."

Source: Cambashi interview

Choose the right area

The range of possibilities for the scope and focus of commonization and re-use initiatives is very broad, and choosing the right areas is critical. In a kitchen with many cooks, sharing ingredients will deliver important benefits, but perhaps sharing recipes is more important, while sharing utensils is counter-productive. Picking the right areas for commonization and re-use is a task for technical and business people capable of seeing

Koenig & Bauer AG

Elmar Tober, Koenig & Bauer manager in charge of standardization for web presses: "Simply by already offering the design engineer a choice of components according to the factory standard in the CAD system – which leads to the NC machines in continuous processes – you can save enormous processing costs"

Source: Siemens PLM Software case study

the big picture while also understanding the detail (see panel 'Konig & Bauer AG') - individual inspiration, team brainstorming, and evaluation of scenarios all have their place. Top-down analysis will generate candidates, and so will bottom-up review of operations.

Applied to the right areas, commonization and re-use serves the business mantra of lower costs, faster response, and managed quality. Also, through simplification and standardization, it supports strategic development in partnering, sourcing, and business flexibility. In a consumer electronics company, commonization and re-use may be the central strategy that enables profit from products whose lifecycles are measured in weeks. In an automotive company, re-use of capital equipment may make important financial contributions, and use of common platforms may be key to offering diversity and variation of models at competitive costs.

Automation of engineering tasks

One approach that highlights commonization and re-use opportunities is to seek ways to automate engineering tasks. Problems in defining the automated sequence may well be the pointers to commonization and re-use opportunities

AB Sandvik Coromant

Jan Axelsson, Senior Manager CAD/CAM/CAE System & Support, AB Sandvik Coromant: "We have used Siemens PLM Software to automate significant parts of product design and production preparation which has increased our throughput with reliable consistency and quality. Now our engineers can concentrate on the areas which need human ingenuity"

Source: Cambashi interview

- "…if only this feature was a standard size…"
- "…if only the maximum dimension of all workpieces was under 100mm…"
- "…if only this assembly operation could be completed while the unit was still horizontal…."
- "…if only all our machine tool controllers handled subroutines the same way…".

Solving these problems, and automating the relevant tasks, involves pre-definition of re-usable parameterized elements - from features and architectures to workflows and specifications. The automated procedure can then select and integrate elements, set parameters, and generate required outputs (see panels 'AB Sandvik Coromant' and Assembléon Netherlands').

Assembléon Netherlands

Walter van Leeuwen, ICT Department, Assembléon: "We generate a manufacturing documentation package for each machine we build. This used to be quite time consuming. Now, using Siemens PLM Software, we have automated most of this process."

Source: Cambashi interview

Communication

PLM addresses one of the fundamental barriers to re-use, namely, communication. PLM systems support controlled access by authorized people to shared databases of resource, product and process information. This may involve in-house departments, multiple sites, suppliers and service delivery partners.

By improving communication between groups (see panel 'Comau'), PLM reduces misunderstandings and makes it possible to consider broader value chain requirements, thus increasing the chance that shared solutions will meet all needs. PLM also helps carry critical information through the entire value chain, helping to ensure that the concept and detail of a re-usable solution will be understood and implemented by everyone concerned.

Comau

Giuseppe Molina, Business Line Chief Operating Officer, Comau: "[Siemens] PLM Software offers a range of tools to increase the integration of individuals and organizations. Using [Siemens] PLM Software technology, all the figures involved in product development (marketing, designer, draftsman, technicians) can use – throughout the phases of design, industrialization and production – a single digital model synchronized in a single environment"

Source: Siemens PLM Software case study

8 Conclusion

> True art endures
>
> *- Moral of Aesop's fable 'The Silkworm and the Spider'*

Using structures such as templates and archetypes, integrated PLM systems allow design and manufacturing organizations to create, communicate and share re-usable elements for a wide range of engineering tasks. Re-use may involve manual search and selection for the appropriate element, or may be part of an automated process using rules – in the form of procedures, parameterizations, and constraints – to select and configure pre-defined product and manufacturing process information.

Many types of information can be created and re-used in these ways, enabling commonization and re-use strategies to be implemented at every level, including:

- re-use of **physical items**, such as components, assemblies, and production assets
- re-use of **information items**, such as specifications, procedures, documentation and software
- re-use of **architectures**, such as common platforms, workcell layout, or replenishment strategies
- re-use of **knowledge**, such as design rules, procedures for performance testing, guidelines on module interactions.

Commonization and re-use strategies may be components of a number of different business initiatives, for example, design automation (to reduce lead times); or production standardization (to reduce operating and capital expenditures). They are also used to gain control over complex environments, cut costs, improve quality, and reduce time to market. Resulting simplifications and standardizations facilitate strategic developments such as partnering and globalization.

For a management team wishing to explore opportunities for business improvements in this area, there are number of questions and tasks to add to the team agenda, for example:

- What commonization and re-use procedures or targets do we currently have in place? Do we address know-how as well as products and manufacturing processes? Are the metrics at a business level, or are they local to one group?
- What are the advantages and disadvantages of common platforms at product and sub-assembly levels?
- What is our experience of products or processes where we deliberately specified more use of standard elements?
- Many groups have potential to create and share information for re-use – can they all easily communicate, discuss and share data?
- Have we used integrated PLM systems to automate routine engineering tasks?

With this type of information in place, it becomes possible to imagine the business benefits that could accrue from more effective commonization and re-use. Given the

availability of integrated PLM solutions, these business benefits are not just blue-sky dreams, they are achievable and are candidates for evaluation and action.