Developing a PLM strategy

PLM Vision:

The PLM Vision provides a Big Picture of the future environment, performance and behaviour that is expected. It provides a picture to guide people in the choices they have to make during strategy-setting and planning of resources, priorities, capabilities, budgets, and the scope of activities.

PLM Strategy:

"A strategy is a general method for achieving specific objectives. It describes the essential resources and their amounts which are to be committed to achieving those objectives. It describes how resources will be organised, and the policies that will apply for the management and use of those resources."

Once the strategy is defined, it will be possible to start planning detailed activities and resources.

PLM Plan:

PLM Plan addresses all the components of PLM such as organisational structure, human resources, systems, processes and practices, Individual projects are identified and planned. Their objectives, action steps, timing and financial requirements are defined. The relative priorities of projects are understood.

However both "strategy" and "plan" describe how to do something. The main differences are that a strategy is at a much higher level than a plan, and that the strategy is broad-brush- it's "a way to achieve objectives" whereas a plan is "a detailed method".

When planning is complete, implementation can take place.

Importance of PLM Strategy:

A good, well-defined and well-communicated PLM strategy is important because it:

- Provides the best chance of achieving the PLM Vision.
- makes sure resources and capabilities are used to their best

 makes sure everybody knows what's happening

 makes sure all resources are aligned in the same direction

 enables planning decisions to be taken in a coherent way.

A strategy describes:

 the way to achieve objectives

 how resources will be organised, managed and used

 Policies governing use and management of resources.

Deciding how to organise, manage and use the resources is a key part of strategy development. The resources that can come into play in the product lifecycle include:

 Facilities such as offices, manufacturing plants, service centres

 Equipment such as computers, office equipments,

 machine tools, assembly line machinery

 people and their skills, moral, know-how

 supplies such as raw materials and energy- and waste materials

 Information systems such as CAD, PDM and ERP

 Customers.

A company-specific strategy:

A PLM strategy will be company specific. Without knowing a particular organisation in detail, it's not possible to say what its strategy should be. For example, the strategy of an organisation that develops and manufactures high-performance aircraft engines can be expected to be different from that of an organisation that develops low cost plastic toys.

A PLM strategy defines a way to achieve the Vision. It describes how resources will be organised and used. PLM strategies aren't generic. They are specific to individual organisations because they depend on the particular circumstances and resources of the individual organisation, and on its particular environment.

The purpose of strategy development is to select the best way of achieving the objectives, given the constraints imposed by the market and the resources, and to position the organisation in the most favourable way relative to the competition. The strategy is concerned with decisions which will have a long-term business impact, will probably require significant investment, and will determine the type of people needed by the organisation.

The strategy has to be communicated to everybody likely to be involved in the future environment or impacted by it. It wouldn't make sense to have a strategy that nobody, apart from its developers, accepts or understands.

Developing and implementing a PLM strategy:

Developing and implementing a PLM strategy to achieve the PLM Vision is a five step process:

1. Collecting information

2. identifying possible strategies

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3. selecting a strategy

4. communicating the selected strategy

5. Implementing the strategy.

First step: Collecting information

In the first step, the information with which the strategy will be developed is collected and assembled.

As the PLM Vision already contains information about the future, most of the information to be collected will probably address the current situation:

 Current company, and PLM, organisation and activities, objectives, strategy, resources, revenue sources, capabilities, strengths and weaknesses.

 The environment in the company, in the industry, in the market, key factors for success, trends, opportunities and threats.

The current situation can be addressed under headings such as:

 objectives of the PLM activity

 user requirements

 existing products

 product development projects

 product support tasks

 product data

 the users of product data

 the management of products and projects

 the management of activities in the product lifecycle

 the management of product data and the product workflow.

Because so much information is available, it's important to define in advance: the approach for understanding the current situation, the information to be collected, and the deliverables that will be produced.

To find out about the current situation, the following types of question have to be answered.

 What is the overall business objective?

 What is the overall business strategy?

 What are the activities of the product lifecycle?

 What does PLM currently do to create competitive advantage?

 What are the needs of the customer?

 What has to be done to satisfy the customer?

 What is value to the customer?

 How do we measure customer satisfaction?

 What are our products and services?

 What is unique about our products?

 Where are we strong?

- user requirements
- What are the key skills?
- What is the critical technology?
- What is unique about our technology?
- Are our people sufficiently dynamic and innovative?
- What are our core capabilities?
- Is competition price sensitive?
- How do we communicate with our customers?
- How successful have we been in meeting our objectives in the past?
- What has prevented us from meeting our objectives?
- How do we view our current performance?
- What were our past strategies?
- How successful were they?
- What has recently changed? What are its implications?
- What is currently changing? What are its implications?
- Do we have our product data under control?
- Do we have our product workflow under control?
- How could we improve our product end-of-life activities?
- How could we improve our customer support activities?
- How good are we at making use of ideas generated internally and externally?
- Which products have performed worst? Why?
- How often do we reuse parts?
- How well do we manage product development projects?

 user requirements

 How well do we manage customer requirements?

 How well do we structure product families?

Different techniques such as brainstorming, process analysis, and the use of questionnaires can be used to gather and understand the information describing the current situation.

One of the ways to understand the current situation is to develop a questionnaire, and get the people who are supposed to be responsible for the individual topics to respond.

 Current situation of the surrounding environment

To get a good understanding of the environment in which the PLM activity takes place, requires understanding competitors, other players in the market, and the overall position of the industry.

In some cases, competitors may be open to an exchange of information. If this is not possible, something may be learned from presentations made at conferences and seminar, from trade shows and exhibitions, government and industry publications, promotional videos, books, journals, television programmes, magazines and newspapers.

The following types of questions need to be asked:

 Who are the competitors? What are they doing?

 What are their key success factors?

 Where are competitors based? Why?

 Where are our competitors strong? Where are our competitors weak?

 Who could be our competitors in the future?

 What is the current PLM strategy of major competitors? Why?

 Which technologies are most important to competitors?

 Which product technologies will become key? Which process technologies will become key?

 What products compete with ours, and what technology do they use?

 What national and international laws, standards and regulations affect us?

 What's happening that could be an opportunity for us? What's happening that could be a threat for us?

Benchmarking is a good technique for helping to understand the performance of other organisations that are believed to have more effective operations. The organisations that are benchmarked may be direct competitors, suppliers, or even companies in other sectors.

If the other organisations are found to have more effective PLM operations, then the organisation can try to understand how they work and why they are better. It can then start to improve its own operations, and will be able to set itself realistic performance targets.

The benefits of benchmarking include:

 making the organisation's relative performance very clear

 providing clear quantitative targets to management

 providing targets that are not just theoretical visions of the future, but are already practical reality in other companies

 getting immediately useful ideas for better products and processes

A benchmarking activity is made up of four phases:

 Setting up a team. Training the team to carry out the activity

 understanding the organisation, and assessing its strengths and weakness

 Identifying industry leaders and competitors. Understanding their strengths and weaknesses. Researching and visiting these companies to improve understanding. (A lot of preparation is required for visits. Without preparation, teams only get a fraction of the possible benefit from visits.)

 Incorporating what has been learned, and improving on it.

About 25% of effort for a typical benchmarking exercise is to get the team up and running, and trained in useful methods for analysing operations. About 25% of the effort goes on understanding the organisation's performance in a chosen area. About 25% of the effort is to prepare for, and conduct, the external benchmarking studies. The remaining 25% captures the lessons learned, and puts them to use.

Second step: Strategy Identification

In the second step of strategy development, several potential strategies are identified, formulated and described in terms of the organization and policies to be applied to the resources.

It is always useful to identify and describe several possible strategies. This will improve the chances of finding the best strategy since the most obvious strategies are not necessarily the most appropriate.

As in the military and business environments, a range of strategies will be possible. For example, in the military environment, strategies include: control of the seas, control of the air, control of a land region, attack in overwhelming strength, attack with overwhelming speed, destroy the enemy's will to fight, divide the enemy's resources, cut the enemy's communication lines, cut the enemy's supply lines, siege blockade and impregnable defence.

Business strategies include: cost leadership, differentiation niche, leadership, follower low-cost variety, fast response time, partnering and process-based strategies.

The strategy chosen for PLM has to meet the objectives of the company. As each company will have a different objectives, as well as different resources and a different environment, the strategy a company develops will be different in some respect from that of any other company. It is to be expected that the strategy selected will contain some elements of one (or more) of the basic strategies, and also have some additional elements.

 Strategy Elements:

The name given to a strategy has to be meaningful and self-descriptive. For example "control of the seas". At a lower level than the strategy itself are "strategy elements", addressing particular resources and activities, which also need to have simple names and clear descriptions. For example, "control of the seas" may lead to "autonomous aircraft carriers".

PLM strategies aren't one-dimensional. Several strategy elements need to be combined to develop a particular organisation's strategy. It may appear that all elements should be needed, but in practice, organisations have limited resources so can't do everything. An attempt to do everything would lead to confusion, and probably nothing would get done. As a result, choices have to be made and a clear strategy has to be created.

Examples of the types of strategy elements that can be proposed include:

 Customisation capability - every customer can configure their own product

 the highest functionality products and/or services

 the most robust product or service

 the most sustainable products- perpetual recycling

 the best processes across the lifecycle

 environmental-friendly products and processes

 fastest time to market

 market-leading hi-tech products

 long-life products- buy once, use forever

 lowest-cost competitor

 the safest products

 maximum reuse of parts

 partnering

 most skilled workforce.

The criteria for selecting strategy elements, and deciding how they will be implemented, will be made clear to some extent by the objectives provided by the business strategy, and to some extent by the application of PLM principles.

Strategy elements can be described in exhaustive detail. Some of the key points could be:

 Customer involvement

- Customer involved in product development and support teams
- frequent communication with the customer
- in-depth customer surveys
- specifications negotiated and optimised with customers
- online feedback from customer use.

- the most robust product or services
- product has long mean time between failure
- product requires little maintenance
- extensive simulation and testing
- simple product or service with small number of parts
- product certification demonstrating robustness.

 the best processes focus on implementing the best development process and methodology able to do tasks well customer belief in process competence process certification.

 fastest time to market projects started early with up-front effort profile information shared as early as possible simulation rather than test information re-used.

 the longest life product modular design easy to upgrade add-on services.

 environment-friendly products sustainable development no pollution re-use.

Each strategy element has to be described in detail. It will be different for each company. Similarly, the strategy elements may be interpreted differently in different companies.

The detailed descriptions of each of these strategy elements will differ from one company to another, and may be quite long.

 This can be illustrated with “reuse”

The first time that information, or a part, is created it goes through a long process involving a lot of quality checks and validation. It is then used, and any remaining errors are uncovered and corrected. By the time someone wants to reuse it, it will be more or less bug-free. As reuse of existing information and parts doesn’t require any development time- everything has already been developed- it can greatly reduce development cycles.

By reusing existing designs, less investment will be needed for the development of new designs. As there will be fewer designs, and fewer changes to designs, the overhead costs associated with managing, storing, copying and communicating designs can be reduced. The development cycle will be shorter if existing information is re-used. Design and verification time will be reduced.

Similarly, if an existing part is re-used there is no need to go through the wasteful process of re-developing the part, re-developing the process to make and support it, simulating performance, re-developing tools, waiting for prototypes, etc. By reusing an existing part, time and money is saved, and quality is guaranteed. Also, since a new part number is not needed, overhead is not increased, there is no need to extend part files, there is no need to find additional storage space, and there is no need for additional working capital for holding coats. Because there are fewer parts, it is easier to locate existing parts, so access times can be kept acceptable.

 Implications of strategy elements:

Different companies will develop different strategies and these may have very different implications for the resources used in the activities of the product lifecycle.

Consider the strategy of "the lowest-cost product".

A "lowest-cost product" strategy could focus on Value Analysis, simplifying the product, reducing the number of parts, using standard parts, using cheaper parts, and reducing machining and assembly time. The main activity of such an organisation would be to work at the level of detailed components and parts- just the opposite of the organisation described above. Highly creative engineers and system engineers would not be needed to make detailed changes.

There are similar implications for other strategy elements. Some examples of the type of action that each strategy element might lead to are given below:

 customer focus improve customer relations identify and implement customer satisfaction metrics.

 customisation capability define and improve processes manage customer requirements better

exploit technological base better implement CAD/CAE/CAM and product Configurator implement simulation tools.

 the best process carry out process mapping and analysis define, simulate and improve processes

 fastest time to market build on platform products, modular design use Rapid Prototyping reuse.

 automation use CAE/CAD/CAM, PDM, simulation tools

Use NC machine tools.

 minimise costs eliminate non-value adding activities Reuse parts.

 Policies

A strategy has to be simple and concise, otherwise it will be impossible to implement successfully. A strategy doesn't aim to describe all the detailed issues that may arise in the product lifecycle environment. Those issues which are not explicitly addressed in the strategy document can be addressed with policy statements.

A policy is a general guideline that will help people in the company to make decisions without continually referring back to top management.

Typical subjects of policies include use of technology, supplier relationships, management span, quality, investment in new equipment, recruitment, salaries and benefits, and training.

Policy statements could address points such as:

 Technology leader or follower maturity level for use development of proprietary technology or use of commercially available technology

 quality prevention or inspection

 suppliers long-term relationships or decisions based solely on contract price

 culture Management-driven or worker empowerment.

Third step: Strategy analysis:

In the third step of strategy development, potential strategies are tested, and the most appropriate strategy is selected and detailed.

It will be useful to investigate between three or four alternative strategies. This should lead to an in-depth understanding of the possible strategies. The strengths and weaknesses of a particular strategy often become clear when examining the strengths and weaknesses of other strategies.

The analysis of the different strategies is often called SWOT analysis. The acronym stands for strengths, weaknesses, opportunities and threats. These are the four factors that have to be described and compared for each of the possible strategies.

The SWOT analysis for PLM is carried out after identifying several potential strategies. The questions are aimed at finding out which strategies are suitable, and which of the suitable strategies is the most appropriate. Among the questions to be asked are:

- Does this strategy meet the objectives?
- Is it in line with overall company objectives?
- Will it enable us to achieve the mission?
- How does it address key issues?
- What would be the key metrics?
- How long would it take to implement?
- What are the overall costs?
- Do we have the financial strength to do this?
- What are the benefits to the organisation?
- Do we have the resources to do this?
- Would this strategy save time?
- What would be the effect of this strategy on quality, product costs, cost of product development and cost of product support?
- What are the risks associated with implementing the strategy?
- What are the risks associated with not implementing it?
- What are the technological implications of the strategy?
- Does this strategy make it easier and/or cheaper to develop new products?
- Does this strategy really correspond to what we are trying to do?

It's important that the analysis is carried out on the basis of facts, not opinions.

After the SWOT analysis has been carried out in the third step, one strategy must be selected and fully documented.

Fourth step: Communicating the strategy

In the fourth step of the five-step strategy development process, the chosen strategy is communicated to the people who will be affected or involved. Communication of the strategy is essential. A strategy is useless unless the people who are going to be involved are fully aware of it, can understand it and can implement it.

The name given to a strategy must be so short and simple that everyone (not just strategy theorists in ivory towers and company headquarters) can understand it.

A strategy has to be realistic. It has to be expressed in language that everyone can understand. There's no sense in including motherhood statements, or in claiming to greatly improve performance overnight.

It's important to have general agreement on vocabulary. Otherwise, if a group of people is asked to describe the strategy they will all give different answers. Before communicating the strategy, make sure that everybody understands the meaning of the terminology.

Before disseminating the strategy, test it out on a few people who are typical of the audience. If they don't understand it, then make it understandable before communicating it more widely.

No-one is going to be interested in a PLM strategy that doesn't seem to concern them. Make sure people realise the relevance of the strategy for them as individuals.

As most people are very busy with other things apart from PLM strategy, there's a good chance that they won't take it in the first time that they hear or see it. The strategy message needs to be repeated. Repeat it on different occasions and in different ways, such as in formal and informal presentations, meetings and newsletters.

Decide who the strategy needs to be communicated to before starting to communicate it- Product developers, field engineers, customers, company management, suppliers, regulatory organisations, other companies?

Communicate the strategy to everyone involved with PLM. The more they understand it, the more chance it has of being implemented. Make sure people understand why it is important to understand the strategy. Make sure they understand why the strategy is necessary for the organisation. Make sure people can see where it takes them as individuals.

Fifth step: The PLM plan (Implementing the strategy)

The PLM Strategy Report should contain a plan showing how the strategy will be implemented over the length of the total implementation (for example five years) and a more detailed plan for the first year.

The structure for the plan should follow that for the PLM framework, making it easier for managers and others to see how all the issues are linked, and will be addressed.

1. Start-up

2. Management of the initiative

3. Organisational structure of activities across the extended enterprise

4. Processes

5. Organisational structure- internal

6. People

7. Information

8. Working methods

9. Information systems

10. Accompanying actions

Different views of the plan should be prepared- with different levels of detail. The first view should be a block diagram only showing which types of activity will take place in each year. This level of detail may be sufficient for company management.

Other views of the plan will show more details of the activities. They will be needed for people who participate in, and manage, the activities.

Impact of Strategy:

What is the impact on the organization of developing a strategy for PLM? Why not just begin installing PLM applications, or even entire systems, to implement the individual areas we have talked about previously, such as vaulting, engineering change management, factory simulation, warranty reporting and analysis? Each of these areas can be justified on the basis of individual ROAs or ROIs. Why go to the trouble and expense of having to create a comprehensive vision of

the future? It is difficult, contentious work to develop and build consensus on a vision of the future.

One of the reasons that there is substantial payback to strategy is that developing strategy does not require a huge consumption of resources. 'While it does take a concerted effort on the part of an organization's leadership to create a shared vision of the future and devise a plan to get there, it would seem difficult to find a higher priority activity. Without such a vision and plan, the organization is a reactive entity, being buffeted by continual winds of change. Lean Thinking requires that the leadership make the best use of its resources. It does that by planning and executing a strategy that drives it in a clear direction to its vision of the future.

PLM Initiatives to Support Corporate Objectives:

Since most organizations have as their objectives to grow the organization and to reduce costs, it is not hard to align PLM projects with corporate objectives. From the IT Value Map, we can see that the drivers of revenue growth are increasing functionality, quality, and quantity of product sold. Parts reuse, start parts, and smart parts all allow areas to do more with the same amount of resources. If additional resources are not available to increase the quality or functionality of products, PLM applications enable areas or departments to free up the needed resources by utilizing existing resources more efficiently. On the cost side, better visibility and control of product information allows the reduction of material and time. PLM applications that track and control math-based designs allow departments to avoid wasting time working with old and outdated versions. Process reuse in manufacturing allows departments to reduce the amount of worker-hours required to produce product routings. Simulation of those routings decreases ramp-up time required to produce products at their most efficient level.

Conducting a PLM Readiness Assessment:

PLM IS MAJOR SHIFT in perspective for most organizations that have an orientation to traditional functional perspectives. In addition, PLM is not simply an application that is implemented as-is. There are issues of culture, process, practice, and even power that will affect the success of PLM within the organization. This chapter lays out those issues that need to be examined and provides techniques and methodologies to help the practitioner assess his or her organizations readiness for PLM.

Assessing an organization's readiness for product lifecycle management requires an assessment of all the elements of PLM: technology, not only of the enabling PLM technology, but its

infrastructure, people and their processes and practices. This assessment needs to be done using a systematic and understandable framework that compares where we are with where we determine we need to be.

Infrastructure Assessment:

As we saw in Chapter2, PLM is defined as being an approach, not simply technology. However, technology and, more specifically, software are key components of and enablers for PLM. PLM initiatives are not feasible without PLM software applications. These PLM software applications require a computer/communications infrastructure on which to run. In addition, these PLM software applications are not trivial in their infrastructure requirements, so a careful assessment of the computer/communications infrastructure is an important aspect of any readiness assessment.

With respect to computer/communications infrastructure, we noted earlier that computer/communications infrastructure is a hurdle issue. Having excess capacity with respect to computer/communications infrastructure does not add anything to the PLM initiative. However, having less capacity than required can cause the Product Lifecycle Management initiative to flounder and possibly fail. As a general statement, users are comfortable with the computer applications they currently use. They reluctantly use new applications. If the new application lacks minimum responsiveness because of inadequate computer/communications infrastructure, users will employ one of a number of potential coping strategies.

In the least disruptive, users will chronically complain to their superiors, who will begin to question and re-evaluate the usefulness of the application. More disruptive to the PLM initiative, users will circumvent or bypass the system by minimizing their use of the application; by entering only the minimally required data; by batching entry to off-periods, thus delaying the availability of necessary information; or, in the more extreme cases, by abandoning the application entirely and returning to a former or ad hoc method to get their jobs done.

So, in assessing the computer/communication infrastructure, it is important not only to assess what is required under the current initiative, but also to look out over the future and project what will happen to this infrastructure if Product Lifecycle Management becomes a successful initiative (i.e., if people adopt it and change their way of doing things so that they use these new PLM tools and technologies to their fullest extent). With respect to this computer/communications infrastructure, there are four things that we need to look at: the

adequateness of the current technology, the scalability of the technology, the modularity of the technology, and the openness of the technology.

1. Adequateness of the Current Technology:

With respect to adequateness, we need to assess the components of the computer/communications infrastructure to see that they are adequate for the current applications that are being deployed on them. If the computer/communications infrastructure is questionable for the current environment, it will definitely be inadequate for the new requirements the PLM software applications will place on it. We also need to assess and evaluate the new requirements that these PLM applications will place on the infrastructure. The three major component areas that need to be assessed are computing capability, bandwidth capability, and storage capability.

With respect to computing capability, the two different aspects are the computing capability with respect to the individual users, and the computing capability with respect to centralized applications and databases. Looking at the individual users first, the assessment needs to take into consideration the current computing requirements of the individual users. If users did not manipulate math-based models in the past, will the new Product Lifecycle Management initiative require them to do so?

For example, engineers who previously dealt only with specifications contained in Excel spreadsheets or Word documents may now bring up a visual model and check its specifications directly, in addition to seeing how various potential modifications affect it. On the factory floor, manufacturing engineers who used to lay out two-dimensional drawings on a table and who puzzled out the three-dimensional geometry of a part may simply bring up the part on a computer screen, flip it, rotate it, deconstruct it, and do other operations on it that would enhance their ability to understand the part and add to its manufacturability.

The one thing that is certain regarding Product Lifecycle Management initiatives is that if they are successful, the requirement for computing resources will increase, and most likely increase dramatically. As we will discuss later, whatever computing capabilities are in place will need to be scalable.

The second aspect of infrastructure is storage. The amount of storage that will be required to store math-based representations in various stages of completion will also increase dramatically. In addition, depending on the policies with respect to the organization on backup and security, it

may be a requirement not only to have the storage occur in one place, but also duplicated in multiple places.

This is also true if it is impractical to store drawings in one place because of the bandwidth requirements to serve them to diverse geographical locations. The requirement may be that there are servers in different geographical locations that will serve up these math-based drawings to the users. In this case, these servers need to be kept synchronized and, as a result, the storage requirement increases will be fairly dramatic.

Finally, the bandwidth issue needs to be assessed carefully inside individual areas of the organization, in different geographical locations within the organization, and outside of the organization. Moving math-based drawings currently takes a tremendous amount of bandwidth. If we give access to a wide variety of people who currently do not have this ability, we would expect to see the requirements for bandwidth to increase substantially. In addition, transfers of math-based information between geographically dispersed locations will also increase. If the interest is in part reuse, the ability to move those parts from other parts of the organization and gain the advantage of the work that has already been done on developing these parts will cause bandwidth capacity to be used for this purpose.

2. Scalability of the Technology:

Special care must be taken to look at the upper limits of computing, storage, and bandwidth, and determine whether there is any point at which the system will become fully saturated and unable to scale. That point must be assessed fairly carefully because, if it is not, the infrastructure will build to that particular point and then degrade rapidly, puffing the entire system in jeopardy.

3. Modularity of the Technology:

Modularity is important because it makes sense to add capacity in small increments. With the computing power of today, the cost to add a new increment of computing capability or storage capability is generally not that great and, therefore, that decision is made fairly easily. Although some scarce computing resources, such as special purpose computers to do heavy duty simulation, can be expensive resources, their use is limited to a small area of experts and can be allocated fairly efficiently to get the maximum utilization.

The network backbone is generally the constraining factor for bandwidth and increasing its capacity is usually an expensive proposition. There are some techniques that can be used to change the modularity and improve the capacity of the backbone infrastructure. One technique is

separating out users who share files on a constant basis and localizing their file sharing. This is so that the files are not required to go over the entire network. Another is to send only changed data, such that the information that has changed needs to be updated and not the rest of the file, which may be unchanged.

4. Openness of the Technology:

Finally, openness will be extremely important for Product Life-cycle Management, since the scope of PLM is so vast. No one solution provider will be able to perform all of the functions that are required in an organization for full Product Lifecycle Management implementation. Open architectures on both the hardware and software side are a must so that technologies and applications can work together to provide the functionality that the customers require.

The first best solution is obviously to have interoperability with common data formats and common data models to facilitate the exchange of information. The next best solution is to provide conversions or translators to convert and translate the information into a common format that can be used by different programs. XML (Extensible Markup Language) and STEP (Standard for the Exchange of Product model data) specifications are examples of common formats that solution providers may support that would provide openness to the user community. It is doubtful that a PLM standards effort would succeed or even be desirable. However, openness does allow for harmonization where different PLM applications can coexist and share information.