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Evaluation of PLM Domain Using Product Attribute Rating

George Joseph

Assistant Professor, School of Management and Entrepreneurship
Kerala University of Fisheries and Ocean Studies, Kerala, India

Renjith T. A.

Assistant Professor, Physical Education, Kerala University of Fisheries and Ocean Studies, Kerala, India

Dr. Mariya T. Cheeran

Assistant Professor, School of Management and Entrepreneurship
Kerala University of Fisheries and Ocean Studies, Kerala, India

Abstract:

Evaluation of PLM domain using product attribute rating aims at identification of attributes from domain consultants, software developers, users and extensive literature survey. The project therefore had to start with understanding the PLM product with all its different features, nature of the industry, it caters, etc. The project although is general in its focus, was done for Wrench solutions private limited, a PLM player catering the needs of different industries like Aerospace and defense, engineering procurement and construction etc. As the topic is broad in itself, there needed focusing a specific industry and this study focus on construction industry. The project was to be completed in stipulated time frame and therefore there were constraints of time. The main objectives of the study is to understand PLM domain and PLM software products, Identifying the attributes of PLM software, conducting a survey of product attribute rating to understand the relative significance of each of the attributes, analyzing the results of the survey to identify the most needed features for the PLM product. The researcher identified 16 attributes were put in 1 to 10 scale, with 1 means least recommended and 10 means highest recommended. The survey questionnaire was tested within Wrench (7 respondents), about 10 respondents outside. As a result, explanations were then given for some attributes regarding their meaning in the context based on their suggestions. Some duplication was avoided. Survey of 164 samples was made It Included -40 employees, 12 clients, and 112 prospects. Survey conducted at two stages revealed some interesting facts about customer perceptions and employee perceptions. There were differences and similarities in opinions with regard attribute scoring. As far as Wrench solutions' is concerned most of the attributes were closely rated by prospects and employees.

1. Background of the Study

According to the University of Michigan's PLM Development Consortium, "PLM is an integrated, information driven approach to all aspects of a product's life from its design inception, through its manufacture, deployment and maintenance and culminating in its removal from service and final disposal." Simply put, says Michael W. Grieves, the consortium's co-director, "PLM is the integration of business systems to manage a product's lifecycle." Innovation can occur spontaneously in almost any situation, but the ability to continuously innovate requires an environment that nurtures collaboration and enables the intellectual assets of the enterprise to be leveraged to their maximum potential. To attain this "environment for innovation," enterprises must be able to capture, manage, and leverage their intellectual assets. Product Lifecycle Management (PLM) is the business strategy that best allows organizations to establish such an environment, say experts. Industries that are using PLM are automotive, aerospace, defense, electronics and telecom. Asia is a huge PLM market. IBM, Unigraphics, PTC, SAP all are seriously committed to Asia. One of the challenges both vendors and industries face is, understanding the real value of PLM. Now there's a big opportunity for those offering PLM because it helps in gaining competitive advantage. It helps companies understand the value of products, with time to market, with response time. All businesses know that if we are the first to market, our product will command a premium price, leading to better profitability. The big benefits are improved time to market; faster response to problems, therefore costs came down. The quality was also better. In a recent report, AMR's Michael Burkett says the PLM market is growing robustly and is expected to jump to \$15 billion in 2009. The biggest factors driving this growth, he says, include globalization (design teams in different countries have to collaborate electronically), compliance (every decision and product input must be tracked) and the need for faster time-to-market (GM, for example, has slashed its vehicle-development time from 48 months to 18 months).

The Economist's article makes a pretty weak case that PLM as a category may disappear as its core product-data management functionality gets mainstreamed into platform software from Microsoft, Oracle, SAP, and IBM. Although these companies could very well acquire some of the PLM pure-play vendors like Cadence Design Systems, Agile Software, PTC, UGS, etc.

One of the major trends in the product life-cycle management (PLM) industry has been its expansion beyond engineering to users across the company and its extended enterprise. But an even broader expansion of PLM enables visibility of product data to others outside this corporate structure—even to consumers of the products. Individuals only need a computer and an Internet connection to access and interact with part of the vast amounts of 3D product-related data and models managed by PLM, and in turn to communicate back to the company in meaningful ways. Scenarios for such applications span the entire product life cycle. Near the end of development, companies can post fully dimensioned 3D models of products on the Web for people to manipulate and view. This enables potential customers to see how a new product is constructed or operates. At the front end of the life cycle, consumers can modify a manufacturer's model to communicate desired changes, or post their own designs for new product ideas. Such direct feedback from consumers is immensely valuable in product planning and a powerful tool for manufacturers to keep abreast of the mind-set of consumers in rapidly changing markets.

The key to such a broad two-way communication environment is Web-based visual collaboration, enabling companies to expose engineering data—selected portions of it, of course—to the wide range of people who don't utilize PLM, don't even know about it, or want to be burdened with it. The product models being viewed in this context are not just pictures, but they have useful attribute data behind them—including, in many cases, geometry and material properties. In such an environment, PLM acts totally in the background, with its data management and communication technologies entirely transparent to those using it. Product lifecycle management (PLM) manages historical data, current configurations and planned changes relating to the definition, design, validation, production, support and ultimate disposal of engineered products.

In effect, PLM can help companies execute the activities that are required to build the right product and build the product right. Building the right product means meeting customer requirements in terms of time, function, performance, price etc. Building the product right means executing design and production processes that meet the requirements of cost, quality, reliability, sustainability etc. In order for manufacturers to be able to simultaneously build the right product and build the product right they must develop a rich platform of product and process knowledge to underpin and support continuous innovation across all disciplines and phases of the product's lifecycle.

The bottom line is that PLM can help address challenges that have accentuated because of the economic slowdown; PLM is critical to help companies accelerate time to market, extend returns from products by quickly introducing market driven enhancements, increase product profitability through reduced warranty costs and optimizing manufacturing processes and resources, reduce build costs by minimizing costly prototypes and eliminating manufacturing errors, reuse knowledge to gain efficiencies in processes and eliminate non-value processes.

WRENCH Enterprise™ is a software solution built for the Engineering, Procurement & Construction industry for efficiently managing turnkey projects. The software integrates Project Management, Quality Management and Engineering Data Management. It has built-in industries best practices acquired over a period of one decade working with leading Engineering companies.

The system provides facility to manage and track all engineering deliverables including engineering drawings, worksheets, specification etc. Broadly speaking, WRENCH Enterprise™ enables to execute projects efficiently by monitoring the deliverables of a project and giving users easy accessibility to all project-related deliverable and all related documentation. It brings in complete accountability for task by providing a To-Do-List to the resources of a project. Tasks can be routed through predefined workflows process as specified by the organization's quality management system. Progress of each deliverable can be consistently monitored in a collaborative environment. Product lifecycle management (PLM) is the process of managing the entire lifecycle of a product from its conception, through design and manufacture, to service and disposal. PLM integrates people, data, processes and business systems and provides a product information backbone for companies and their extended enterprise. WRENCH started out as a generic product/project life cycle management (PLM) product. After working closely with multiple large companies to implement earlier versions, it became clear that the need was for far more than just PLM or 'process automation'; what customers really needed was an end-to-end software solution that addressed all the needs of all their departments across the enterprise - engineering & design, business/sales, customer services, management, internal administration etc.

With WRENCH Enterprise™, we can create, manage, store and easily retrieve all project-related documents from anywhere in the world, at any time. In addition, it duly enforces the change management processes and permits access only to the latest information to the end-user. Older versions of all Engineering data are stored with the history information too. Engineering data/documents of past projects can also be stored and this can be reused for future projects. The system meticulously enforces regulatory compliance in the organization's procedures, controls the access to the data stored and eliminates the delay and error caused by human resources.

1.1. Objectives of the Study

- i. Understanding the PLM domain
- ii. Understanding PLM software product
- iii. Identifying the attributes of PLM software as relevant to the EPC industry by surveys, interviews etc.
- iv. Conducting a survey of product attribute rating to understand the relative significance of each of the attributes
- v. Analyzing the results of the survey to identify the most needed features for the PLM product catering the needs of this industry.

1.2. Research questions

Through analyzing the results of the survey to identify the most needed features for the PLM product catering the needs of EPC industry.

- i. Where does wrench product attribute stands?
- ii. What are employees opinion regarding software with respect to attributes?

1.3. Research Design

Identifying the attributes of PLM software as relevant to EPC industry -Talks with business analysts, marketing team and implementation team, support team of Wrench solutions, Domain consultants and product brochures of various players in PLM EPC domain. Conducting a survey of attribute rating to understand the relative significance of each of the attributes

Survey consisted of 2 phases

- i. Identification of attributes
- ii. Evaluation of attributes

Identified 16 attributes were put in 1 to 10 scale, with 1 means least recommended and 10 means highest recommended.

1.4. Population, Sample Size and Sampling Technique

The survey questionnaire was tested within Wrench (7 respondents) ,about 10 respondents outside. As a result, explanations were then given for some attributes regarding their meaning in the context based on their suggestions. Some duplication was avoided. Surveys of 164 samples were made It Included -40 employees, 12 clients, and 112 prospects. For surveying prospects contact information were obtained from –Wrench marketing team, colleagues, alumni of engineering college, friends in construction field abroad and in India.

Ranking of attributes depending on the score received from each of respondents

Methodology-

- i. adding the scores obtained for each attribute for each sample group separately
- ii. Total score thus obtained expressed as a percentage of maximum total score
- iii. Ranking of attributes based on scores
- iv. Plotting the score in a radar chart to understand the areas of differences, deficiencies etc

1.5. Limitations of the Study

- i. The evaluation of PLM domain using product attribute rating required survey of attribute rating the response of which might be influenced by the experience, knowledge, situations, understanding of the topic ,time available to them etc.
- ii. The EPC industry presents a very vast area of study. The diversity within that industry needs a much more sample data for perfect representation.

2. Data Analysis

2.1. List of Respondents Included Civil Engineers and IT Specialists from the Following Firms

The survey conducted on builders, consultants in Construction domain included-Alpha Properties, Diamond Investments LLC, ETA Star Properties, Bonyan Emirates Properties, Oryx Apartments, Union properties, Edara,Target group Abudhabi, Omniyat Properties, Alfuttaim, Alec, NASAmulitplex, Robodh Contracting co.LLC, Arabtec, Etihad, Investate Realty, Deyaar,. Aldar properties, Burt Hill,Hydra Properties, Larsen and Toubro,Sorouh Real Estate,Al Fajer Properties, Ezdan Real Estate and Tameer, Balmer & Lawrie, Bharat Earth Movers Limited, Bharat Coking Coal Limited (BCCL), Bharat Heavy Electricals Limited (BHEL),.Bharat Refractories limited, Cement Corporation of India Limited (CCI), Central Coal Fields Ltd, Engineers India Ltd, Steel Authority of India, Indian Space Research Organization (ISRO), National Ship Design & Research Center, Delhi Metro Rail Corporation, Sobha developer, BCG Builders, Kalpaka Builders Pvt Ltd, Skyline Foundations & Structures(P) Ltd., Heera Construction Company Pvt Ltd, Gokulam Engineers India private limited, Abad Builders private limited, Galaxy Builders, National Builders and Developers, Desai Homes, Flare Homes,Jewel Homes ,Mather Projects,. Si Homes, Skyline Builders, Emaar Properties PJSC, Al Nakheel Properties, Saba Real Estate Group (Saba Properties).Survey was conducted on IT specialists and users of these companies.

2.2. Phase 1-Identification of Attributes

Identified attributes through first phase of literature survey, interviews are

- i. Innovativeness

It means originality by virtue of introducing new ideas in terms of PLM software product features and capabilities.

- ii. Training

It means practical skills and knowledge that relate to specific useful competencies in relation to usage of product and getting the best results out of it.

- iii. User friendliness

This means that the interface will guide the users through different stages towards the accomplishment of the tasks. It lessens the difference between users and the systems, such that users can interact more with the tasks and less with the system. User friendly interface will ask the user for details that are sufficient enough to complete the task. The requested details are under a narrow scope and constrained to be meaningful answers.

iv. Bug free

A software bug is an error, flaw, mistake, failure, or fault in a computer program that prevents it from behaving as intended (e.g., producing an incorrect or unexpected result). Most bugs arise from mistakes and errors made by people in either a program's source code or its design, and a few are caused by compilers producing incorrect code.

2.2.1. Tailor Made

It means a software build specially to suite the needs and practices of a particular organization.

2.2.2. Technical Support

Technical support services attempt to help the user solve specific problems with a product rather than providing training, customization, or other support services.

2.2.3. User Documentation

It means a narrative and graphical description of a system. It includes kinds of documentation required to describe an information system for both users and systems staff. It includes-Operating Procedures, Application program documentation - Description of the inputs, processing and outputs for each data entry, query, update and report program in the system.

2.2.4. Cost

It means the price in monetary terms for purchasing the PLM software product.

2.2.5. Functional Capabilities (Coverage)

Functional coverage is defined as explicit functional requirements derived from the device and test plan specifications.

2.2.6. Technology

It means refinement that a PLM software product possesses, in terms of achieving its objective and overall value addition.

2.2.7. Fault Tolerance

The ability of the software to retrieve data that was wrongly entered by the user and allows inputting the right data in the right way. Also, it means the property that enables a system to continue operating properly in the event of the failure of (or one or more faults within) some of its components.

2.2.8. Integration & Inter Operatability

Integration concerns the design of artifacts which are easy to use as part of a larger suite of components, tools or services. Interoperability concerns the technical interfaces which enable separately-designed artifacts to function together so they can be used flexibly.

2.2.9. Standardized

It means a PLM software product built on industrial best practices as against tailor made.

2.2.10. Security (Data Storage And Transfer)

It means protection of information from theft or corruption, or the preservation of availability.

2.2.11. Efficiency (System Resources& Time)-

It means the ability of the PLM software in using optimum system resources like memory and time.

2.2.12. Brand

Marketers see a brand as an implied promise that the level of quality people have come to expect from a brand will continue with future purchases of the same product. This may increase sales by making a comparison with competing products more favorable.

2.3. Phase 2 –evaluation of attributes

The analysis of survey results of 164 samples are made. It Included groups-40 employees, 12 clients, 112 prospects
Step 1-Ranking of attributes depending on the score received from each of respondents

2.4. Methodology

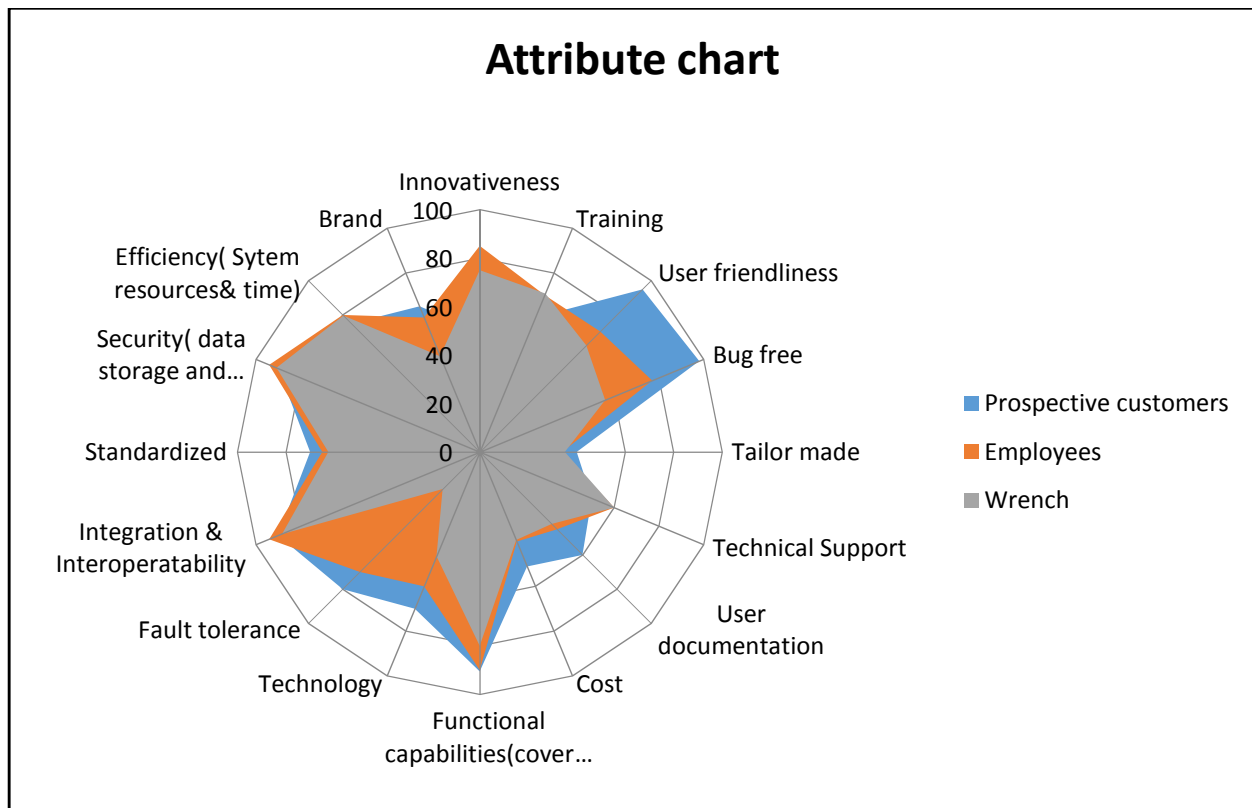
- i. Adding the scores obtained for each attribute for each sample group separately
- ii. Total score thus obtained expressed as a percentage of maximum total score
- iii. Ranking of attributes based on scores.
- iv. Plotting the score in a radar chart to understand the areas that need improvement

1	Innovativeness	75.02	85.02	50
2	Training	70.80	70	60
3	User friendliness	62.18	70.28	95
4	Bug free	55.98	77.03	97.98
5	Tailor made	35.06	34.03	40
6	Technical Support	55	60	50
7	User documentation	42	45.02	60
8	Cost	39.17	40	51.03
9	Functional capabilities(coverage)	79.99	90	90.53
10	Technology	46.50	60	70
11	Fault tolerance	21.60	70	80
12	Integration & Inter operatability	88.35	94.03	90
13	Standardized	62.47	65.02	70
14	Security(data storage and transfer)	90.74	94	90
15	Efficiency(System resources& time)	79.51	80	75
16	Brand	42.18	60	65.02

Table 1

Rank	Employees	Prospective users
1	Functional capabilities(coverage)	Bug free
2	Integration & Inter operatability	User friendliness
3	Security(data storage and transfer)	Functional capabilities(coverage)
4	Innovativeness	Security
5	Efficiency(System resources& time)	Integration & Inter operatability
6	Bug free	Fault tolerance
7	User friendliness	Efficiency(System resources& time)
8	Fault tolerance	Standardized
9	Training	Technology
10	Standardized	Brand
11	Technology	User documentation
12	Brand	Training
13	Technical Support	Cost
14	User documentation	Technical Support
15	Cost	Innovativeness
16	Tailor made	Tailor made

Table 2



4. Findings, Suggestions & Conclusion

4.1. Findings

- i. Attributes have varied significance
- ii. Relative importance of attributes as perceived by clients, employees, prospects were different.
- iii. For prospects in EPC, top 3 attributes were-Bug free, Functional capabilities(coverage), user friendliness
- iv. For employees- Functional capabilities(coverage), Integration & Inter operatability, Security(data storage and transfer)
- v. The attributes like bug free, user friendliness and functional capabilities are rated extremely high by the industry

4.2 Suggestions

- i. Product development team has to cover up the gaps in the product in Bug free, Functional capabilities(coverage), fault tolerance, user friendliness, integration and inter operatability
- ii. Marketing team has to work towards creating a better brand image
- iii. Above all Wrench as an organization has to be proactive-sense the trends and needs of EPC industry and always understand the direction in which they have to move in EPC industry.

4.3 Conclusion

Attributes studied here are critical for a PLM product catering the EPC industry. Going for a product improvement or going for a new product development requires critical information from the industry regarding the attributes that customers expect from software. Survey conducted at two stages revealed some interesting facts about customer perceptions and employee perceptions. There were differences and similarities in opinions with regard attribute scoring. As far as Wrench solutions' is concerned, most of the attributes were closely rated by prospects and employees. That means Wrench can improve further to the proper orientation in product improvement to become the market leader and improve its brand visibility. A market which is not alien to tight competition a few insights and discoveries can always give a company that extra mileage, which can eventually differentiate a leader from the rest. I hope the study can give some insights into product improvement directions for the company.

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