



Project Management Practitioners' Conference 2018

ARCHITECTING PROJECT MANAGEMENT for Value Creation

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The conference banner features a central nighttime photograph of the NIMHANS Convention Centre, a large, ornate building with a prominent central dome and multiple wings, illuminated with warm lights. The background is black, making the white and yellow text stand out. The PMI logo is in the top left, and the PMPC 2018 logo is in the top right.

Managing Electronic Product Development in Global collaborative environments

Global Reach

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ABSTRACT

Description:

With much of the Electronic product development being off-shored to locations other than the native country (Mainly from USA and Europe) there are multi-Fold issues that hamper the course of such development. Many of these problems are attributed to the project management.

Many of these collaborative development model issues have a direct impact the cost of product development, because of Rework, Re-plan, Quality, Certification etc. Offshore Centres like India are losing edge because of above factors to near shore centres Romania, Mexico, etc....

This presentation would highlight some of those Management aspects, issues and solutions that can be employed for a smoother Electronics based Multi-Geographical development projects.

Key takeaways that audience attending this talk would gain:

After this session the attendee shall be able to.

- Understand some of the basic issues one would face during such development
- Solutions to some of the common issues in such development
- Common Points to consider for discussion with suppliers other than costs.

List of topics/sub-topics planned:

- Target Audience
- Relevance of this topic in today's scenario
- Multi-site Scenario and Scope of presentation
- Managing Requirement
- Managing Design
- Development in Multi-site scenario
- Challenges in Verification & Validation
 - Acceptance and payments
 - External audits and Certifications
 - Production and Maintenance
- Q & A

INTRODUCTION

Generally managing any product development has its own challenges. The challenges in the current **Electronic Product Development (EPD)** is twofold. The reasons for this is that in, most of the current electronic product, Software development for that electronic product is an integral part of it. Hence one can consider the development of the Software and Hardware for the electronic product as two separate products in development.

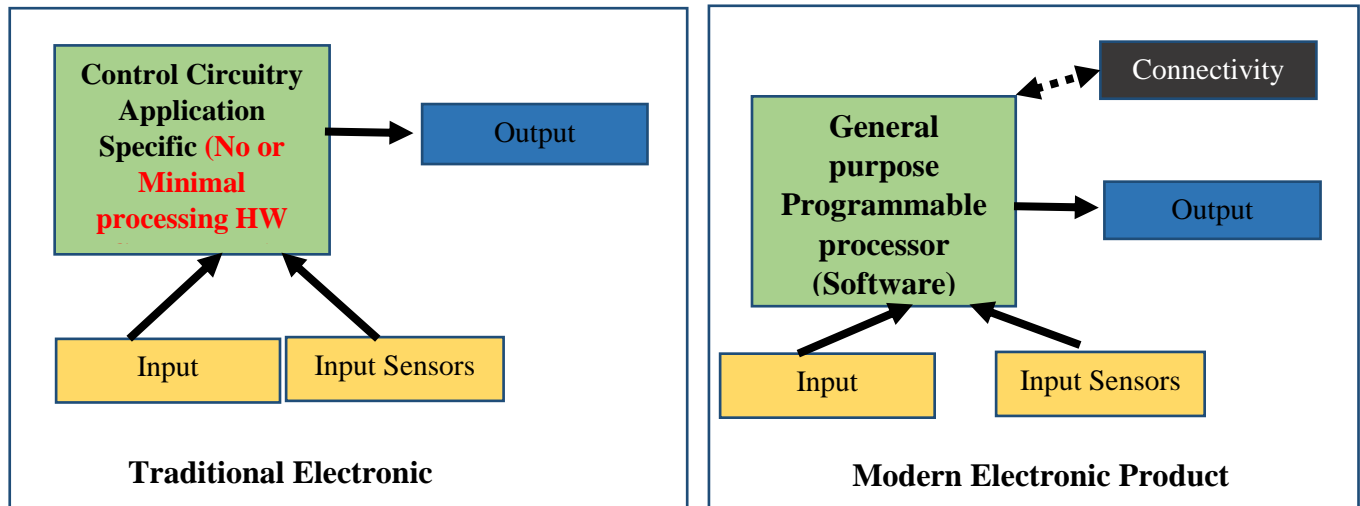


Fig. 1: Traditional Vs Modern Electronic Products

Usually the Electronic/Hardware aspect of these products is more quantifiable in terms of effort, BOM, complexity, resolution time, Skill of member, Quality etc., compared to that of Software. This huge variation in the quantifiable aspect is one of the core reasons for many of the challenges that is faced in any EPD. To this if added multiple geographies then the quantum of challenges increases exponentially.

With much of the EPD being off-shored to locations other than the native country (Mainly from USA and Europe) there are multi-Fold issues that hamper the course of such development. Many of these problems are attributed to the project management. Many of these collaborative development model issues have a direct impact the cost of product development, because of Rework, Re-plan, Quality, Certification etc. Offshore Centres like India are losing edge because of above factors to near shore centres Romania, Mexico, etc....

This Paper would highlight some of those Management aspects, issues and solutions that can be employed for a smoother Electronics based Multi-Geographical development projects.

RELEVANCE

Electronic devices have penetrated all industries (Mechanical, agriculture, Life sciences ...the list goes on). The inclusion of electronic systems into many of the day to day life activities for improvement of performance, comfort, tracking etc. Electronic products combined with the Cloud and AI, through IOT would be the next technological revolution.

IOT whose market share predicted in trillions worldwide in the next few years and with a huge young workforce, combined with the norm of Outsourcing from the west, India is in the cusp of a technological revolution.

The surging of new concept called “Nearshore development centres” is a vindication of the fact that the IT sector encompassing the Electronic Product Development projects in India is losing its sheen. Hence an urging need for revisiting/revitalizing our EPD and management practices. Hence the relevance.

SCOPE

As the title indicates the techniques and practices proposed in this paper shall be applicable to product development happening across geographies, it will be certainly applicable to outsourced embedded development projects even if it is only the SW component. However points may not be directly applicable to some core R&D product developments, and Manufacturing Projects.

INITIATION

Though there are several estimation models available for pure software products/projects and the same applies to the Electronic Hardware. There is no fixed or proven model that can be applied for embedded software development. **Hence during the conceptualising / bidding phase** use the right technical team to conceptualise/asses the product. As a thumb rule involve the technical team (Lead/Architect) who might be heading this project.

TYPE OF PRODUCT/PROJECT:

Broadly any electronic product can be categorized as a hard real-time or Mission critical systems (Pacemakers, brake systems, etc.) or a Soft real-time system (Toys, Mobiles etc.). Thus the costs involved in development of a mission critical product would involve huge additional costs in terms of testing and certification. And it this is activity is out sourced be clear with the **liability** clauses associated with such products.

INFRASTRUCTURE:

For organizations or project managers who are venturing in to the EPD this is an important aspect of the cost to be considered. Because the project sponsor would be having an impression that the points listed below are trivial and not part of the quote.

- 1) Electro static protection and other safety aspects
- 2) Basic tools for the development (Power supplies, Multi-Meters, Soldering Stations etc....)
- 3) Servers for hosting licenses some of the specific software developments
- 4) IT infrastructure as the PCs used for EPD may require some additional privileges and the security thread because of this aspect.
- 5) Special environment for testing (e.g. A water tank for testing a flow meter)

LICENSE:

In any EPD there will be several HW and SW licenses that need to be procured. These costs vary based on the location and the kind of packages that the project would consider if for. If the project is planning to outsource some

part of the project at some part of time then transferring such licenses would involve additional cost. This cost could be very high if the transfer of license is between different countries.

CUSTOMS AND DDP MODE:

Since many of the HW boards are exported from the parent organization usually would attract customs duty on them. But these charges can be easily avoided by providing appropriate documentation to the exporting and importing agency. Also request the exporter to send it in a Duty paid mode. Make this assumption clear in the bid. If this is not agreed then consider an additional bugger cost for this aspect

ELECTRONIC HARDWARE (HW) COSTS

Be clear on the items procured:

This is one of the areas where there is a major inconsistencies will happen in the estimation. Always rely on quotes from the authorised vendors with the right specification and don't make any assumptions. In the case of electronic equipment's there are various grades and standards based on countries which the product is targeted to. Please be aware of this factor.

HW certification costs:

All HW needs to get some basic certification plan for these costs, e.g. the EMI/MC testing and certification.

HW calibration costs:

Many of the Electronic measuring equipment's would require calibration of the devices. This is quite a cost especially if the product being developed is a very sensitive and mission critical product

THIRD PARTY LIBRARIES (TPL) IN SOFTWARE

Generally most of the EPD would involve a significant cost of the Third-party software. Usually when a third party software is not delivered as a library. The whole set of code is provided. This is because the TPL software vendor would have developed his product on a generic HW usually a PC. This is one significant cost.

TRAINING COSTS:

Whatever be the experience levels of team members involved in any EPD a significant cost would be involved in the initial competency build-up for the development activities of the product. More importantly intercultural trainings should be mandated for the team members interacting with the customers/clients

TRAVEL / ONSITE COSTS:

Have enough buffer for short technical business trips (1 or 2 week in duration) for various integrations within the project at various stages of integration. This is apart from the standard travels mandated which has been accommodated in the estimation

TRANSLATION COSTS:

Many of the European countries many a times while giving requirements or sharing documents do it in their native language. In which case there would be additional translation cost involved. Do use certified translators proposed by the project sponsors

PLANNING

Along with the regular project plan document and the Service Level Agreements (SLA) the following topics listed below should be discussed in detail in a multi geographical EPD.

PLANNING FOR IDENTIFYING THE SCOPE AND REQUIREMENTS

Like any other project this step of planning requirements in one of the most important step for an EPD. Significant cost overruns can be expected if this activity if not properly planned and tracked. One of the best practices for requirement management is to do and requirement engineering within the project itself. This is irrespective of the fact that the customer is giving detailed requirements. It can be elaborated in the following steps:

- 1) Customer delivers requirements for the product/project
- 2) Leads of architects develops the **Module requirements** for the customer requirements
- 3) Defines the scopes for the work and develops a RASIC kind of sheet for the requirements
- 4) Review within the project/other stake holders in other locations and other groups as a first step
- 5) **Share it to the customer, TPL and other stakeholders outside the organization** for a sign off before starting the major phase of development.

Though following the above set of steps is the most difficult in the starting of the, if followed will help in identifying the, project scope that the concerned team has to look upon. Many a times this ambiguity in the scope of work is the main cause of cost overruns.

The customer who's interested is mainly on the project delivery timelines would certainly understand that this is the crucial step in the EPD but at the same time request out a timely delivery. In this scenario the managers influential and negotiation skills are put to the test. The manager has to strike a balance between the delivery timelines and the content of his first set of deliveries.

In this step the Architect skill are also under test. He has to start with the design even before the signoff of the requirements from the customer but be ready the design such that it can be adapted to any changes in the module requirements.

Also make versioning very clear and in detail, this will identify from which stakeholder maximum changes have happened. This can help to either request for additional budget or additional time.

DEVELOPMENT STRATEGIES

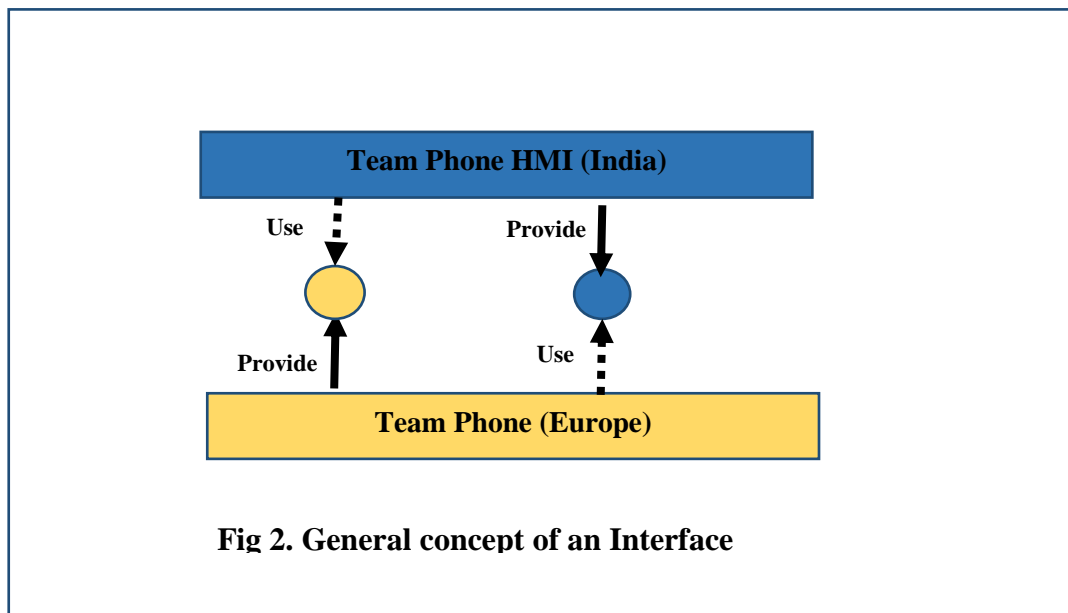
Planning for development is one of the important steps the EPD. One of the major and the important step is the identification of division of work (Work package) and identifying the dependencies and planning based on those inputs. Some of the imminent issues that you will find are as follows:

DEPENDENCY ON HW: This is a very important dependency. The strategies that can be applied to tackle this issue are as follows

- 1) *Initiate development on sample boards* – based on the development Processors/Micro-Controller, generic development kits are available in the market. Make sure that you also develop software in the same OS as request by the project sponsor. Later the development can be moved to the customized HW developed for the product
- 2) *Use PC environment for development* – Depending on the size of the project a PC variant of the software can also be developed. This PC environment Software can be used in conjunction with some generically available sensor. E.g. Assume that you are requested development of a special digital camera using a specific camera sensor interface which is being developed by the HW team. In this case the development can start on a Pc with any commercially available camera sensor available for PC. This approach technically has many advantages if done in the right way.
- 3) *Development of simulated environments* – Assume that the project involves development of a GUI for a speed sensor on a particular HW board. And there is a delay in getting the speed sensor on time for development because of various reasons. In this example since the output of the speed sensor is in some voltage range based on speed this can be simulate using a variable power supply. The above illustration is only an example similar approaches can be explored at the start of the project.

Dependency on Software (SW): Much of this dependency can be handled carefully and thought fully through a document called “interface specification” (IS). This interface specification should be developed and agreed between all the interdependent SW components.

Though this is a technical document as managers one has to makes sure that an agreement is reached between the two development teams on the IS much early in the project (Before Completion of Design). Also get the agreed timelines for the delivery of the document and the deliverables.



PLANNING OF RESOURCES:

Apart from the regular role planning of resources the following special roles should be considered for an EPD.

LEAD SYSTEM ARCHITECT: This role is the most important role in a Multi-Site development scenario. This person should be the final authority on the technical process adapted across geographies and point of contact for technical conflict resolution.

COORDINATOR FROM THE CUSTOMER: If a 15 member team sized project is outsourced then one coordinator from the outsourcing Organization is a must. If this is not addressed by the outsourcing company then raise this as and major issue through your escalation mechanisms.

ONSITE RESOURCE PLACEMENT: Place one coordinator resource at the place where all the components of SW and HW are getting integrated. It is best to consider minimum of 6% of effort for Integration related activities

NATIVE COORDINATOR: Apart from the above consider adding a senior resource who is a native of the project sponsoring organisation. E.g. if a Project is outsourced from Japan consider adding a Japanese manager for discussion with the senior management. This effort ratio can be such that for a 20 member team this high level coordination would require a 4 hour / week of effort.

SOURCING CONTRACT EMPLOYEES: One of the important aspect in any EPD is the team ramp-up time. This aspect clearly differentiates from the rest of Application/IT software development projects. Hence for projects where the ramp-up time is very short sourcing contract employees is a must. But take caution with the sourcing company some of the cautions to be taken are as follows:

Ensure Sourced contract employees serve under the terms and conditions of the outsourcing organization and not the parent organization.

Ensure that the sourcing company has relevant expertise in the field in which you are looking for. Minimum there should be 2 or 3 employees who are readily available for the project needs. If this is not the case do not consider entering a contract with that sourcing organization.

All the above planning can incur additional cost. Depending on the type of coordination scenarios, sourcing needs the cost incurred can vary. As thumb rule if a contract whose duration is more than 5 months better to hire permanent employees.

TECHNICAL COMMUNICATION / PROCESS PLAN:

One of the best practices for development is to use continuous integration (CI) process for faster turnaround EPDs. But this is effective only if requirements are readily available with less ambiguities.

Importantly have a separate discussion as to how a multi geographical process would happen. Key points to consider who will own the configuration management, how the deliveries will be done, how requirements would be given and discussed.

Also having a clear Technical communication plan, this communication is about the documentation that various teams will keep in place and updated – mainly the Interface Specification document.

INFRASTRUCTURE OF THE OUTSOURCING COMPANY

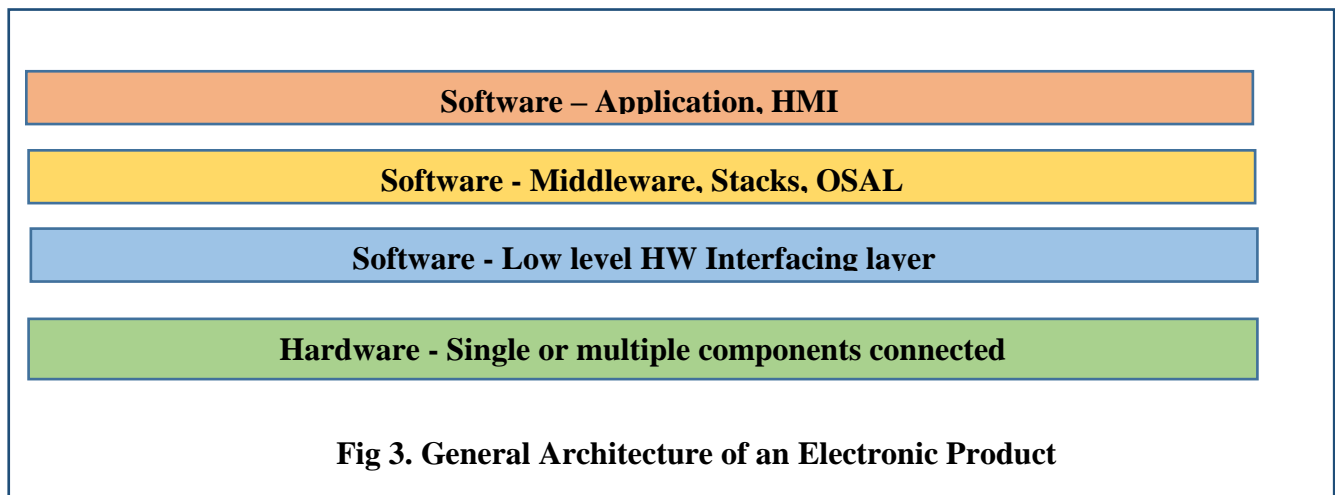
Consider a situation where a part of the HW that has to be developed and If this HW had to be outsourced consider assessing the company to which this would get outsourced before getting into an contract.

EXECUTION

Every execution of a project in EPD has the following steps – Requirement analysis, Design for requirements, Code/Develop, Integrate, and Finally Test the product, in short it is called RDCIT. Depending on the size of the project the above steps may happen at a single location or at multiple locations. Generally the RDC are not placed across different locations.

There are various ways the Product development activities are divided and distributed. Some of the prominent are as follows:

- 1) Entire HW and SW are outsourced to only one Organization/Company
- 2) The Product has single HW and multiple SW components and some of the SW components are outsourced
- 3) The Product has multiple HW and SW components and some of the SW components are outsourced
- 4) The Product has multiple HW and SW components and some of the both HW of the SW components are outsourced
- 5) The EPD has single HW and SW – but the SW is divided into multiple layers and each of these layers are outsourced.
- 6) In some cases the Customer is only an integrator



In all of these scenarios what really makes the EPD successful is Communication and Process adherence. Management should ensure that the process laid down for the EPD are strictly followed and adhered to by all the stake holders. Some of the challenges faced during execution are listed below:

MINIMISE DEPENDENCIES:

One of the main reasons for product delays is the dependencies. Plan a detailed design and then start execution. This would minimise dependencies. Be cautious in changing interface specifications. Try and have generic interface definitions.

For testing create test stubs for standalone testing and testing through scripts. This would reduce the rework at the stage of integration.

ACCEPT CHANGE REQUESTS (CR'S) CAUTIOUSLY:

Customers would usually come up with many CRQs and would request them in the next release planned. Accept this only and only if it is feasible. If you see a risk take all stake holders into consultation and arrive at a solution. The best process is to do an impact analysis on the change and have the customer into confidence.

SYNC BETWEEN VARIOUS LOCATIONS

There are several areas of synchronisation required between multiple locations in the project execution.

SYNC OF DEVELOPMENT ENVIRONMENTS: The product owner should ensure that all the locations involved in the development have the same development environments. This starts from the various variants of the HW, compiler settings, Tools used etc.

If for various reasons if some team is developing on simulated environments – care should be taken to accommodate issues that might arise of this.

SYNC OF TESTING AND ISSUE REPORTING MECHANISM: In most of the EPD involving multiple geographies the test team is kept separately. And the expectations of the test team with that of the development team would not match. As result more issues are logged and the development team's effort is lost in issue rectification process. Hence a feature description is given to both developers and testers in a common forum.

SYBC OF TIME ZONES: Time zones of various locations can be Boon and Bane depending on the process accepted for the product development.

DECISION POINTS

In the EPD across geographies taking decisions more time than actual work. Have process to ensure that decisions are arrived across team in a very short period. This would save a lot of effort and rework.

MONITOR AND CONTROL

Apart from the regular monitoring and control mechanisms some of the additional points are the for any EPD.

PERFORMANCE OR NON-FUNCTIONAL REQUIREMENTS:

Start checking for the Non-Function and performance requirements much early in the project. Some of the non-functional requirements could be size of the final executable binary, adhering to certain certification requirements etc. Start testing on those parameters from the start of the first deliveries.

EMPOWERING THE TEAM & ACCOUNTABILITY:

One of the main steps in monitoring and control is to identify accountable persons across geographies. Use the RASIC sheet for identifying the same. Though this planning is done quire early reiterate and revisit this document every month if possible.

QUALITY METRICS:

Empower the team to adhere to the quality metrics. Give clear illustrations to the team of the consequences if not adhering to the quality metrics. Also listen to the team concerns across geographies if a particular metric is not met.

COMMUNICATION POINTS

Since communication is with various people from various geographies ensure the following:

KEEP THE COMMUNICATION SIMPLE. – Do not use complex sentences in oral or written communication. Always start from the beginning when describing a problem. Use examples or diagrams to communicate. Diagrams speak a thousand words

CULTURAL SENSITIVITY- Have cultural sensitivity while communication. Inter cultural training would help in this regard.

OVER/UNDER COMMUNICATION – Both types of communication are not a healthy for the project. Keep the communication accurate, precise and simple and also communicate to the targeted audience only.

CLOSING

Apart from the other closing formalities what would be additional in the EPD are listed below:

E- WASTE

E-Waste is a by-product of any EPD. Carefully handling of this waste is a must.

BACK SHIPMENT

In many of the EPD projects customers would have shipped or shared the equipment's, Test devices etc. for the development activities. At the end of the project we would have to do a reshipment back.

CONCLUSION

Described above are some of the challenges and solutions in Electronic Product Development across multiple – geographical scenarios. If adhered to these suggestions Indian EPD companies can bag in global projects thus repositioning India's IT industry in greater **Global reach**.

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