International Journal of Innovative Research in Computer Science & Technology (IJIRCST)
ISSN: 2347-5552, Volume-10, Special Issue-12, December-2022
Innovative Projects 2022
Organized by Presidency University, Bangalore, India

Organizing and Integrating System Development

Mr. Kunal Saxena
Asst Professor, Department of Management, Presidency University, Bangalore, India,
Email Id-drkunal@presidencyuniversity.in

ABSTRACT:

For complex systems to be developed and implemented successfully, system engineering is essential. The difficulties involved in planning and integrating system development becoming more complicated as technology progresses. The main factors, tactics, and approaches involved in efficiently organising and integrating system development within the framework of system engineering are covered in detail in this abstract. It starts out by demonstrating how important system development organisation and integration are to the success of system engineering projects as a whole. It emphasises the need for a methodical strategy to handle the plethora of parts, parties engaged, and activities involved in system development. The abstract then explores the numerous elements that affect how system development is organised. It looks at how crucial it is to build efficient communication channels, clearly define project objectives, and use the right project management techniques. The importance of multidisciplinary cooperation, stakeholder involvement, and the integration of many subsystems within the broader system are also discussed.

KEYWORDS:

Complex Development, Integrating System, Cross Membership, System Development.

I. INTRODUCTION

Successful project management and systems engineering depend on planning and integrating system development. It entails organising several tasks, assets, and stakeholders to guarantee effective system delivery and smooth cooperation. System development often includes several teams, departments, and organisations cooperating in today's complex and linked environment. To produce a united and cohesive result that matches the project's goals and stakeholder expectations, it is crucial to organise and integrate these activities. There are various important components that make up the organising and integrating phase of system development. First and foremost, it entails clearly outlining the roles, duties, and reporting lines for the teams and people working on the project. This promotes efficient decision-making and effective communication while also establishing responsibility [1], [2].

Furthermore, organising and integrating system development requires the creation of efficient communication channels. It makes sure that information is shared across all parties in a timely and correct manner, allowing for the exchange of ideas, demands, and criticism. There are several ways to communicate, including via regular meetings, written materials, teamwork tools, and project management software. Resource management is another component of planning and integrating system development. This include determining and assigning the project's support staff, equipment, facilities, and financing. The project will advance in accordance with the planned timeline if resources are allocated properly, and any possible bottlenecks or resource shortages will be dealt with early on [3], [4].

Integration is also an important part of planning system development. For a system to be cohesive and functional, different subsystems, components, or modules must be combined. System testing, verification, and validation are some integration tasks that may be used to make sure that all components function properly and satisfy the specified performance standards. Strong configuration management procedures must be set up for effective integration. This entails managing and regulating adjustments to the system configuration during the course of the system's lifespan and making sure that changes are appropriately documented, tested, and applied. Maintaining system integrity, traceability, and dependability is made easier by configuration management. Planning and integrating system development is essential for a project's effective completion. Roles and duties must be established, effective lines of communication must be established, resources must be managed, and subsystems must be integrated into a single system. Organisations may improve cooperation, reduce procedures, and

ultimately produce high-quality systems that satisfy stakeholder demands by strategically planning and integrating system development initiatives [5], [6].

II. DISCUSSION

Complex Development

Since many years ago, the DoD has mandated that system designs be integrated to balance the competing demands of objectives including performance, affordability, supportability, producibility, and testability. To develop integrated designs, the DoD and industry are increasingly turning to the employment of multidisciplinary teams. It has been discovered that teams make it easier to achieve cost, performance, and other goals from product conception through disposal [7], [8].

Design-Build, simultaneous engineering, concurrent engineering, integrated product development, and other proprietary and non-proprietary names that represent the same idea all refer to the utilisation of multidisciplinary teams in design. The term "Integrated Product and Process Development" (IPPD) is used by the DoD to refer to a broader concept that include the systems engineering effort as a component. This chapter goes on to discuss the DoD policy. Regardless of the nomenclature, the basic concept comprises multi-functional, integrated teams that are ideally co-located and who collaboratively formulate requirements and schedules that give equal weight to the development of both products and processes. The integration calls for:

1. Making sure the team(s) participating in the design process includes the eight basic roles;
2. Process-specific technical expertise in areas like quality, risk management, safety, etc., and
3. Business operations, including contracts, financial, legal, and other non-technical assistance (often in an advising position).

Benefits

The following advantages of team-based integration are anticipated:

1. Less rework in planning, production, tooling, etc.;
2. A decrease in product variability and an improvement in first-time quality
3. Decreased cycle time and cost
4. Lower risk,
5. Better operation and assistance, and
6. Consistently higher levels of customer satisfaction and product quality over the lifespan of the product.

Characteristics

The following characteristics of a well-integrated effort are crucial:

1. Customer-centricity
2. Concurrent product and process development,
3. Planning for the life cycle early and often,
4. Maximum adaptability for improvement,
5. Stronger design and enhanced process performance,
6. Event-driven planning;
7. Multidisciplinary collaboration

System Development Organisation

The majority of DoD programme offices are a component of a Programme Executive Office (PEO) group, which is typically backed by a functional group like a systems command. Contractors and other government initiatives provide the extra help that is required. A network of teams that include members from each of these organisations is necessary to establish a system development organisation. This network, which is often referred to as the enterprise, facilitates vertical and horizontal communications while representing the interests of all stakeholders [9], [10].

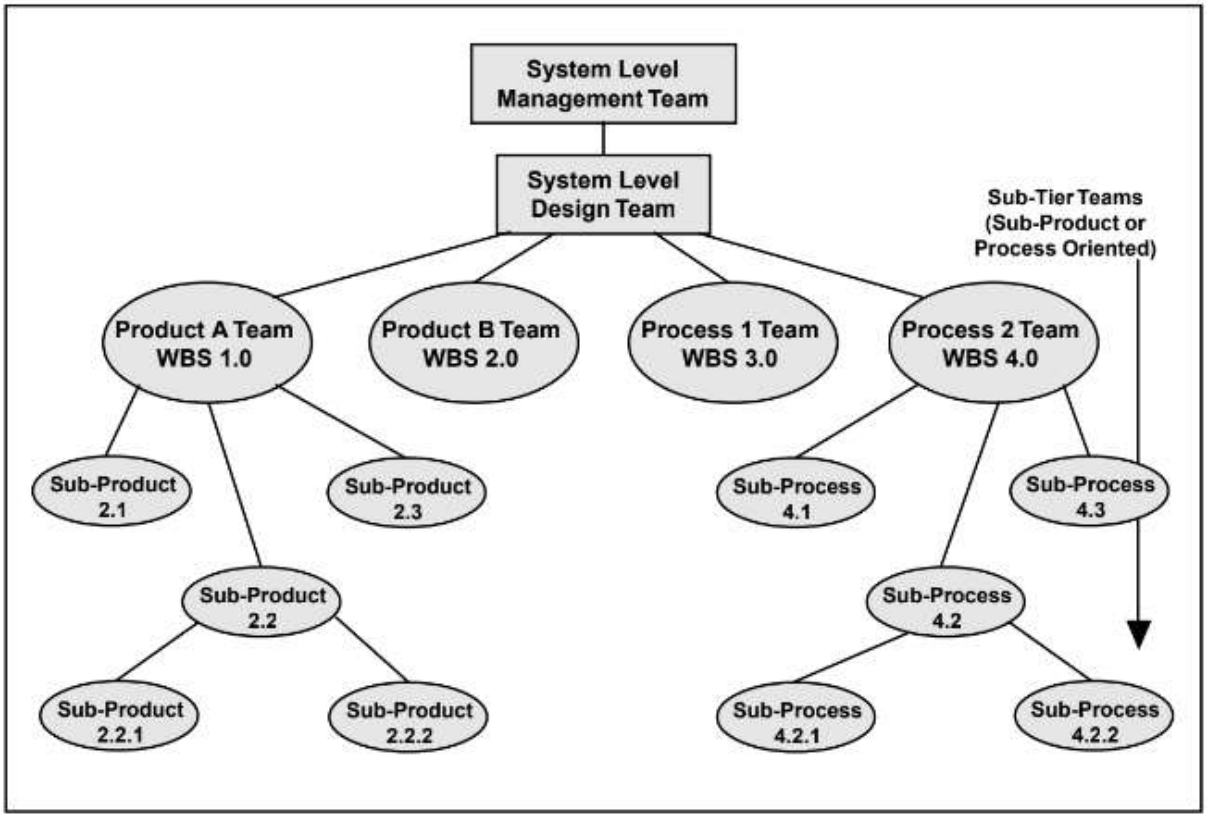

Figure 1: Integrated Team Structure.

The WBS is used to organise these integrated teams, which are intended to maximise vertical and horizontal collaboration throughout the development process. The typical method of team organisation is shown in Figure 1. There are often a management team and a design team at the system level. The programme managers from the government and contractor, the deputy programme manager(s), possibly the contractor Chief Executive Officer, the contracting officer, major advisors chosen by the programme manager, the leader of the system design team, and other important members of the system design team make up the management team in most cases. First-level subsystem and life-cycle integrated team leaders are often on the design team.

On Figure 1, teams at the next level are shown as either product teams or process teams. These teams are in charge of creating either the supporting or enabling goods (process teams) or the system segments (product teams). The system level process development is being coordinated at this level by the process teams. The support team, for instance, will include the supportability analysis from the components produced by lower-level design and support process teams. Teams below this level continue the decomposition process at a lower level. Only the smallest teams required to manage the integration are established. Contractor teams may extend to lower levels, depending on the complexity of the project and the management-favored strategy, although DoD team structures seldom reach lower than levels three or four on the WBS. Figure 1 depicts a team organisation that is hierarchical and enables for ongoing vertical communication. This is generally accomplished by having the team leaders and, if necessary, other important team members, be team members of the next highest team. In this way, the choices of the higher teams are promptly communicated to and explained to the lower teams, while the higher teams are regularly updated on the lower teams' decisions. By using this strategy, lower-level teams' choices are made in accordance with higher-level teams' decisions, which take lower-level teams' concerns into account.

Figure 2 depicts the typical process to establish horizontal communication. The Integration and Test Team includes at least one team member from the Product A Team. This team member would be well-versed in testing and Product A generally. The member's role would be to help the two teams create their final or enabling products and to ensure that each team is aware of how its choices may affect the other team.

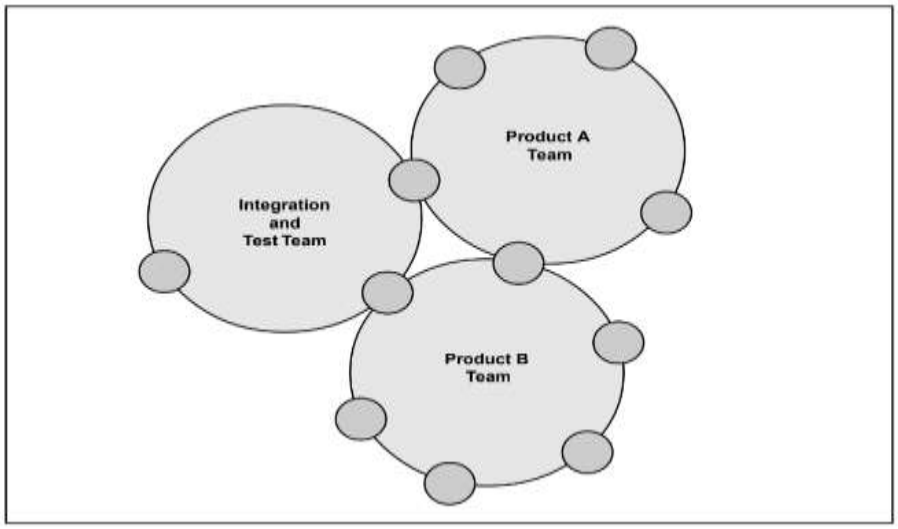

Figure 2: Illustrate the Cross Membership.

Similar to this, the team member who works on both Products A and B would need to be familiar with both the technology and the interface problems related to both products. This is an idealised example. This structure must be customised for each kind of system, contractor organisation, and degree of available resources. The structure should evolve as the emphasis and duties do with each phase. The business structure and team composition should be reassessed and adjusted as stages are transited.

COMPOSITE TEAMS

Representatives from all relevant core functional disciplines form integrated teams under the direction of a team leader to:

1. Create profitable, well-rounded goods.
2. Create the configuration necessary for effective life-cycle control.
3. Recognise and address problems; and
4. Make wise judgements in a timely manner.

The teams adhere to the systematic systems engineering process, which has already been covered in this book, from requirements analysis through the creation of configuration baselines. The systems engineering management planning and execution should fall within the purview of the system-level design team. The highest level programme IPT, the system-level management team, is in charge of acquisition planning, resource allocation, and management. Lower-level teams are in charge of organising and carrying out their own procedures.

Team Organization

Good teams are the outcome of deliberate management choices and activities; they do not simply happen.

Each team has to be created at the same time as the corporate organisation mentioned above. In an enterprise network, the following are essentially the main factors to take into account while preparing for a team:

1. The team has to have the right mix of key duties, technical specialties, and business support.
2. In order to build vertical and horizontal communication inside the organisation, linkages must be present.
3. You should avoid using cross-membership excessively. As a general guideline for the working level, limit membership to three or four teams, and
4. To ensure integration across important organisations, make sure the government, contractors, and suppliers are properly represented.

Team Development

Teams go through a number of stages when they are founded before evolving into a synergistic self-actuating team. These stages are also known as "forming," "storming," "norming," and "performing." The team size, personality of the members, effectiveness of the team building techniques used, and team leadership will all influence the time and intensity of each phase. During the team development, the team leaders and an enterprise-level facilitator give leadership.

The forming phase is when new members are introduced to their roles and fellow members. Members will often want a controlled environment with a clear goal and method throughout this time. Members' doubt and hence their capacity for comprehension are decreased if they are guided at this preliminary phase. The team building facilitators should provide the participants with rules and duties, but progressively lessen the amount of guidance as the team members get to know one another. Members get more comfortable in their surroundings and start interacting at a greater level as they become more acquainted with other members, the rules, and duties.

The storming phase is now underway. Storming is the conflict that results from interactions between people's approaches to the tasks and personalities of the team. Members that understand how they must interact with one another to achieve team goals are the result. Storming dynamics may be very complicated and stressful, making it the most important stage. There will be teams who pass through it swiftly and without a noticeable wave, teams that are loud and heated, and teams that never leave this phase. The facilitators of team building exercises must be vigilant for signs of dysfunction.

III. CONCLUSION

In conclusion, system engineering project execution success and efficiency depend on organising and integrating system development. To guarantee a well-coordinated and integrated system, it entails organising and coordinating the different activities, disciplines, and stakeholders engaged in the development process. Establishing distinct roles, duties, and communication channels within the project team is the first step in developing an organising system. The project organisation structure must be defined, relevant stakeholders must be identified, and team members must be given particular duties and deliverables. Organisations may encourage cooperation, reduce disputes, and increase overall project efficiency by outlining roles and fostering efficient communication. The process of integrating system development involves combining many elements, subsystems, and disciplines to produce a cohesive and useful system. To make sure that the system's components operate together without a hitch, rigorous planning and coordination are necessary. It entails creating clear system interfaces, organising design and development tasks, and putting effective integration and testing procedures into place. Organisations may reduce the risk of expensive rework or system failures by properly integrating system development by identifying and resolving any conflicts or concerns early on.

REFERENCES

[1] M. Derakhshanmanesh, J. Ebert, M. Grieger, and G. Engels, “Model-integrating development of software systems: a flexible component-based approach,” Softw. Syst. Model., 2019, doi: 10.1007/s10270-018-0682-5.

[2] L. Cheng, T. Yu, H. Jiang, S. Shi, Z. Tan, and Z. Zhang, “Energy Internet Access Equipment Integrating Cyber-Physical Systems: Concepts, Key Technologies, System Development, and Application Prospects,” IEEE Access, 2019, doi: 10.1109/ACCESS.2019.2897712.

[3] R. Blonder and S. Rosenfeld, “Integrating the Human Element in the Responsible Research and Innovation Framework into Systems Thinking Approaches for Teachers’ Professional Development,” Journal of Chemical Education. 2019. doi: 10.1021/acs.jchemed.9b00387.

[4] T. Rana, D. Wickramasinghe, and E. Bracci, “New development: Integrating risk management in management control systems—lessons for public sector managers,” Public Money Manag., 2019, doi: 10.1080/09540962.2019.1580921.

[5] M. A. Weissenberger-Eibl, A. Almeida, and F. Seus, “A systems thinking approach to corporate strategy development,” Systems, 2019, doi: 10.3390/systems7010016.

[6] J. Costa, J. C. Diehl, and D. Snelders, “A framework for a systems design approach to complex societal problems,” Des. Sci., 2019, doi: 10.1017/dsj.2018.16.

[7] R. S. Riley, C. H. June, R. Langer, and M. J. Mitchell, “Delivery technologies for cancer immunotherapy,” Nature Reviews Drug Discovery. 2019. doi: 10.1038/s41573-018-0006-z.

[8] P. R. S. da Paixão, M. H. da S. Wencelewski, and M. H. R. Nascimento, “development of an automation system, integrating a virtual assistant and iot devices,” ITEGAM- J. Eng. Technol. Ind. Appl., 2019, doi: 10.5935/2447-0228.20190051.

[9] Y. Manoharan et al., “Hydrogen fuel cell vehicles; Current status and future prospect,” Applied Sciences (Switzerland). 2019. doi: 10.3390/app9112296.

[10] W. D. Juniawan, “Sistem Perencanaan Pembangunan Terintegrasi Melalui Penerapan E-Planning (Studi Kasus pada Bappeda dan Litbang Kabupaten Gianyar),” J. Ilm. Adm. Publik, 2019, doi: 10.21776/ub.jiap.2019.005.03.4.