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An analysis of the main project organizational structures: Advantages, disadvantages, and factors affecting their selection

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Abstract

Generally, we can define project organizational structures as organizational forms, based on temporary teams that are created to perform particular tasks and disappear after achieving the established goals. Whereas simple projects may require a limited number of steps and specializations, complex projects may be composed of plentiful of steps and require diverse and different specializations. As the project increases in size and design more units and specializations are added to the organizational structure contributing to both more vertical and horizontal organizational differentiation. Thus, when designing a project organizational structure the following questions must be answered: How many different specializations are included in the design of the project? How are the interrelatedness between the different elements of the project and between the different specializations? How many different activities are to be managed? In this paper, we analyse the three generic project organizational structures that are presented in the extant literature; functional, pure project, and matrix, together with their advantages and disadvantages. Furthermore, the most important factors that should be considered when designing a proper organizational structure are also analysed.

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Keywords: Projec Organizational Structure; Funticonal Structure; Pure Project Structure; Matrix structure

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1. Introduction

When considering project organizational structures, there have traditionally been two main approaches. The first one considers projects as a sub-set or branch of organizations, while the second one consider them as a concept completely disconnected from them. In the context of complex organizations, for example, projects have been treated as temporary or additional burdens on the organizations, outside their regular operations in order to distinguish them from the hierarchical, functional organization that operates on an assumption of continuity or even growth [1-3]. Based on contingency theory and following a similar approach, Senhar [4], consider projects as particular kinds of organizations, having a specific structure depending upon external and internal factors.

In setting up an organizational structure for a project there are many important aspects to consider, i.e, physical constraints of the project, market conditions, the time needed for conducting procurement, etc. All of these factors will shape the context in which decisions are made, the form of the organizational structure, the ability of project managers to make decisions and, first and foremost, the future of the project.

The design of an organizational structure for a project may be a challenging task. Many questions arise at this early design stage. What decisions are made upfront at the start of the design phase, how the organizational structure develops over time, how is the structure modified in response to a changing environment, how are the project organisation and the project routines adapted to changing circumstances, how is the structure interpreted and adapted by project managers, how the type of project affects the project organisational structure and vice versa.

Careful thought needs to be given to the design of these project organizational structures in terms of coordination, communication, and control. Organizational arrangements create physical and operational boundaries for decision-making, they can also reduce or increase complexity through the choices made in defining relationships, allocating responsibilities, authority, and tasks [5]. The distribution of roles and responsibilities within the project organizational structure needs also to balance technical, social, cultural, and administrative issues [6].

The organizational structure of projects has been addressed only rather reluctantly. By the Project Management Institute, project organizations has been dealt with as a separate subject [7]. The existing literature only implicitly addresses different project structures and contingency factors that influence project design parameters within these structures [3]. Part of the literature [8,9] provides a nuanced understanding of the suitability of different project types showing how different project based organizational structures change over time and deliver different types of projects such as R&D and new product development projects [10-14], large scale projects [15-19], and sector specific project activities [20-23].

Morgan [23], and Winter and Szczechpanek [24] argue that multiple perspectives are needed on organizations into a call for multiple perspectives on projects. Maylor et al [25] adopt a project management perspective when dealing with project structures and organizational structures. Turner [26] and Meredith and Mantel [27] discuss the advantages and disadvantages of locating a project within a functional department, as a separate, independent project or within a type of matrix or mixed organization. Whittington et al., [28] refer to as the routinization and standardization trap in large scale projects when routines, procedures, standardization work patterns and formal hierarchies are adopted and develop. Hodgson [29] illustrates how project based organizations may end up being more bureaucratic than the bureaucracies they are intended to replace. Van Donk and Molloy [3] contribute to the conceptual basis and development of project management by considering projects having a specific structure as organizations. Based on the work of Mintzberg [30], the authors develop a typology of project structures. Senhar [4] builds on contingency theory to distinguish different types of projects and how they are managed in different ways but without including a discussion about the structure of the project organizations. Aubry et al., [31] analyse and document with events, tensions, and changes, the evolution of four project management offices in four different organizations. The authors aim at providing a grounded theoretical foundation on which to base a better understanding of organisational project management. Kuprenas [32] presents the implementation and use of a matrix organizational structure in the Bureau of Engineering at the city of Los Angeles. The author identifies the needs for a matrix structure, describes the problems associated with its implementation, and evaluates the effectiveness of the project management process within the matrix organization. Kwak et al., [33], using a case study approach, examine the development and implementation of the project management competences in a project-based organization over a period of 30 years. Eriksson and Kadefors [34] carry out a longitudinal case study of the early design phase of a major railway tunnel project in order to provide a deeper understanding of how organisational structures and

coordination mechanisms emerge and develop over time in large and complex infrastructure projects. MacAskill and Guthrie [5] explore the impact of organisational scope on shaping infrastructure reconstruction decisions in a case study of post-earthquake reconstruction in New Zealand. The authors demonstrate how active exploration and early recognition of organizational scope provide the opportunity to identify means of collaboration and to overcome complexities.

This paper analyses the three generic project organizational structures that are presented in the extant literature; functional, pure project, and matrix, together with their advantages and disadvantages. Furthermore, the most important factors that should be considered when designing a proper organizational structure are also analysed. The organization of the paper is as follows. We begin with a discussion about organizational structures and the main factors that can affect their form. Next, the three generic project organizational structures are presented. Section 4 presents a comparison between these project structures. Finally, there is a concluding section with the main findings of the paper.

2. Project Organizational Structures

When it comes to structuring a project, one of the most important decisions is the form of the organizational structure that will be used to execute the project. The form of the structure will define the relationships among the members of the project, the relationships with other projects, or even with the external environment. It will also define the authority, where each member of the project is located, and the lines of communication, supervision, coordination and collaboration among its members. Table 1 shows the most important factors that should be considered in order to attain an effective project organizational structure [35-38].

Table 1. Main factors affecting the form of a project organizational structure.

Factor	Description
Division of labor	Labour should be divided among departments to ensure specialization. Dividing labour into distinct tasks and coordinating these tasks will define the structure of an organization
Background and experience	Previous experience with project organizational forms
Interdependence and interactive management	The number of systems and subsystems that integrate the project, the different methodological and philosophical assumptions across these systems, the cross-organizational and schedule interdependencies between activities.
Concurrent Engineering	Concurrent Engineering breaks down functional and departmental barriers by integrating team members with different discipline backgrounds often known as cross-functional teams
Authority, responsibility, and leadership	Authority and leadership should correspond with responsibility. Vision, strategy, and a cohesive team are also considered key factors
Unity of command	It should be clear who the upper level managers are with a well-established lines of commands. Every member of the project must also know what his obligations are
Personnel	Good selection of personnel with adequate skills and talents, which can lead to objectives accomplishment
Stakeholders	The number of project participants and how the information flows between them can affect the form of the structure
Spans of control	Work processes and systems should be efficient and effective with adequate levels of control
Flexibility	Structures should be flexible and dynamic with the ability to adapt to changing conditions of the external environment
Culture values	Loyalty of workers and commitment to the project
Other factors	Project size and duration, environment and territory, technology

There are several possibilities of organizational structures that differ in size, authority, responsibility, reporting, etc., but basically, three generic project organizational structures are the most common in the extant literature,

functional, pure project, and matrix structure [4,37,38]. We cannot say that one of these particular organizational structures is the most efficient and effective for all types of projects. Every project is unique and it requires a different management approach, so it is important to choose and adjust the organizational structure to the project needs taking into account, for example, the organizational environment, the project characteristics, the level of authority, etc. Next, we will analyse in detail the three generic project organizational structures mentioned above.

2.1. Functional project structure

In the functional project structure, various temporary teams coexist with a stable hierarchical form. Project managers can be located on various organizational levels and there is no clear subordination. Organizational hierarchy is replaced by heterarchy, a situation where there are numerous temporary authority centers on different levels of the organization and they can change as tasks are completed [39]. This type of structure is not suitable for projects that require a diverse mix of people with different expertise, however it works well for small projects that require a great deal of technical expertise. A typical functional project structure is shown in Fig. 1.

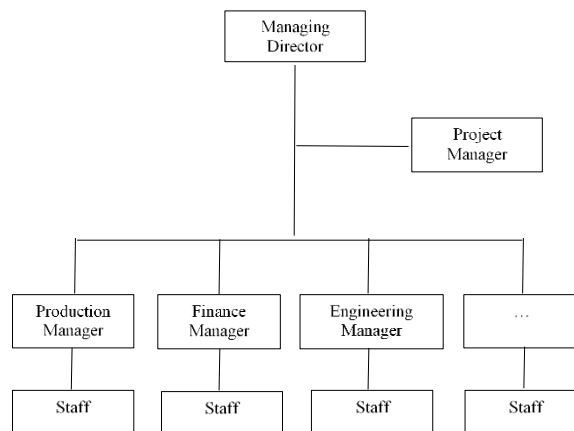


Fig. 1. Functional project structure.

2.2. Pure project structure

In this type of structure project managers have a high level of authority which affords them strong project control but also the full responsibility for the performance of the project [35-38]. Personnel are specifically assigned to the project and departmentalized by task similarity, usually on an exclusive or full-time basis developing a strong sense of project identification and a good understanding of the project goals. Pure project based structure are more common in large organizations that realize huge valuable and long-term projects and that can absorb the cost of maintain this type of structure. Fig. 2 shows a typical pure project structure.

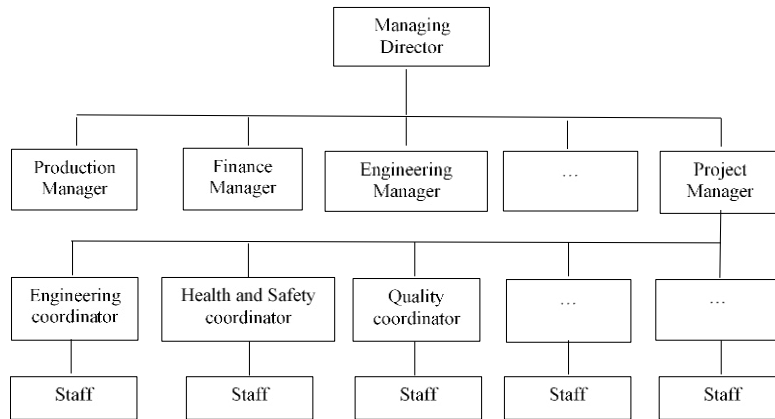


Fig. 2. Pure project structure.

2.3. Matrix project structure

The matrix or temporary matrix structure is a combination of a project structure and line-and-staff structure, which came into existence as a combination of functional design and horizontal project teams [35-39]. The idea is based on the typical matrix structure-double subordination, balance of authority, and both vertical and horizontal orientation. In this type of structure there are several functional areas that set up along the horizontal axis and several projects along the vertical axis that use the resources from the functional areas in order to complete project activities. It is used in large organizations which exist in a complex and dynamic environment or in a global market and in highly innovative organizations connected with advanced technologies data and information and sophisticated knowledge, where the results of the projects are completely new products or technologies [38].

In this type of organizational structure, project managers share responsibility with program unit managers and must work closely with other team members, sometimes competing for the same resources. Thus, a high level of communication and cooperation is required between programmatic unit managers and project managers. A special organizational culture focused on collective forms of working and decision-making, compromise and openness, is also needed [39]. In some cases, it is necessary to decide whose authority, project or functional manager, will be dominant or whether their authority will be equivalent [38]. A typical matrix organizational structure is shown in Fig. 3.

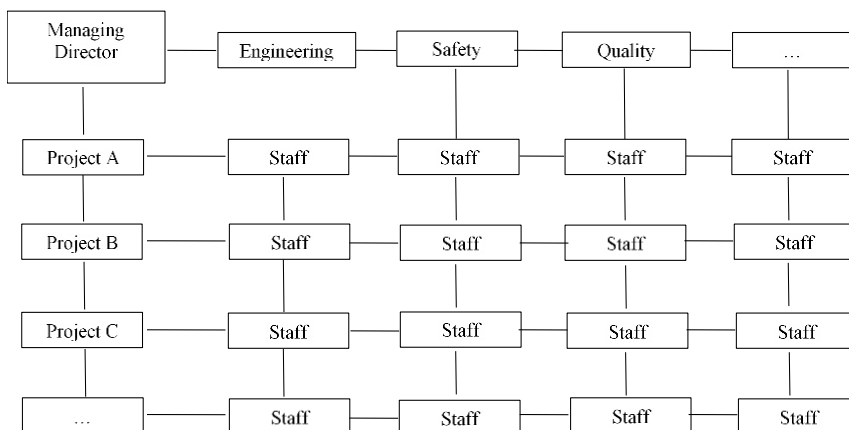


Fig. 3. Matrix project structure.

3. Comparison of Project Organizational Structures

There is no ideal structure and each form has its benefits and drawbacks. In complex projects, the performance of certain tasks may require composite memberships creating overlapping and shared responsibilities as well as dual roles, making both the project and the functional organizational structure inadequate for handling this type of problems [40]. The matrix organization form, for example, enables good disciplinary work together with project integration and focus, but it involves conflict and fuzzy authority definitions. It is something like a compromise between functional and project organization and it is not as staff demanding as the projectized organization [8]. Kalu [10] claim that complex organizations do better with the matrix organizational structure than those that adopt the functional or project structure. Arguments against this type of structure emphasize either the factors that contribute to conflict generation or to the product of conflict situation [41,42].

Mishra and Soota [43] claim that functional organization is suitable only if operations are continuous and routine. In such cases, the coordination is not so important and the specialists are grouped to perform just one function, despite they can lose the big picture of the project. Problems may also arise due to lack of addressed authority and accountability, which slows down the decision-making process. In a pure project structure, there are several specialists in various disciplines answerable to a manager. Such structure is more staff demanding and that is why it can be recommended for large projects. Multidisciplinary structure brings a broader perspective and clear accountability and authority speed up the whole process [38]. In project-based organizations the main concern is the inertia embedded in the project organization since these project-based organizations may end up being more bureaucratic than the bureaucracies they are intended to replace [14,29]. Table 2 shows the main advantages and disadvantages of the three generic project organizational structures presented in this paper [38,44].

Table 2. Main advantages and disadvantages of the three generic project organizational structures

Structure	Advantages	Disadvantages
Functional	There is no need to negotiate and compete with other areas for resources. Team members are familiar with each other since they work in the same area.	Program areas may not have all of the specialists needed to work on the project. Team members may have other responsibilities in the program unit since they may not be full-time on the project.
Pure Project	The project manager maintains authority over the entire project, which implies strong project control. Centralized lines of communication. Strong sense of project identification and good understanding of project goals by team members.	Costly and inefficient use of resources since several resources may be duplicated on different projects. Limited opportunities for knowledge sharing and professional growth since team members are dedicated to one project at a time.
Matrix	Efficient allocations of specialists, which can be fully leveraged by working on multiple projects. Employees can change from one unit to another without making the change permanent. Effective information flow, which allows team members to share information more readily across the unit boundaries. Strong project coordination and better control.	High administrative costs Shared authority between line managers and project managers which may be cause of conflict Reporting relations may be complex. Some team members might report to a programmatic unit managers while actually working for one or more project managers.

4. Conclusions

When designing a project organizational structure it is important to bear in mind different factors as the number of specializations included in the project, the interrelatedness between the components of the project, culture values, experience, size of the project, etc. In this paper, the three generic project organizational structures that are presented in the extant literature, functional, pure project, and matrix, together with their advantages and disadvantages have been shown. In addition, the most important factors that should be considered when designing a proper organizational structure are also analysed. Based on our findings, we have found that the matrix organization form can be recommended for complex organizations. It enables good disciplinary work together with project integration and focus, but it also involves conflict and fuzzy authority definitions. The functional organization form is suitable only if operations are continuous and routine, whereas, the pure project structure is more staff demanding and that is why it can be recommended for large projects.

Project managers can benefit from thinking about what could be the required type of project organizational structure and the type of project they are working in. The design of a project organizational structure is a challenging task. The decisions made upfront at the start of this design phase, the way the organizational structure develops over time, how it is modified in response to changing environments, and even more importantly, how the structure is interpreted and adapted by project managers, all of these factors, will play an important role in the future of the project.

This paper aims at opening up channels for project managers to continue engaging organizational theory more directly, developing a more precise appreciation of the relationships between different project structures and their context. Future research is needed to evaluate different aspects of project structures such as its structural agility or performance and that can help to measure its complexity and even to identify the factors that are the main cause of complexity in projects and prevent them from being effective.

References

- [1] Yeo KT. (1993) "Systems thinking and project management—time to reunite." *International Journal of Project Management* **11**: 111–117.
- [2] Lundin RA, Söderholm A. (1995) "A theory of the temporary organization." *Scandinavian Journal of Management* **11**:437–455. doi:10.1016/0956-5221(95)00036-U.
- [3] van Donk DP, Molloy E. (2008) "From organising as projects to projects as organisations." *International Journal of Project Management* **26**: 129–137. doi:10.1016/J.IJPROMAN.2007.05.006.
- [4] Senhar, A.J. (1999) Strategic project management: The new framework. Portland International Conference on Management and Technology, PICMT'99, 27-29 July, Portland..
- [5] MacAskill, K., and Guthrie, P. (2017) "Organisational complexity in infrastructure reconstruction-A case study of recovering land drainage functions." *International Journal of Project Management* **35**: 864-874.
- [6] Lizarralde G, Blois, MD, and Latunova, I. (2014) "Structuring of temporary multi-organizations: Contingency theory in the building sector." *Project Management Journal* **42** (4): 19-36.
- [7] Project Management Institute (PMI), (2004) "A guide to project management body of knowledge", 3rd ed. Pennsylvania: Project Management Institute, Inc
- [8] Lindblom C. (1959) "The science of muddling through." *Public Administrative Review* **19** (Spring): 78–88.
- [9] Klein BH, Meckling W. (1958) "Application of operations research to development decisions." *Operations Research*, **6** (3):352–363
- [10] Freeman C. (1974) "The economics of industrial innovation." Harmondsworth: Penguin.
- [11] Allen TJ. (1977) "Managing the flow of technology: technology transfer and the dissemination of technological innovation within the R&D organization." Cambridge, Mass: The MIT Press.
- [12] Clark KB, and Fujimoto T. (1991) "Product development performance." Boston:Harvard Business School Press
- [13] Chesborough H. (2003) "Open innovation: the new imperative for creating and profiting from technology." Boston: Harvard Business School Press
- [14] Cusmano MA, and Nobeoka K. (1998) "Thinking beyond lean: how multi project management is transforming product development at Toyota and other companies." New York: The Free Press.
- [15] Morris PWG, and Hough GH. (1987) "The anatomy of major projects." Wiley
- [16] Morris, P. (1994) "The management of projects." Thomas Telford: London

- [17] Kadefors A. (1995) "Institutions in building projects: implications for flexibility and change." *Scandinavian Journal of Management* **11** (4): 395–408.
- [18] Wheelwright SC, and Clark KB. (1992) "Revolutionizing product development." New York: The Free Press.
- [19] Bowen H, Clark K, and Holloway C, (1994) "Wheelwright S, editors." *The perpetual enterprise machine*. New York: OUP
- [20] Kidder T. (1982). *The soul of a new machine*. New York: Avon Books
- [21] Sauer C, Liu L, and Johnston K. (2001) "Where project managers are kings. Lessons for IT from the construction industry." *Project Management Journal* **32** (4): 39–49
- [22] Stinchcombe AL, and Heimer CA. (1985) "Organization theory and project management: administering uncertainty in Norwegian offshore oil". Oxford: OUP
- [23] Morgan G. (1986) "Images of organizations." Sage
- [24] Winter M, Szczepanek T. (2007) "Reframing project management: new thinking, new practice." Gower Publishing.
- [25] Maylor H, Brady T, Cooke-Davies T, and Hodgson D. (2006) "From projectification to programmification." *International Journal of Project Management* **24**: 663–764.
- [26] Turner JR. (1999) "The handbook of project-based management: improving the processes for achieving strategic objectives." 2nd ed. London, McGraw-Hill.
- [27] Meredith JR, and Mantel Jr SJ (2003) "Project management: a managerial approach." 5th ed. Wiley; 2003
- [28] Whittington R, Molloy E, Meyer M, and Smith A. (2004) "Negotiating the routinisation and standardisation traps." *Academic Management Proceedings*.
- [29] Hodgson DE. (2004) "Project teams: the legacy of bureaucratic control in the post-bureaucratic organization." *Organization* **11** (1):81–100
- [30] Mintzberg, H. (1979) "The structuring of organizations: A synthesis of the research." London: prentice-Hall.
- [31] Aubry, M., Hobbs, B., and Thuillier, D., (2008) "Organisational project management: An historical approach to the study of PMOs." *International Journal of Project Management* **26** (1): 38–43.
- [32] Kuprenas, J.A., (2013) "Implementation and performance of a matrix organization structure." *International Journal of Project Management*, **21**: 51-62.
- [33] Kwak, Y.H., Sadatsafavi, H., Walewski, J., and Williams, N.L., (2015) "Implementation of project based organization: A case study." *International Journal of Project Management* **33**: 1652-1664
- [34] Eriksson, T., and Kadefors, A. (2017) "Organisational design and development in a large rail tunnel project-Influence of heuristics and mantras" *International Journal of Project Management*: **35**: 492-503.
- [35] Kerzner HR. (2017) "Project management: a systems approach to planning, scheduling, and controlling." John Wiley & Sons..
- [36] Benesova, J. (2013) "Management multilaterálních nadnárodních projektů.". *Management of Multilateral Transnational Project*. PhD Thesis. Univerzita Masarykiana Brunensis.
- [37] Blažek L. (2011) "Management-Organizování, rozhodování, ovlivňování." Grada Publishing as.
- [38] Villinova, K. (2014) "International Project Management-Organizational Structure." PhD Thesis. Masarykova Univerzita 2014.
- [39] Lichtarski JM. (2008) "Barriers of project structures' development." *Management* **12**: 108–119.
- [40] Kalu JM. (1993) "A framework for the management of projects in complex organizations." *IEEE Transactions on Engineering Management* **40** (2): 175-180.
- [41] Avots, I. (1970) "Why does project management fail?" *Management Review* :36–41.
- [42] Posner, B. (1987) "What it takes to be a project manager." *Project Monagment Journal* **18**: 51–54.
- [43] Mishra, R. and Soota, T. *Modern project management* [online]. New Delhi: New Age International (P) Ltd., Publishers, c2005 [cit. 2013-03-10]. ISBN 9788122425505. Available from [www: <http://site.ebrary.com/lib/masaryk/docDetail.action?docID=10318692&p00=mishra%20soota>](http://www.ebrary.com/lib/masaryk/docDetail.action?docID=10318692&p00=mishra%20soota)
- [44] Pm4dev (2016). *Project Management Organisational Structures*. Project Management for Development Organizations.