ADVANCING INDUSTRIAL ENGINEERING IN NIGERIA THROUGH TEACHING, RESEARCH AND INNOVATION

A BOOK OF READING

Edited By
Ayodeji E. Oluleye
Victor O. Oladokun
Olusegun G. Akanbi

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ADVANCING
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(A Festchrift in honour of Professor O. E Charles-Owaba)

Professor O. E. Charles-Owaba

Advancing Industrial Engineering in Nigeria through Teaching, Research and Innovation.

ISBN : 978-078-515-9

Published by

Department of Industrial and Production Engineering
University of Ibadan.

Printed by:
Leading Edge Printers & Publisher
Ibadan

FOREWORD

It gives me great pleasure writing the foreword to this book. The book was written in recognition of the immense contributions of one of Nigeria's foremost industrial engineers, respected teacher, mentor, and lover of youth – Professor Oliver Charles-Owaba.

His commitment to the teaching and learning process, passionate pursuit of research and demonstration of excellence has prompted his colleagues and mentees to write this book titled – Advancing Industrial Engineering in Nigeria through Teaching, Research and Innovation (A Festschrift in honour of Professor O. E Charles-Owaba) as a mark of honour, respect and recognition for his personality and achievements.

Professor Charles-Owaba has written scores of articles and books while also consulting for a medley of organisations. He has served as external examiner to various programmes in the tertiary educational system. The topics presented in the book cover the areas of Production/Manufacturing Engineering, Ergonomics/Human Factors Engineering, Systems Engineering, Engineering Management, Operations Research and Policy. They present the review of the literature, extension of theories and real-life applications. These should find good use in the drive for national development.

Based on the above, and the collection of expertise in the various fields, the book is a fitting contribution to the corpus of knowledge in industrial engineering. It is indeed a befitting gift in honour of erudite Professor Charles-Owaba.

I strongly recommend this book to everyone who is interested in how work systems can be made more productive and profitable. It represents a resourceful compilation to honour a man who has spent the last forty years building up several generations of industrial engineers who are part of the process to put Nigeria in the rightful seat in the comity of nations. Congratulations to Professor Charles-Owaba, his colleagues and mentees for this festschrift.

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CHAPTER 1

Quantitative Approach to Organisational Design in Project Management Office

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Abstract
In a competitive and dynamic business environment, project management is an efficient framework to ensure flexibility and to manage beneficial change. In the design of a project organisation structure, the use of a quantitative approach to model contingency variables and human dynamics challenges have received limited attention. In this chapter, the basic concepts of projects, organisation design and structure, and Project Management Office (PMO) was discussed. Thereafter, the applicability of operations research paradigm to structure a PMO using the methodology developed by Professor Charles-Owaba were highlighted.
Keywords: Project, Project management, Organisation structure, Project-based organisation, Modeling, Charles-Owaba.

1. Introduction
An organisational structure is rooted in different organisational design theories and provides the required platform to drive organisation strategic goals. Although different organisational structure exists, the effect of competition and an uncertain business environment often leads to organisational restructuring. In this chapter, the applicability of quantitative methods in project organisational structure will be discussed from sections 1.1 to 1.6.

1.1 Projects and Project Management: Concepts and Definitions
As agents of beneficial change, projects are conceptualised and executed within the established schedule, resource and performance parameters to achieve organisation strategic goals. Therefore, in a dynamic and competitive environment, the pace of change offered by projects is one of the ways to remain

relevant. Projects constitute 30% of the world economy as commented by Anbari *et al*. (2008). Projects are characterised by their uniqueness, temporary and transient nature, urgency, unitary, resource usage, novelty, complexity, integration, level of risk, flexible structure, modularity of design, and predefined objectives (see Bard et al., 1994; Atkinson, 1999; Turner & Muller, 2003; Bredillet, 2007; Reiss, 2007; Gray & Larson, 2008, p.100; Moleli, 2012; Project Management Book of Knowledge (PMBOK) Guide, 2017, p.4; Odedairo & Olenloa, 2021). These inherent attributes of projects differentiate it from another business process; for example, the transient nature of projects refers to different stages in the project management processes. Hence, project management is an efficient framework to ensure flexibility and handle changes.

Project Management (PM) as defined by Association of Project Management (APM) is "a process by which projects are defined, planned, monitored, controlled and delivered such that the agreed benefits are realized" (APM Book of Knowledge, 2006, p.2). Project Management Institute (PMI), view PM as the "application of knowledge, skills, tools and techniques to project activities to meet the project requirements" (PMBOK, 2017, p.10). While the core of PM methodologies is adaptable and universal, an effective project life-cycle ensures smooth transformation from vision to reality. Project life-cycles can be characterised along level (i.e. degree) of change and delivery frequency. A project life-cycle is agile if it offers a high degree of change and high delivery frequency, while the predictive, iterative and incremental life-cycles lies within these two extremes. The project management team (or the organisation) must identify the peculiarity of the project before selecting the preferred life-cycle. Also, the project organisational structure and needs (e.g. time, resources, communication links, etc.) should be appraised continually during the life-cycle.

1.2 Organisations: Design and Structure

An organisation is developed "whenever the pursuit of an objective requires the realization of a task that calls for the joint effort of two or more individuals" (Hax & Majluf, 1981 p. 417). In essence, organisations can be characterised based on type and size. Greenwood and Miller (2010) commented that most organisation types are confronted with arrays of design and decision challenges. Eames (1969) defines design as a plan for arranging elements effectively to accomplish a purpose. Most design efforts present flexibility to gather multiple choices and offer opportunities to compare alternatives. Organisational design is an approach that holistically integrates people, processes, structure and other

core organisation elements to enable an organisation to actualise its strategic goals. Any organisational design method should be responsive to the ability to adapt to new strategies and future changes. This responsiveness will enable the organisation to respond to disruption arising from the environment, political and economic pressure, technology, and culture.

Organisation design has rich and established literature on different design frameworks such as classical, neoclassical and modern theories (Charles-Owaba, 2002; Greenwood & Miller, 2010; Van de Ven et al., 2013; Food and Agriculture Organisation). However, the complexity and malleability inherent in almost all types prohibit a "one-size-fits-all" organisational design framework. Although, an in-depth discussion of these design theories is beyond the scope of this chapter; however, a summary will be provided. The components of the classical theory are Taylor's scientific management (scientific selection, management and training of workers), Weber bureaucratic approach (structure, specialization and democracy) and administrative theory by Fayol (discipline, unity of command, and equity). The neo-classical approach consists of human relation and decision-making theories. The modern theories include the following approaches: (i) system-view (ii) socio-technical and (iii) contingency or situational. Irrespective of the design theory adopted, a carefully designed organisation is expected to reduce confusion in the choice of a structure.

Organisation structure (OS) rooted in organisational design theories is one of several elements in any business. OS provides the necessary platform to conceptualise and drive the strategic plan. Some of the elements to consider in the selection of an OS include decision positions and levels, supervisory positions, cost, physical locations, operation positions, communication lines, and span of control (Charles-Owaba (2002); PMBOK, 2017 p.46). An efficient structure provides an enabling environment for rapid transformation of decisions into actions. Usually, to arrive at an acceptable structure, a trade-off among several elements is unavoidable. Since organisation structure is expected to work in tandem with organisation design, some of the constraints associated with the preferred design theory have to be addressed before a working structure can be achieved. An organisation may adopt more than one structure across its business functions e.g. the sales/fulfilment function may require a different structure from the purchasing function. Once the design and structure of an organisation support its business objectives; ultimately, organisational

effectiveness will be actualized. In Table 1, different structures are compared along with several factors.

Table 1 Comparison of some organisation structures

	Factors	Structure type				
		Functional	Divisional	Matrix	Network	Cluster
1	Strategic goal	Specific	Multiform	Reactive	Innovative	Competitive
2	Environmental conditions	Stable	Heterogeneous	Complex	Volatile	Fast-paced
3	Division of Labour	By inputs	By outputs	Inputs and Outputs	Knowledge	Skills and knowledge
4	Co-ordination / Reporting	Hierarchical	By division-General manager and Corporate staff	Dual purpose	Cross-functional teams	Centralised
5	Decision making	Centralised	Separated	Shared	Decentralised	Internal
6	Boundaries	Core	Dual-Internal/ external	Multiple	Unstable	Multiple
7	Mode of authority	Functional/Positional	Management Skills and responsibility	Required negotiating skills	Use of knowledge	Combination of expertise and resource usage
8	Resource usage	4	1	2	3	4
9	Time usage	1	3	2	4	4
10	Responsiveness	1	2	3	4	4

11	Adaptability	1	3	2	3	3
12	Accountability	3	4	1	3	3
Legend: 1-Poor, 2-Moderate, 3-Good, 4-Excellent						

Source: Adapted from Guide to Organisation Design (Stanford, 2007, p.66)

1.3 Organisation Structure in Project Management

The term 'temporary organisation' is one of the characteristics of a project. Lundin and Söderholm (1995) highlighted the difference between a permanent and temporary organisation using the concept of task, time, team and transition. Permanent organisations are preoccupied with goals (rather than tasks), the need to survive (not time-based), functioning organisation (not a team concept) and continuous production (rather than a transition). The question 'what is the most suitable organisation structure in project management is somehow complicated due to inherent characteristics of projects. A project organisation structure (POS) is expected to support, maintain and ensure balance among the following criteria: resource allocation, authority, division of work, communication lines, etc. Invariably, a poor POS can result in a failed project; for example, a report submitted in 2011 by the presidential projects assessment committee in Nigeria revealed a huge number totalling 11,886 of ongoing and abandoned federal infrastructural projects (Premium Times Newspaper, 2012). Lack of direction in project management was cited as one of the several reasons for the problem. Usually, a good direction in project management aligns the selection of the project, organisation structure/culture, and the project management process with corporate strategy. Similarly, Dai and Well (2004) suggested that while project failure rates are on the increase, more research into improved organisation structures such as the Project Management Office (PMO) should be encouraged.

1.3.1 Typology of Project Organisation Structure

In organisation theory, based on environmental conditions (i.e. internal and external factors) surrounding an organisation the need for typology arises. Project-based organisation (PBO) has its mixture of design choices and contingency features. The idea of developing a generalised typology will be useful in modelling different types of organisations. In literature, researchers have discussed project organisation by multiple nomenclatures as presented in Table 2.

Table 2. Typology of Project Organisation Structures

	Authors	Description/ Characteristics	Nomenclature/ Names
1	Hobday, 2000; Pemsel and Wiewiora, 2013;	Description: Project is the primary unit of production, innovation, and competition. Characteristics: Standalone, subsidiary of a big corporation and role defined by the parent organisation	1. Project-Based Organisation (PBO)
2	Oliviera, 2017; PMBOK, 2017; Babaeianpour and Zohrevandi, 2014; Kerzner, 2003; Hurt and Thomas, 2009.	Description: (i) An organisation unit with the responsibility of coordinating projects in a PBO. (ii) PMO is implemented to standardise, improve, administer and control project management processes. (iii) PMO may be in stages depending on the maturity of an organisation. (iv) PMO referred to as Project Office Characteristics: Diverse, transient (can be created and closed when not needed), an organisation within an organisation	1. Project Management Office (PMO). 2. Project Office 3. Organisational project office

3	Monteiro et al (2016)	(i) Identified 47 PMO models (ii)Number of models sharing the same name reduced to 25. (ii) Common nomenclature across models reduced to 4	1. Enterprise PMO 2. Project Management Centre of Excellence (PMOCE) 3. Project Office 4. Project Support Office

1.3.2 Project Management Office

In recent years, several organisations have embraced PMO as a formal organisational structure to ensure a good direction in project management, eliminate trial and error in project administration and efficient resource management. A PMO (also called the Centre of Excellence or Center of Expertise) is a governance strategy and a control layer between an organisation and its project management efforts. Project management institute defined a PMO as:

> an organizational structure that standardizes the project-related governance processes and facilitates the sharing of resources, methodologies, tools, and techniques. The responsibilities of a PMO can range from providing project management support functions to the direct management of one or more projects (PMBOK, 2017, p.48).

In the third edition of its PMBOK (2004), PMI highlighted other nomenclature for PMO as "project office" or "program office". Some of the functions of a PMO includes: storing of proprietary information, defining and maintaining project standards, facilitating and provision of resources, consulting and knowledge sharing, and to conduct training.

Ward and Daniel (2013) consider a PMO as an organizational entity designed to offer supports on strategic decisions and proper implementation of project management principles; to project managers, project and management teams. As an entity, Montero et al (2016) commented that a PMO could be a unit or department in a matrix or PBO. Babaeianpour and Zohrevandi (2014) identified the project office, basic PMO, standard PBO, advanced PMO and centre of excellence (CoE) as stages a PMO may transform through in an organisation. Just like projects, PMOs are complex and due to variability in different project management firms, their design may be difficult. However, Hobbs and Aubry (2008) through their rigorous empirical study proposed three (3) classifications

for PMOs using three variables; namely, number of projects (NP), number of project managers (NPM) and level of decision-making authority (DMA). The three classifications are (i) PMOs with many NP and NPM with considerable high DMA (ii) PMOs with few NP, few NPM with less DMA and (iii) PMOs with few or zero NPM with a moderate level of DMA.

1.4 Organisation Design and Project Management Structure: Current Issues

Miterev et al. (2017) commented that despite limited studies on the interaction between project management and organisation design, PBO presents promising research opportunities. The contingency features and human dynamics challenges of elements such as decision positions and levels, supervisory positions, cost, physical locations, operation positions, communication lines, and span of control in a PBO is worth researching.

1.5 Organisational Design Approaches in Project management Office

Several organisation models (e.g. Galbraith's Star Model, 7-S model) derived from different organisational design theories form the basis of many organisational structures. Hax and Majluf (1981) identified three forms of organisational structures widely used. These are the functional, divisional and matrix derived from well-proven design theories. The advantages and disadvantages of these design structures are widely published. For example, the matrix structure is mostly preferred in project management; however, its use is characterised by conflicts bothering on authority, reporting and resource management (Thiry, 2007).

1.5.1 Quantitative methods

With quantitative research design, it is possible to observe, assess, diagnose, generate a hypothesis, and estimate interaction among system components. Quantitative methods emphasize the mathematical and numerical analysis of data to enhance better communication. Hax and Majluf (1981) suggested the use of operations research (OR) paradigm in organisational design. OR methods can evaluate and determine optimal choice among several courses of action. Charles-Owaba (2002) not only accepted the idea of studying the applicability of OR in organisational design, the author further suggested the adoption of the engineering design process in organisational design. The author highlighted 24 benefits of using engineering design methodology in organisational design studies to show that OR methods can handle mechanistic tendencies in different organisation design theory. Some of the benefits include (i) adoption of

quantitative procedures for the design (ii) ability to mathematically model an organisation structure (iii) quick modification of an organisation structure (iv) provision for comparative evaluation of different types of structure (v) combination of suitable design tools from mathematics, physical sciences, social sciences, industrial and systems engineering opportunities (vi) ability to choose appropriate design criteria (vii) identification of design variable and parameters required to define an organisation structure, etc.

1.6 Modeling PMO with Personnel Utilisation as the organisational design objective

An organisational design problem using OR approach will aim to optimise a pre-defined design objective such as personnel utilisation, redundancy and their associated cost; subject to the satisfaction of a set of organisation design variables and constraint functions parameters within sets of variables limiting values (Charles-Owaba, 2002). Since the organizational design of PMO using quantitative approach is an emerging research area, the design methodology proposed and developed by Charles-Owaba (2002) will be adopted. Consequently, an employee utilisation design approach to PMO and the relevant solution procedure to ensure an optimal business organisational structure will be highlighted further in the next section.

1.6.1 Notations and Terminologies

The basic notations and their definitions are presented in Table 3.

Table 3. Notations and Definitions

Notation	Definition	Notation	Definition
i	Index for Work level (Decision-making authority)	j	Index for decision-making centre (Number of project managers)
H_{ij}	The utilisation of personnel of decision making centre j at work level i	M	Number of decision levels

K_{ij}	The span of control for a decision-making centre with index *j* and i*th* work level	N_i	Number of decision position available at work level *i*
W_{ij}	Average waiting time(hours) a case is available to receive attention from the project manager	P_{ij}	The amount of time a project manager has no case requiring his/her attention
λ_{ij}	The subordinates arrive to consult the superior (project manager) at this rate	A_{ij}	The time required (in hours) for work scheduled in a day
N_O	Number of operation positions which perform terminal activities (number of the lowest cadre of staff)	μ_{ij}	The subordinates are attended to by a superior at decision-making centre *j* and work level *i*, at this rate
ϕ_h	Set of functions $(A_{ij}, \mu_{ij,} N_{O,} \lambda_{ij})$	L_{ij}	The average number of cases available for a project manager to attend to in one day
H	Personnel utilisation function for entire organisation structure which contains a set of functions $(K_{ij}, N_{i,} M, \phi_h)$		

1.6.2 Organisation Design Problem: Project Management Office

For personnel utilisation based organisation design problem, Charles-Owaba (2002) stated the problem as follows: Given the values of N_o, λ_{ij}, μ_{ij} and A, judiciously select a feasible set of a span of control $\{K_{ij}\}$, a set of management / supervision positions $\{N_i\}$ and the number of management levels (M) such

that the function, H ($K_{ij}, N_{i,} M, A, \lambda_{ij}, \mu_{ij}, N_o$) is of the maximum possible value.

1.6.3 Model Assumptions

As earlier stated, a PMO is responsible for knowledge management, resource management, maintaining project standards and facilitation of training. The following assumptions from Charles-Owaba (2002) were adopted for use with two organisational design variables peculiar to PMO as identified by Hobbs and Aubry (2008). These are the number of project managers (NPM) and the level of decision making authority (DMA).

a) A specific number of immediate subordinates is assigned to a project manager in charge of a decision-making centre.
b) The time a case leaves its location and travels to the superior's desk is negligible
c) Superior is experienced enough to handle a decision centre. Otherwise, there will be a large heap of cases at every moment.
d) Each case from subordinates is attended to one at a time, this means first come, first served approach is used.
e) The workload assigned to a project manager at the decision-making centre is proportional to the span of control of the project manager
f) Every employee has, at least one job to perform in the organisation.
g) The arrival of cases and subsequent release by the boss is assumed to be stochastic events.
h) The business function is assumed to have a person-person, person-machine interaction, stochastic, dynamic decision and operation work system.
i) Standard workload (suitable for a position) is assigned to every staff.
j) There is a difference between terminal, supervisory and pure decision activities in the organisation.

1.6.4 Personnel Utilisation Function for the PMO

The non-linear constrained optimisation problem for the personnel utilisation (H) for PMO is expressed in equation 1.

Maximise

$$H(K_{ij}, N_{i,}, M, A, \lambda_{ij}, \mu_{ij}, N_o) = \sum_{i=1}^{M}\sum_{j=1}^{N_i} H_{ij} \Big/ \sum_{i=1}^{M} N_i \quad (1)$$

subject to:

$$\sum_{j=1}^{N_i} H_{ij} = N_{i-1;} \quad N_o \ \ is\ known \quad (2)$$

$$N_m = 1 \quad (3)$$

$$K_{ij}, N_i, M > 0$$

From equation 1, H_{ij} is expressed as:

$$H_{ij} = 1 - \frac{1}{A_{ij}(K_{ij}+1)} \left[\frac{\left[\frac{\sum_{n=2}^{K_{ij}} (n-1) C_n^{K_{ij}} n! \rho_{ij}^n}{1 + \sum_{n=1}^{K_{ij}} C_n^{K_{ij}} n! \rho_{ij}^n} + 1 - \left(1 + \sum_{n=1}^{K_{ij}} C_n^{K_{ij}} n! \rho_{ij}^n \right)^{-1} \right]^2}{\mu_{ij} \left(1 - \left(1 + \sum_{n=1}^{K_{ij}} C_n^{K_{ij}} n! \rho_{ij}^n \right)^{-1} \right)} \right] - \frac{\left(1 + \sum_{n=1}^{K_{ij}} C_n^{K_{ij}} n! \rho_{ij}^n \right)^{-1}}{K_{ij}+1} \quad (4)$$

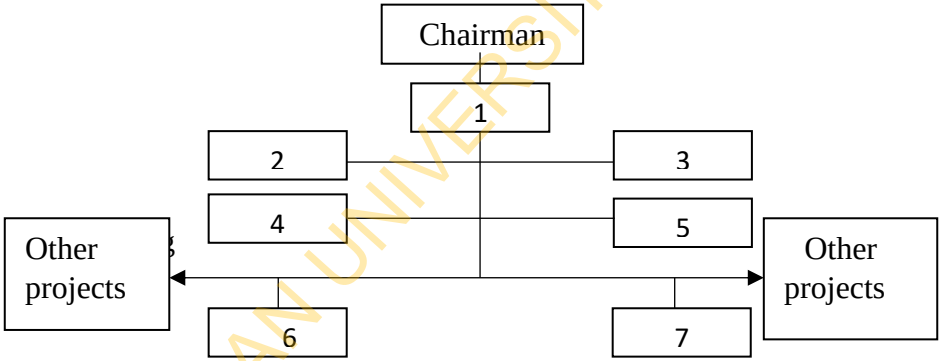
$$\lambda_{ij} = \frac{\text{total number of cases at position (i,j)}}{\text{total time (hours)for study at the position}} \quad (5)$$

$$\mu_{ij} = \frac{\text{total completed cases at position (i,j)}}{\text{time (hours)spent to treat all completed cases}} \quad (6)$$

$$\rho_{ij} = \frac{\lambda_{ij}}{\mu_{ij}} \ ; \ \lambda_{ij} < \mu_{ij} \quad (7)$$

1.6.5 Applicability

To use the model represented from equations 1 to 7, a PMO (a sample structure presented in Fig.1) organisational goals will be converted to the volume of work and personnel requirements. This involves the determination of terminal activities, skill identification, determine the amount of available work per skill, determination of the number of operations positions, determine the number of project managers and number of decision making authority. Also, the values of A_{ij}, λ_{ij},μ_{ij} K_{ij} and N_O have to be determined. A chronological review of organisation structure design algorithm to obtain an optimal design and compare to an existing design is contained in Charles-Owaba (2002, p. 223-225). It is expected that the number of projects (NP), number of project managers (NPM) and level of decision-making authority (DMA) that will reduce redundancy will be obtained.



1. Director, 2- Marketing Department, 3- Human Resources, 4-Finance and Administration, 5 – Legal, 6- Project A, 7- Project B

Fig.1 Project Organisation Structure for a sample Project management office

1.6.6 Summary

In this chapter, projects, project management, and components of project organisation structure were discussed. In the selection of a project organisation

structure, some of the elements to consider include, the number of projects, number of project managers, level of decision-making authority, physical locations, operation positions, communication lines, and span of control. Therefore, due to inherent characteristics of projects, organisations have embraced project management office as a formal organisational structure to eliminate trial and error in project administration and to ensure efficient resource management. From the organisational design framework proposed by Professor Charles-Owaba through operations research paradigm, the modeling structure for a project management office was presented.

References

Anbari, F. T., Bredillet C.N., & Turner, J. R. (2008). Exploring research in project management: the nine schools of project management. Retrieved on October 2, 2020. Available at https://www.academia.edu/3294985/Exploring_research_in_project_management_Nine_schools_of_project_management_research_Part_2

Association for Project Management (2006). *APM Body of knowledge (APMBOK)* (5th ed.) Somerset: Butler and Tanner

Atkinson, R. (1999). Project Management; Cost, Time and Quality, Two Best Guesses and a Phenomenon, Its Time to Accept Other Success Criteria. *International Journal of Project Management, 17*(6), 337-342.

Babaeianpour, M & Zohrevandi, S. (2014) Using project management office (PMO) to improve Project Management Abilities, *International Journal of Business and Economics* *6* (1), 153-165.

Bard, J., Globerson, S., & Shtub A. (1994). Project Management Engineering Technology and Implementation. Prentice Hall, Inc., 1995, 634 pp., ISBN 0-13-556458-1.

Bredillet, C. N. (2007). Exploring Research in Project Management: Nine Schools of Project Management Research (Part 2). *Project Management Journal*, *38*(3), 3–5. https://doi.org/10.1002/pmj.20001

Charles-Owaba, O.E. (2002). *Organisational Design: A Quantitative Approach.* Ibadan: Opotoru Books.

Dai, C.X. & Wells, W.G. (2004). An exploration of project management office features and their relationship to project performance. *International Journal of Project Management*, *22*(7), 523-532.

Eames, C. (1969) *What Is Your Definition of "Design," Monsieur Eames?A Vitra Anecdote* **Retrieved October 3, 2020.** https://www.vitra.com/en-us/magazine/details/what-is-your-definition-of-design-monsieur-eames

Food and Agriculture Organisation (FAO) of the United Nations: Management of Agricultural Research: A training manual. Module 3: Organizational principles and design. Retrieved October 3, 2020 at http://www.fao.org/3/w7503e/w7503e00.htm

Greenwood, R., & Miller, D. (2010). Tackling design, a new: Getting back to the heart of organizational theory. *The Academy of Management Perspectives*, *24*(4), 78-88.

Hax, A. C., & Majluf, N.S. (1981) Organisation Design: A Survey and an Approach. *Operations Research*, 29(3), 417-447. Retrieved October 2, 2020, from http://www.jstor.org/stable/170106

Hobbs, B. & Aubry, M. (2008). An empirically grounded search for a typology of project management offices. *Project Management Journal*, 39, 69-82.

Hobday, M. (2000). The project-based organisation: An ideal form for managing complex products and systems? *Research Policy*, 29, 871-893

Hurt, M. & and Thomas, J.L. (2009) Building Value Through Sustainable Project Management Offices. *Project Management Journal*, *40*(1), 55-72. https://doi.org/ 10.1002/pmj.20095

Kerzner, H. 2003. *Project management – A systems approach to planning, scheduling, and controlling*. 8th ed. New York: John Wiley & Sons

Larson, E.W., & Gray, C.F., (2008). *Project Management: The Managerial Process* (5th ed.). McGraw-Hill/ Irwin.

Lundin, R. & Söderholm, A. (1995). A theory of the temporary organization. *Scandinavian Journal of Management*, *11*(4), 437-455.

Miterev, M., Mancini, M., & Turner, J.R. (2017). Towards a design for the project-based Organization. *International Journal of Project Management*, *35*(3), 479-491. https://doi.org/10.1016/j.ijproman.2016.12.007

Moleli, L.J. (2012). The Impact of Project Management on Road Construction and Maintenance at Emfuleni Local Municipality. Retrieved October 2, 2020, from https://repository.nwu.ac.za/handle/10394/10317

Monteiro, A., Santos, V., & Varajão, J. (2016). Project Management Office Models – A Review. *Procedia Computer Science*, *100*, 1085-1094. DOI: 10.1016/j.procs.2016.09.254

Odedairo, B.O., & Olenloa, O.E. (2021). Scheduling of Post-Flood Recovery Project with Flexible Project Structure. *Journal of Engineering, Project, and Production Management*, *11*(2), 118-126. https://doi.org/10.2478/jeppm-2021-0012

Oliveira, R.R & Martins, H.C (2018). Strategy, People and Operations as influencing agents of the Project Management Office performance: an analysis through Structural Equation Modeling, *Gest. Prod. 25*(2), 410-429. http://dx.doi.org/10.1590/0104-530X2294-16

Pemsel, S. & Wiewiora, A. (2013). Project management office a knowledge broker in project-based organisations. *International Journal of Project Management*. *31*(1), 31-42

Premium Times Newspaper (2012) The Tragedy of Abandoned Projects by Nasir El-Rufai Retrieved September 15, 2020, https://www.premiumtimesng.com/opinion/98468-the-tragedy-of-abandoned-projects-by-nasir-el-rufai.html

Project Management Institute (2004). *A Guide to The Project Management Body of Knowledge* (PMBOK®) (3rd ed.) Newtown Square, PA

Project Management Institute (2017). *A Guide to The Project Management Body of Knowledge* (PMBOK®) (6th ed.) Newtown Square, PA

Reiss, G. (2007). *Project Management Demystified* (3rd ed.). Routledge

Stanford, N. (2007). *Guide to Organisation Design: Creating high- performing and adaptable enterprises*. London: Profile Books.

Thiry, M. (2007). From PMO to PBO: the PMO as a vehicle for organizational change. Paper presented at PMI Global Congress North America, Atlanta, GA. Newtown Square, PA: Project Management Institute.

Turner, J. R., & Müller, R. (2003). On the Nature of the Project as a Temporary Organization.

International Journal of Project Management, *21*(1), 1-8.
Van de Ven, A.H., Ganco, M. & Hinings, C.R. (2013). Returning to the Frontier of Contingency
Theory of Organizational and Institutional Designs. *Academy of Management Annals*, *7*(1), 393–440. https://doi.org/10.5465/19416520.2013.774981
Ward, J. & Daniel, E. M (2013). The role of project management offices (PMOs) in IS project
success and management satisfaction. *Journal of Enterprise Information Management*, *26(*3),316 – 336.
http://dx.doi.org/10.1108/17410391311325252