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On the Need of Functional Priority and Failure Risk Assessment to Optimize Human Resource Allocation in Public Service Organizations

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Abstract. Optimization of resource utilization plays a significant role in the continuous improvement initiatives of an organization providing services. Lean thinking and systematic approaches, such as multicriteria analysis (MCA), are necessary to optimize the utilization (or allocation) of human resources (HR) in a public service organization, especially to assure that functional performance satisfies organizational and public needs and objectives. This manuscript demonstrates the use of functional priority assessment (FPA) and functional failure risk (FFR) assessment to support and optimize human resource allocation (HRA) management in a public sector organization. Action research has been carried out in one Norwegian police district, to investigate the appropriateness of FPA and FFR assessment for HRA. First, functional priorities have been assessed, based on their impact relative to nine central organizational criteria. Further, based on a tailor-made risk matrix composed of six criteria, consequence of failure (CoF) and probability of failure (PoF) have been qualitatively assessed, resulting in a quantitative representation of FFR levels. The suggested Lean and MCA-based methodology provides significant support to strategic management and Lean practitioners who are involved in implementing or locating improvement initiatives in service organizations, especially in optimizing resource utilization.

Keywords: Human resource allocation, Lean thinking, functional failure risk, functional priority

1 Introduction

Lean thinking has become an important business philosophy within the field of organizational governance and improvement [1, 2]. It emphasizes principles such as customer value creation, pull, just-in-time service deliveries, systematic elimination of waste or non-value-added (NVA) activities and employee-driven continuous improvement [2, 3]. Implementation of Lean thinking to support optimal resource utilization can positively impact several aspects of service performance [1, 4]. In the public sector, this is especially relevant, as top level managers are charged with the difficult task of meeting both public service needs and increasing demands for performance, whilst budgets and resources are decreasing [5]. Public sector organizations are expected to prioritize and manage their HR and continuously improve their services [6, 7]. However, strategic decisions regarding HRA are usually made based on the experience and intuition of managers [8]. Hence, there is an increasing need for logical approaches and a framework to assist decision makers in prioritizing their limited HR for the execution of functional activities and service enhancement initiatives [9].

In the literature, different approaches have been proposed, aiming to provide improved support to make the task of HRA more efficient. There is an increasing interest in the use of MCA approaches to define directions and guide cultural changes, prioritizing limited resources and improvement opportunities [9-11]. It is proven to be a helpful way to assess current situations and manage major transformational changes in an organization [12, 13]. By utilizing MCA-based approaches, such as FPA and FFR, this study aims to generate knowledge regarding functional priority and failure risk, based on the current performance level in a public service organization, and, furthermore, to support strategic decision makers in optimal HRA management. Action research has been carried out in one Norwegian police district, to investigate the appropriateness of FPA and FFR assessment for HRA and the prioritization of improvement initiatives.

2 Organizational Challenge

The Norwegian Police Service is a nationwide government agency in Norway. The police district in this study, which is one of twelve districts, consists of approximately 1250 employees, 12 units, 30 departments and 60 functions with different service areas. It has a hierarchical structure, represented by strategic, tactical and operational management levels. In the existing forecast, the district is expected to enter 2020 with 1200 employees, without the possibility of new recruitment. Hence, there is a need to monitor, prioritize and adapt the operational environment and its HR utilization and flow. Due to the recruitment freeze, the district may have to adjust the organization, reallocate HR and accelerate systematic improvement initiatives in some functions. This is especially vital in order to avoid functional failure and maintain a satisfying and improving level of service performance in society (Fig. 1).

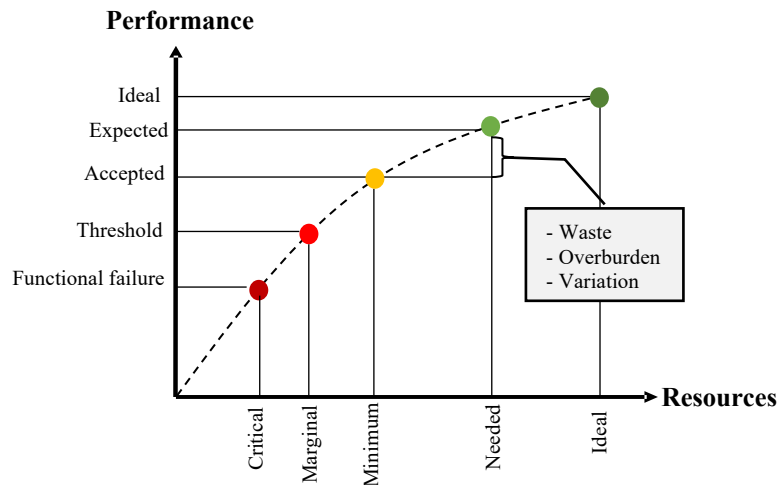


Fig. 1. Illustration of the idea for functional failure

3 Research Methodology

This study has chosen an action research strategy as the objective is to generate new explicit knowledge through participation that will lead to strategic and informed action, [14, 15]. A mixed method

approach, with a combination of qualitative and quantitative analysis, is applied. Accordingly, questionnaires and unstructured interviews are used in the implementation phase of this study.

As the district is composed of multiple departments and functions, this manuscript test and present the appropriateness of the developed methodology and MCA models, in order to make adjustments before official implementation in the organization. Accordingly, five functions from different departments, but from the same unit, were chosen to collect data from. As a bottom-up strategy was desired, operational management and employee representatives, responsible for each function, were chosen as participants. Furthermore, the criteria and the developed content were based on close cooperation with disciplinary experts within law enforcement in the district and strategic circulars and documents. Due to sensitive information, content descriptions are not provided in this study.

3.1 Functional priority assessment

Based on the concept of maturity assessment [13], a questionnaire-based priority matrix was developed, with a total of nine criteria (Table 1). These are described and questioned according to five assessment levels, which are formulated relative to the aspect of impact (or importance).

Table 1. Overview of chosen criteria

<i>Category</i>	<i>Criteria</i>
Public impact/importance	1. Maintain order and safety in society
	2. Crime prevention
	3. Protect public law-abiding activities
	4. Investigate and prosecute offenses
Internal impact/importance	5. Requirements for expertise
	6. Specialized expertise
	7. Internal cooperation/impact
Strategic impact/importance	8. Short-term local strategy 0-1 year
	9. Long-term national strategy 5 years

3.2 Functional failure risk assessment

This study defines functional failure as the termination of the ability of a function to perform its required functional services internally and/or externally [16, 17]. The NORSOK standard, Z-008 Risk-based maintenance and consequence classification, provides the requirements and guidelines for constructing a tailor-made risk matrix, and directions for performing a classification of consequences due to potential failures [16, 18]. Based on the NORSOK standard, a risk matrix (Fig. 2) consisting of six operational consequence criteria was developed (Table 2).

Table 2. Criteria, abbreviations and level of risk categorization

<i>Criterion</i>	<i>Aspect</i>
C1	Public safety and order
C2	Public trust and reputation
C3	Compliance (with law and guidelines)
C4	Economy

C5	Expertise
C6	HSE
Risk levels	Risk categorization
VH	Very high: unacceptable risk – immediate action to be taken
H	High: unacceptable risk – action to be taken
M	Moderate: acceptable risk – action to reduce risk may be evaluated
L	Low: acceptable risk
VL	Very low: acceptable risk – insignificant

Consequence criteria							Increasing probability					
Increasing consequence	Severity	C1	C2	C3	C4	C5	C6	Failure is not expected (1/VL)	Never heard of (2/L)	Has occurred (3/M)	Has been experienced several times (4/H)	Failure will occur (5/VH)
	5							M/5	10/H	15/VH	20/VH	25/VH
	4							4/L	M/8	12/H	16/VH	20/VH
	3							3/VL	6/L	M/9	12/H	15/VH
	2							2/VL	4/VL	6/L	M/8	10/H
	1							1/VL	2/VL	3/VL	4/L	M/5

Fig. 2. Illustration of risk matrix, adapted from [18]

4 Findings

4.1 Functional priority assessment (FPA)

Based on the given assessments and leveling for each criterion, an average priority score (P) was calculated for each function. Fig. 3 illustrates the distribution of functional priority scores. When comparing the average priority scores, there is variation in impact and/or criticality, relative to the defined criteria. For example, Function B is highly critical or has overall high impact on a majority of criteria compared to Function D.

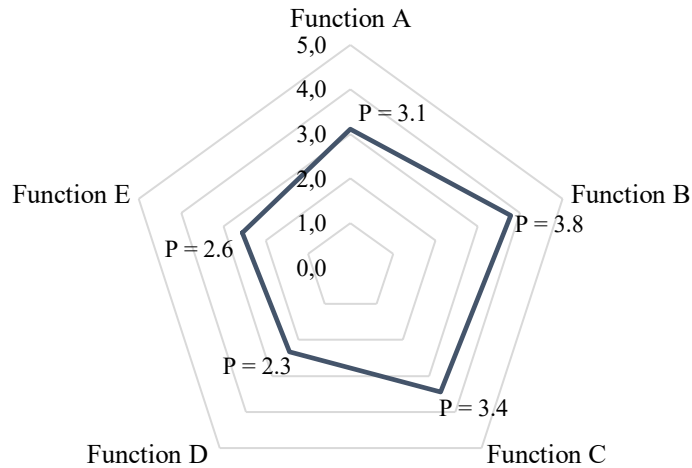


Fig. 3. Average functional priority score based on defined criteria

4.2 Functional failure risk (FFR) assessment

Based on the developed risk matrix, the participants qualitatively assessed CoF and PoF, resulting in a quantitative representation of the FFR level for each consequence criterion (Fig. 4). Fig. 4 illustrates the level of risk category for two assessed scenarios for each function: a worst best case (WBC) and a worst case (WC). These provide two perspectives on the number of HR that can be strategically pulled and reallocated from one function to another before reaching functional failure. For example, WC for Function B is pulling and reallocating nine HR to other functions. This is reflected in the assessed risk levels for each criterion.

Function	P	WBC	WC	C1		C2		C3		C4		C5		C6	
A	3.1	1	2	12	20	12	20	9	15	1	6	16	25	8	9
B	3.8	1	9	1	16	1	20	1	20	6	20	4	16	4	20
C	3.4	1	5	6	16	3	16	3	9	3	20	6	16	3	9
D	2.3	1	2	20	25	20	25	20	25	20	25	20	25	20	25
E	2.6	1	3	8	12	4	12	8	12	8	12	16	20	15	20
				WBC	WC	WBC	WC	WBC	WC	WBC	WC	WBC	WC	WBC	WC

Fig. 3. Overview of FFR assessment according to WBC and WC

Fig. 4 presents a framework that illustrates which functions are in immediate need of HRA or improvement initiatives, according to their priority and FFR. For example, if disciplinary knowledge and expertise is compatible, pulling resources from a highly prioritized function, such as Function B, and reallocating to Function D may not be an optimal solution, as Function B has a very low priority score. However, due to very high FFR at WBC, which arguably indicates a performance level below

acceptable (Fig. 1), immediate action and a plan for systematic improvement initiatives should be considered for implementation in function D. The focus should be on the Lean perspective of “doing more with less”, identifying and eliminating NVA activities and enhancing the function’s performance level with its existing resources. However, considering function A, it has a high priority score and high FFR at WBC. In this scenario, immediate action in the form of HRA and utilization from another function is necessary for the purpose of performance enhancement.

5 Discussion and Conclusion

Based on Lean thinking, this study has adapted and demonstrated the use of MCA approaches in a public service organization for a given organizational challenge. In a time of limited budgets and resources, optimal utilization of existing HR within the organization, along with continuous improvement, is significantly important. The findings in this paper clearly illustrate that there are variations in functional priority and FFR. It is therefore deemed necessary to utilize MCA approaches, such as FPA and FFR, to systematically generate knowledge regarding the organization and its functions according to current performance level, especially in order to support optimizing HRA and prioritizing the location of improvement initiatives. The suggested FPA and FFR assessment-based methodology and framework is believed to provide support to the strategic management level and practitioners who are involved in implementing Lean thinking in organizations providing services, especially in optimizing the HRA.

However, as the selected criteria in both assessment models are heavily impacted by political, social, economic and technological environments, the presented findings only provide a snapshot of a dynamic environment. Hence, further research related to digital transformation of this methodology, in order to enable continuous planning and data collection, will be carried out. Furthermore, by expanding the implementation of this methodology to all 60 functions in the district, scenarios may arise where several functions are represented equally in relation to average priority score and FFR. In order to distinguish the functions even more, the strategic management level should be able to prioritize or weight the various criteria, to handle scenarios where multiple functions have the same functional priority and failure risk. Further study will therefore investigate the possibility of integrating approaches, such as analytical hierarchy process (AHP), where expert judgments can provide the necessary information for the ranking of various criteria [19].

References

1. George, M.L., *Lean Six Sigma for Service* 2003: The McGraw-Hill Company
2. Liker, J.K., *The Toyota Way: 14 Management Principles From the World’s Greatest Manufacturer*. 2004: McGraw Hill. 3-289.
3. Womack, J.P., D.T. Jones, and D. Roos, *The Machine that Changed the World*. 1991: Free Press. 352.
4. Arias, M., et al., *Human resource allocation in business process management and process mining: A systematic mapping study*. *Management Decision* 2018. 56(2): p. 376-405.
5. Callan, T., B. Nolan, and J.R. Walsh, *The economic crisis, public sector pay and the income distribution*. *Research in Labor Economics*, 2011. 32(32): p. 207-225.
6. Antony, J. and B. Rodgers, *Lean Six Sigma in Policing Services* *International Journal of Productivity and Performance Management* 2018. 67(5): p. 935-945.
7. Bambera, G.J., et al., *Human resource management, Lean processes and outcomes for employees: towards a research agenda*. *The International Journal of Human Resource Management* 2014. 25(21): p. 2881-2891.
8. Yoshimura, M., et al., *Decision-making support system for human resource allocation in product development projects*. *International Journal of Production Research*, 2006. 44(5): p. 831-848.

9. Mitton, C., et al., *Allocating limited resources in a time of fiscal constraints: A priority setting case study from Dalhousie University Faculty of Medicine*. *Academic Medicine* 2013. 88(7): p. 939-945.
10. Becker, J., et al. *Maturity models in IS Research in European Conference on Information Systems* 2010. AISel
11. Mitton, C. and C. Donaldson, *Twenty-five years of programme budgeting and marginal analysis in the health sector, 1974-1999*. *Journal of Health Services Research and Policy* 2001. 6(4): p. 239-248.
12. Ibbs, C.W. and Y.H. Kvak, *Assessing project management maturity* *Project Management Journal* 2000. 31: p. 32-43.
13. Becker, J., R. Knackstedt, and J. Peoppelbuss, *Developing Maturity Models for IT Management* *Business and Information Systems Engineering* 2009. 1(3): p. 2123-222.
14. Greenwood, D.J. and M. Levin, *Introduction to Action Research* 1998: SAGE Publications, Inc. .
15. Koshy, V., *Action Research for Improving Practices* 1ed. 2005: SAGE Publications
16. Ratnayake, R.M.C., *Plant systems and equipment maintenance: Use of fuzzy logic for criticality assessment in NORSOK standard Z-008*, in *Industrial Engineering and Engineering Management (IEEM)*. 2013.
17. DNV-OS-F101, *Submarine Pipeline Systems in Offshore Standard* 2012, Det Norske Veritas AS.
18. Ratnayake, R.M.C.C., *Knowledge based engineering approach for subsea pipeline systems' FFR assessment: A fuzzy expert system*. *The TQM Journal* 2016. 28(1): p. 1754-2731.
19. Samarakoon, S.M.K. and R.M.C. Ratnayake, *Strengthening, modification and repair techniques' prioritization for structural integrity control of ageing offshore structures*. *Reliability Engineering and System Safety* 2015. 135: p. 15-26.