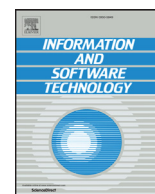




Contents lists available at ScienceDirect

Information and Software Technology

journal homepage: www.elsevier.com/locate/infosof

Benefits and limitations of project-to-project job rotation in software organizations: A synthesis of evidence

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ARTICLE INFO

Article history:

Received 27 September 2016

Revised 14 April 2017

Accepted 19 April 2017

Available online xxx

Keywords:

Job rotation

Work design

Software engineering

Systematic literature review

Case study

Replication

ABSTRACT

Context: Job rotation has been proposed as a managerial practice to be applied in the organizational environment to reduce job monotony, boredom, and exhaustion resulting from job simplification, specialization, and repetition. The scientific literature distinguishes between *job-to-job* and *project-to-project* rotations. Despite the potential benefits and its actual use on behalf of software companies, we do not have an accumulated body of scientific knowledge about benefits and limitations of job rotation in software engineering practice. In particular, we have no concrete empirical evidence about the use of project-to-project rotations in practice.

Goal: We aim to identify and discuss evidence about project-to-project (P2P) job rotation, in order to understand the potential benefits and limitations of this practice in software organizations.

Method: We deployed a mix-method research strategy to collect and analyze empirical evidence from the scientific literature, performing a systematic literature review, on one hand and from industrial practice, performing qualitative case studies on the other. We synthesized the evidence using techniques from meta-ethnography.

Results: We found eight benefits, nine limitations, and two factors classified as both benefits and limitations of P2P rotations in software engineering. Different research methods yielded confirmatory and complementary evidence, emphasizing the importance of conducting mix-method research. We found no contradictory evidence and five factors were identified in more than one study using different research methods, contributing to the strength of the evidence.

Conclusion: We synthesized evidence from multiple sources and used different research methods concerning the benefits and limitations of P2P rotation in software engineering practice. Our findings show that rotation tends to benefit important job outcomes, such as motivation, and to decrease job monotony. The main limitations were associated with the potential increase in intra-group social conflicts, individual cognitive effort, and workload, and a temporary decrease in productivity.

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1. Introduction

Job rotation has been proposed as a managerial practice to be applied in the organizational environment to reduce job monotony, boredom, and exhaustion resulting from job simplification, specialization, and repetition [41]. Researchers have studied job rotation in diverse types of organizations and different jobs, such as nursing, business, and manufacturing industries, finding negative and positive effects on factors such as knowledge exchange, job satisfaction, motivation, and job burnout [4,9,29,32]. In an attempt to

tap the above-mentioned benefits, software companies have also been using job rotation in practice. However, so far there has been no consistent and comprehensive body of evidence about its benefits and limitations in software engineering practice. Our goal is to contribute to reducing this knowledge gap.

Woods defines job rotation as "the systematic movement of employees from job to job, or project to project, within an organization, as a way to achieve various human resources objectives" [42]. In *job-to-job* (J2J) rotation, individuals are rotated between different jobs in the same organization, to perform activities with distinct natures. In *project-to-project* (P2P) rotation, individuals are moved between projects of similar nature (e.g. two software development projects), often keeping the same technical role. In a recent systematic review [35], we identified that both types of ro-

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<http://dx.doi.org/10.1016/j.infsof.2017.04.006>

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tation had been used by software organizations. For instance, Fægri et al. [11] investigated job-to-job rotation in which software developers were rotated to customer support to increase knowledge redundancy at the organizational level. On the other hand, Santos et al. [34] investigated an organization in which project-to-project rotations were used to supply the need for specialized skills in a given project and to increase the variety of the tasks performed by the employees.

In our systematic review [35], we also identified that these two types of rotation serve different organizational and individual purposes, thus having distinct benefits and limitations. According to our findings, P2P rotations seem to enhance team flexibility and reduce job monotony through its increase in task variety. On the other hand, J2J rotations focus on organizational goals, in particular on organizational understanding and its effects on innovation and the establishment of multicultural teams. Further, we also found that J2J and P2P rotations seem to differ in how they address organizational, team, and individual needs, with J2J rotations focusing on organization and managerial needs, and P2P affecting workgroup and individual ones.

However, among the 17 primary studies analyzed in the above-cited review, only one investigated job rotation in the context of software engineering as its main goal. The remaining studies gathered evidence about this practice while researching other topics, in a non-intentional way, resulting in a low strength of evidence. Furthermore, the only study that focused on job rotation investigated J2J rotation in a context where software engineers were rotated to other areas in the company. No primary study, therefore, explicitly investigated the benefits and limitations of P2P rotations in software engineering practice. This is an important knowledge gap for the proper application of this managerial practice.

In this article, our goal is to contribute to reduce this knowledge gap by answering the following research question:

RQ: What are the benefits and limitations of the application of project-to-project (P2P) job rotation in software development industrial practice?

To achieve this goal, we synthesized evidence from multiple primary and secondary studies using techniques from meta-ethnography [28]. We used four sources of evidence in this synthesis: (i) a systematic literature review, published by Santos et al. [35] (hereafter called SLR) covering studies published between 1997 and July 2015; (ii) an industrial case study, published by Santos et al. [34], which focused on the motivational aspects of P2P rotations (hereafter called Case I), investigating the potential effects of P2P rotations on the motivation and satisfaction of software engineers in industry. These two studies created a preliminary understanding about potential benefits and limitations of job rotation in software engineering practice. They found five distinct benefits (two in common) and six distinct limitations (no intersection) of the use of P2P in software engineering.

We added two further sets of evidence to this initial body of knowledge: (iii) the extension of Case I (unpublished) covering a broader set of factors besides the motivational ones (hereafter called Case I – Extension); (iv) a second industrial case study (unpublished), conducted using the same protocol of Case I and a multiple case replication logic [45] (hereafter called Case II – Replication). We then compared the findings from the software engineering contexts with results from other areas.

Our meta-ethnographic synthesis resulted in 19 distinct factors that are potentially affected by the practice of P2P job rotations in software development organizations. Among them, eight were considered benefits or positive outcomes of the application of P2P rotations, nine were identified with potentially negative outcomes and, thus, considered as limitations of this practice, and two were considered as both benefits and limitations, depending on context-

ual factors. This synthesis produced the most comprehensive set of potential benefits and limitations of the use of P2P rotations in software engineering so far. Therefore, it constitutes a solid contribution to research and can also be used to inform practice, as discussed below.

Summarizing, this article synthesizes and extends the findings from previous publications. Firstly, we extended our first case study and then replicated it. Secondly, we used meta-ethnographic techniques to synthesize and consolidate the evidence from the different data sources.

The rest of this article is organized as follows. In Section 2, we present the conceptual background that characterizes job rotation in general and in software engineering projects. In Section 3, we describe the research methods used in each individual study and also the steps used in the meta-ethnographic synthesis. In Section 4, we present the results of our study. In Section 5, we discuss the implications of our findings for research and practice, together with the limitations of this study. Finally, in Section 6, we present our conclusions and directions for future research.

2. Background and related work

We start by presenting definitions and types of job rotation discussed in the literature. Then, we present a review of studies about job rotation performed in other areas. We also characterize P2P job rotation in software projects.

2.1. Definitions and types of job rotation

Since the 1950's, job rotation has been proposed as a practice to be applied in the organizational environment to reduce job monotony, boredom, and exhaustion, resulting from job simplification, specialization, and repetition [41]. The literature presents many definitions to describe this practice that focuses on distinct approaches to achieve the desired organizational goals.

A group of authors focuses their definition on job-to-job (J2J) rotations. Coyne [5] described job rotation as the purposeful and organized movement of staff within and across organizational areas to enhance both the success of the company and the employability of staff. Kuijter et al. [24] stated that job rotation is a regular alternation between different jobs within an organization, based on a scheme or spontaneously based on the workers' personal needs. Richardson et al. [32] defined job rotation as a reciprocal exchange of staff between two or more areas for a predetermined period.

Other authors made explicit reference to project-to-project (P2P) rotations, in which individuals move among projects or places but keep the type of job or role they were performing before the rotation. In this group, Soderquist and Prastacos [39], Alei et al. [1] and Brady et al. [2] presented job rotation as a practice that allows individuals or group of individuals to be moved from team to team and from project to project within the same organizational area. In software engineering, this would be equivalent to moving engineers from one software development team to another team in the same organization.

Encompassing both types of rotations, Woods [42] defines job rotation as “the systematic movement of employees from job to job or project to project within an organization during the development of a task, as an approach to achieve many different human resources objectives, such as staffing jobs, orienting new employees, preventing job boredom or burnout, rewarding employees, enhancing career development, and exposing employees to diverse environments”. In this study, we use Wood's characterization as the conceptual definition to guide our research.

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