

Factors of Software Engineers' Work Motivation

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Facing the fourth industrial revolution, new types of requirements appear, as well as new job positions which are accompanied with new work standards. All of this brings along innovations in technology, but also calls for innovations in strategic management. Software developers are key employees in this industrial revolution and they present new type of workers which indicates a need for innovative approach regarding reducing their fluctuation. Fluctuation can be reduced with adequate motivating, which can be provided only with deep understanding of their work motivation and perception of certain job aspects. In this research job perception of software developers and their work motivation is being discussed.

I. INTRODUCTION

The industry that is most productive and fastest developing in countries all over the world is IT industry and especially software development. One of the controversies in the software development industry is high fluctuation of employees, despite the working conditions that are much better than for engineers in other sectors. This kind of facts imply a need to better understand factors of motivation and job aspects. Job aspects are commonly related to motivation for work and job satisfaction. Whether it's job requirements or availability of resources for work, it's inevitable that these aspects will affect employees and their motivation for work [1]. Job aspects that are being related to motivation are primarily diversity and authenticity of work, importance of tasks being done, autonomy and feedback [2],[3],[4]. Employees' perception of job aspects is one of the key factors when employees make decision between changing the job or keeping the current one. This question is not just very important for the wellbeing of the employees in the software development industry, but for competitiveness of organizations in the market. Apart from perception of job aspects, this research has shed light on other factors of motivation that affect not only employees' wellbeing, but their productivity as well.

The goal of this research is to explore how do software engineers perceive job aspects, how they evaluate and value them, as well as how do these implicit evaluations affect their motivation for work. Previous research done on this topic started from the theory that was consistently applied to employees of all professions. Problem with this approach is that with fast paced development of

technology demands from the industry, labor market and method of work have been fast changing as well, making previously used theories obsolete. In accordance with these changes in line with these changes are changes in employees' demands and expectations, and IT industry is the best showcase for this. Exactly for these reasons, it was needed to start the research by interviewing software engineers and hear it first-hand how aforementioned job aspects are experienced. In order to be sure that developers are representatives of postmodern era and new wave jobs, we've conducted interviews with 25 developers and 25 engineers from similar fields. Afterwards, using developers' answers from the interview we made a questionnaire that targets this particular population of employees. 389 developers completed the questionnaire.

A. Hypothesis

First assumption in scope of this research was that perception of job aspects will be different between software engineers and engineers of similar fields. Because of the influence of fourth industrial revolution, specific job characteristics and various types of employment we expected the difference between perceiving new and old era types of job positions.

Second assumption is that diversity of work and authenticity of work will be the most important job aspects for software engineers. As it has already been said, this industry is the fastest developing industry in the world. In accordance with that, it can be expected to always face new challenges and work on various different tasks. When tasks become repetitive it is more likely for developers to seek for new challenges and try to make their work more innovative and exciting.

Third assumption is derived from the second one and it presumes that the most important factors of motivation for work will be related to problem solving and intellectual stimulation as these factors of intrinsic motivation. This hypothesis was set because these job positions acquire analytical thinking, problem solving and creativity. Also, developers are known for their work devotion [6]. In compliance with this and knowing that they are well paid for their work, we assumed that developers are mostly motivated by intrinsic factors, especially problem solving and intellectual stimulation. Furthermore, we believe that if this factor was to be left out as a job aspect, they are more likely to leave their workplace and search for jobs

that will give them the opportunity to learn something new and to face new logical problems.

II. METHODOLOGY

Research was done in two phases. First, qualitative phase was characterized by interviews with software engineers and engineers of similar fields (25 interviewees per group). Second phase of the research consisted of giving questionnaire that evaluated motivation for work to 389 software engineers. First two assumptions were checked using conversational methods that include different techniques like ABC, pyramiding, laddering and others, while the third assumption was checked by analyzing answers that interviewees gave when filling the questionnaire, which was made and tested especially for this population of interviewees.

First phase was used to check if developers are really different enough from other employees, even from similar fields of expertise. Data was processed together with interlocutors during interviews, so intrinsic and idiosyncratic meanings would be written down. Afterwards, comparison and assortment of collected data was done by content analysis. Organized data from interviews was used for making of indicators and items for questionnaire constructing.

Initially, questionnaire consisted of 89 items and was reduced to 32 items after Factor analysis in IBM SPSS.

III. RESULTS

A. Hypothesis Testing

First part of the research has shown that software engineers differently experience, and value aforementioned job aspects compared to engineers in similar fields. Quantitative element of evaluating this job

aspect didn't differ significantly with these two interviewee groups, but meaning and implicit expectations that these two groups have for job aspects are what differentiates software engineers from others, even within very similar fields. Confirmation of first hypothesis gave this whole research a meaning and relevance to carry on with the further testing.

Second assumption, related to "diversity and authenticity of work", was confirmed as well. Furthermore, this job aspect was evaluated as the most important factor, as well as the factor that motivates developers for work the most. This information was gotten by analyzing individual meanings and frequencies on sample of 25 software engineers. Interviewees from this sample were Junior, Medior and Senior developers of both genders that work in both big and small companies and also owners of companies. Variety of interviewees was important because of several things. First, we wanted to see if motivation and job aspects perception vary among these categories. Second, it was important that samples from these two phases of research are correspondent. The second reason was particularly important because the questionnaire was made to fit the population of developers, considering their gender and work conditions.

Third assumption has been confirmed with statistical data analysis, using data gained from questionnaire that was made specifically for this population of interviewees. Intrinsic motivation has been shown as more important for population of software engineers in opposed to extrinsic (see Table 1), and within it, problem solving and intellectual stimulation as the most important factors (see Table 2). IBM SPSS T-test technique was used to test this hypothesis.

		Paired Samples Test							
		Paired Differences		Std. Error	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
		Mean	Std. Deviation		Lower	Upper			
Pair 1	intelektualna stimulacija - bitnost mene	11.66581	3.27540	.16607	11.33930	11.99232	70.247	388	.000
Pair 2	intelektualna stimulacija - kreiranje	5.34704	2.94982	.14956	5.05299	5.64110	35.751	388	.000
Pair 3	intelektualna stimulacija - korisnost produkta	9.55270	3.19881	.16219	9.23383	9.87157	58.900	388	.000
Pair 4	intelektualna stimulacija - Fidbek od mašine	10.48843	2.62678	.13318	10.22858	10.75028	78.752	388	.000
Pair 5	intelektualna stimulacija - materijalni faktor, mogućnost izbora i sigurnost u svoje vjestine	13.48586	4.35096	.22060	13.05214	13.91959	61.132	388	.000
Pair 6	intelektualna stimulacija - materijalni faktor - prestiž	9.85604	4.55718	.23106	9.40176	10.31032	42.656	388	.000
Pair 7	intelektualna stimulacija - primenjenost vjestina od drugih	6.27249	3.25668	.16512	5.94785	6.59714	37.987	388	.000
Pair 8	intelektualna stimulacija - specifični benefiti profesije	11.83033	3.78324	.19232	11.45220	12.20846	61.512	388	.000

Table 2. T-test for intellectual stimulation and problem solving

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	ExtMot	55.4807	389	8.06819	.40907
	IntMot	60.7147	389	6.43110	.32607

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	ExtMot - IntMot	-5.23393	9.08887	.46082	-6.13996	-4.32791	-11.358	388	.000

Table 1. T-test for intrinsic and extrinsic motivation

IV. DISCUSSION

Aside from the problem that educational system does not produce enough software engineers for the labor market, as already mentioned, additional problem that is apparent is high fluctuation of this workforce. Using information gained from this research it appears that keeping quality employees can be influenced. By taking care of employee needs, their motivation for work can be influenced, and consequently motivated and quality work staff enables keeping market competitiveness and improvement of the organization. Meeting employees' expectations when it comes to job aspects and

understanding their motivation for work appear to be crucial success factor to IT organizations.

This research clarifies the specificity of this population and it's needs and motivators. It also points out the steps that need to be taken in order to keep developers motivated. It is important to keep in mind that results of this research do not show what developers are used to or that they demand these work conditions. Results are supposed to be considered as guidance for managers when they want to motivate their employees, or to understand the fluctuation better and to know how to prevent it. Satisfied and motivated employees are crucial for companies' long term success.

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