



# Challenges and strategies for motivating software testing personnel



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## ABSTRACT

**Context:** Software testing is the key to ensuring a successful and reliable software product or service, yet testing is often considered uninteresting work compared to design or coding. As any human-based activity, the outcome of the final software product is dependent of human factors and an essential challenge for software development organizations is to find effective ways to enhance the motivation and job-satisfaction of their testers.

**Objective:** Our study aims to cast light on how professional software testers can be motivated and we explore the policies and rules conceptualized and implemented inside software development projects.

**Method:** This paper presents the results of an empirical study that collected data through semi-structured and in-depth interviews with 36 practitioners from 12 companies in Norway. The data collection was performed over a two years period and investigates the strategies applied by the companies for stimulating their testers, while considering the motivational and de-motivational factors influencing the testing personnel.

**Results:** Our results provide a set of motivational and de-motivational factors for software testing personnel and present the strategies deployed by the companies for stimulating their testing staff.

**Conclusions:** The study shows that combining testing responsibilities with development and ensuring a variety of engaging, challenging tasks and products does increase the satisfaction of testing personnel. However, despite the systematic and sincere effort invested in recognizing the importance of testing and motivating the testers, heavy emphasis is laid on minimizing project costs and duration. The results could help the companies in organizing and managing processes and stimulate their testing personnel, which will lead to better job satisfaction and productivity.

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## 1. Introduction

Software testing is a crucial activity in the quality assurance of most software products. In spite of a wide range of available tools, it is still an activity requiring a lot of human labour, i.e., a socio-technical rather than purely technical activity [1], for which the outcome will be highly dependent on the performance of the involved employees. Unfortunately, findings both in industry [2,3] and among IT students [4] indicate that many current and future software professionals consider testing as unattractive work. This may cause problems in recruiting and retaining testers, while low motivation can lead to poor testing and overlooking of software defects [5]. Such problems are especially worrying in a time when the relative importance of testing to e.g. coding is increasing, due to more system integration projects and fewer green-field development projects, and relying gradually more on available compo-

nents and services rather than coding from scratch [6]. Though we have found few academic publications claiming shortage of skilled personnel for testing, except ([7,8]) specifically for China, there are signals from industry in many countries (e.g., Britain, Australia, India)<sup>1</sup> that this is becoming a key challenge, and that there is an increased need for testing-related training [9].

Massive automation of testing work might alleviate some personnel shortage, but as observed in [10], this is a long-term research goal, rather than a solution for the near future. Outsourcing and offshoring will work only if a shortage of skilled testers in some companies or countries is compensated by a surplus elsewhere, but as argued in the previous paragraph the shortage might instead be global. Hence, testing jobs must be made more attractive.

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<sup>1</sup> E.g., Britain: <http://www.computerweekly.com/news/1280091893/UK-is-short-on-software-testing-skills>, Australia: <http://www.itwire.com/it-people-news/recruitment/45107-software-testing-skills-shortage>, India: [http://www.siliconindia.com/guestcontributor/guestarticle/354/Software\\_Testing\\_The\\_Next\\_Big\\_Employment\\_Wave\\_Pradeep\\_Chennavajhula.html](http://www.siliconindia.com/guestcontributor/guestarticle/354/Software_Testing_The_Next_Big_Employment_Wave_Pradeep_Chennavajhula.html)

The research on human factors in software testing is limited. Bertolino [10] gives a good overview of a variety of research challenges in software testing, outlining different angles by means of the question words why, how, how much, what, where, and when. A word lacking from her analysis framework, though, is *who*. This seems to be symptomatic of the research she has been reviewing. As also observed by Kanij et al. [69], testing as a human activity tends to be under-researched relative to technical issues.

Although there is extensive work on motivation of IT personnel in general [11] and specifically on motivation in agile teams, e.g., [12] and [13], to our knowledge there is a lack of research focusing specifically on motivation in software testing. There was a survey in Spain with 127 respondents [2], looking at human factors negatively affecting the practice of software testing. The factors reported by the most respondents were instability of tester positions (48%), lack of attractiveness of testing (48%), and poor career development for testers (42%). Similar problems were also identified in a study by Shah and Harrold [3], investigating human and social aspects of working as a tester, or inside a testing team, as well as the attitude towards the testing team in the company. Our own investigations on student attitudes towards the prospect of a future testing career [4] revealed a similar image of low status for testing work, with most students seeing development positions as more rewarding from a career and financial perspective.

Given the limited research on the topic so far, we find it premature for this article to focus on establishing advice to the industry on how to make testing more attractive. A necessary first step is rather one of gaining understanding: what aspects of testing work makes it unattractive? Positive aspects to testing work must also be investigated. After all, in spite of the mentioned problems in recruitment and motivation, it is also possible to find many professionals who actively pursue careers in testing, who really enjoy that kind of work [14] and stay with it for a long time. A prerequisite for making advice on how to make testing work more attractive is therefore to understand its negative issues, which must somehow be reduced, and its positive sides, which should be kept or strengthened during the proposed changes. Hence, this paper poses the following research questions:

- **RQ1:** Which motivational and de-motivational factors influence testing personnel in their daily activities?
- **RQ2:** Which strategies are applied by companies to encourage their testers?

The idea behind RQ1 is to capture both the positive and negative aspects of testing work, as argued above. For RQ2, given the limited research on the topic so far, it seems natural to elicit descriptive knowledge of what companies are currently doing to encourage their testers, rather than jumping directly to the task of giving advice to companies on what should be done.

Other research questions could also have been justified by the observed problems related to recruitment, retention and motivation in software testing. For instance, the problem could be mitigated by improved education in testing, or improved recruitment strategies. Both these have, however, already received some attention. Testing education is addressed in ([15–18]) and several other publications. Related to recruitment strategies, there has for instance been work on what personality types are most suitable for testing work [19,20]. Although interesting, these topics are out of scope for this article, whose focus is on factors that motivate or de-motivate testers, and what companies do to encourage their testers.

The rest of the paper is organized as follows: Section 2 presents the related research while the research methods are described in Section 3 together with the research design and data collection process. In Section 4 we present and analyze the results, while in

Section 5 we examine the findings of the study and discuss the implications. Directions for future work are presented in Section 6.

## 2. Research context

Based on the research questions posed in the previous section, there are three topics we need to cover: (i) The concept of *motivation*, to establish a theoretical underpinning for the investigation. This makes it necessary to look at the theory of work-related motivation which, unfortunately, is not specifically targeting software testing. (ii) Findings from empirical software engineering related to industrial practice in testing, or related to motivation of software engineers/software testers. The last category relates most directly to our research questions, and if there was already a large body of theory and empirical findings here, we might not have needed to cover so much of the broader background. However, the limited literature makes it necessary to have a broader look to have a sufficient basis for the investigation. The two items presented above will be discussed in subsequent subsections below.

### 2.1. The concept of motivation

According to Ryan and Deci, motivation “concerns energy, direction, persistence and equifinality—all aspects of activation and intention” [21, p. 69], while Robbins [22] stated that motivation is the willingness to do a certain action and is conditioned by this action’s ability to satisfy needs for the individual. When referring to motivation it is necessary to understand the differences between *needs, drive, motivation and motives*, e.g. Toates, [23], Deci and Ryan [24].

One main theory of motivation is Herzberg’s two-factor theory, also known as “Motivation-Hygiene Theory”. Herzberg identified the types of job related factors that influence employee motivation (he called it attitude) to perform well [25,26]. Dissatisfaction factors (also called hygiene factors) are a group of factors that can cause negative attitude. These include unfair rules, poor physical working conditions and poor relationship with supervisors. The opposite, fair rules, good physical working conditions, and good relationships with supervisors, do not lead to particularly positive job attitudes, but at least gives absence of dissatisfaction – a neutral position. Motivation to do a good job is linked to another group of factors, such as responsibility, recognition, promotion and duties perceived as interesting. Herzberg called these motivational factors. Herzberg noted that motivational factors were primarily related to “the actual job”, while the hygiene factors are more focused on “the job situation” [25].

The Motivation-hygiene theory classifies motivational factors into extrinsic and intrinsic factors. Extrinsic motivation means that the activity is necessary to achieve some desirable result, for instance material gains (e.g., salary, bonus) or increased status. Intrinsic motivation means that the reward lies in enjoying the activity itself. Intrinsic motivation was described by Deci and Ryan as “the inherent tendency to seek out novelty and challenges, to extend and exercise one’s capacities, to explore, and to learn” [24]. Csíkszentmihályi’s concept of *flow* [27] also relates closely to intrinsic motivation.

De Jonge et al. [28] and Sargent and Terry [29] found that a work situation having both high job demands and job control was related to a high degree of work motivation and job satisfaction. Similarly, in a study of Swedish IT consultants, Wallgren and Hanse [30] found that influence on and variety in tasks contributed much more strongly to motivation than monetary incentives or company norms. High job demands, however, are positive only as long as they can be handled by the employee. If demands exceed abilities, time or resources, or employees do

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