

Comparative Analysis of Job Satisfaction in Agile and Non-Agile Software Development Teams

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Abstract. Software engineering is fundamentally driven by economics. One of the issues that software teams face is employee turnover which has a serious economic impact. The effect of job dissatisfaction on high turnover is consistently supported by evidence from multiple disciplines. The study investigates if and how job satisfaction relates to development processes that are being used and the determinants of job satisfaction across a wide range of teams, regions and employees. A moderate positive correlation between the level of experience with agile methods and the overall job satisfaction was found. The evidence suggests that there are twice as many members of agile teams who are satisfied with their jobs (vs members of non-agile teams). The ability to influence decisions that affect you, the opportunity to work on interesting projects, and the relationships with users were found to be statistically significant satisfiers.

1 Introduction

Economics is an important dimension of software engineering and it cannot be ignored. One of the issues that software teams face is voluntary turnover which has a serious economic impact. DeMarco and Lister's early work on peopleware [8] reveals a strong impact of people onto the success of software development projects. In this paper, we analyze if the development process used has an impact on job satisfaction. Concretely, we investigate agile processes and compare them to the overall industry.

Organizational psychology defines job satisfaction as a "present-oriented evaluation of the job involving a comparison of an employee's multiple values and what the employee perceives the job as providing" [12]. Even though the effect of job satisfaction on employee's performance and productivity (happy teams = productive teams) is disputed and considered by some organizational psychologists as a myth [19], [7], one particular discordant association – between job satisfaction and volunteer turnover (i.e. perceived desirability of movement) – has been consistently supported by evidence. Furthermore, job dissatisfaction is one of the most important confirmed antecedents for the high volunteer turnover [14], [17], [16]. As such it has a considerable economic effect on organizations, individuals and society¹.

¹ Although a positive economic effect can be achieved by the individual (i.e. increased salary), this study focuses on the societal macro aspects of the turnover, which are typically negative.

Projecting this onto the IT industry, analogous observations can be made. However comparatively less work has been done in this direction. For example, in a study of software development environments, Burk and Richardson showed that “job satisfaction relates more closely to an employee’s choice to stay with the organization than does financial reward” [6]. Estimates of turnover costs in IT industry vary. For example, studies put turnover costs as much as 70-200% [10] and 150-200% of that employee’s annual salary [15]. The cost of employee loss includes advertising, search fees, interview expenses (air fare, hotel etc.), manager’s and team members’ time spent interviewing, training and ramp up, overload on team, including overtime to get work done during selection and training of replacement; lost customers, lost contracts or business, lowered morale and productivity, sign-on bonus and other perks, moving allowance, and loss of other employees [10]. Boehm extensively discusses factors of software developers’ motivation and satisfaction and their various effects in the seminal Software Engineering Economics work [4].

Agile methods – human-centric bodies of practices and guidelines for building software in unpredictable, highly-volatile environments – are gaining more popularity now. They, supposedly, increase, among other things, job satisfaction by improving communications among team members and with the customer, promoting continuous feedback, and allowing developers to make decisions that effect them.

Agilists claim that agile methods make not only the customer more satisfied but also the members of the development team. If that is the case, then the improved job satisfaction may lead to a lower turnover, which in turn results in the economic benefits discussed earlier. However, most of what we know about job satisfaction in agile software development teams is anecdotal [5]. As agile methods increase in their popularity, the benefits of higher job satisfaction mentioned have been: increased individual and team morale [11], motivation [1], performance [18], productivity [18] and retention [11], [18], [3]. With the exception of a single study by Manaro et al [13], all claims were based on anecdotes and required a leap of faith. However, if we are to really understand the impact of agile methods on employees, teams and organizations, we need to go beyond anecdote and determine employee satisfaction empirically. In the present study, we set out to investigate how employees in agile and non-agile teams perceive the quality of their work life. By restricting our attention to job satisfaction, we can sharpen the understanding of its multiple determinants and those aspects of software engineering that are most valued by the individual.

2 Research Questions, Context and Method

To structure our research, we followed the Goal/Questions/Metrics (GQM) Paradigm [2]. Table 1 provides a summary of the goals, research questions and metrics. We also include our hypotheses and testing strategies. The goal of our research is to understand if and how job satisfaction relates to development processes that are being used and the determinants of job satisfaction across a wide range of teams, regions and employees based on the type of development process used. Consequently, the main research question is whether agile methods lead to higher, similar, or lower job satisfaction rates in software development teams in comparison to the IT industry in

general. An additional objective is to discover and describe relationships between selected job satisfiers (see Table 2) and the overall job satisfaction. We distinguish job satisfiers into three groups: internal, financial and external. Financial and external satisfiers are called “factors of hygiene” [9]; for these factors “act in a manner analogous to the principles of medical hygiene”. When these factors deteriorate to a level below that which the employee considers acceptable, then job dissatisfaction ensues. However, the reverse does not hold true. It is widely recognized that “when the job context can be characterized as optimal we will not get dissatisfaction, but neither will we get much in the way of positive attitudes. The factors that lead to positive job attitudes do so because they satisfy the individual’s need for self-actualization at the job” [9], [4].

Additionally, we analyze satisfaction outcomes based on the employee role: *manager* (team lead, project lead, scrum master), *worker* (developer, analyst, tester, architect, user experience designer, security specialist etc.) and *consultant* (process improvement consultant, coach, facilitator) and the extent of agile process adoption (none, <6 months, 6-12 months, 1-2 years, 2-3 years, 3-4 years, 4-5 years, >5 years).

For our study, we chose quantitative survey analysis and comparative analysis as our research procedure. Two self-administered Web-based surveys were used as a research instrument. One survey – denoted as the “*main survey*” – consisted of 17 questions of both quantitative (on Likert summated scale) and qualitative (open-ended) natures. It was administered by the authors of this paper. We recognized the multidisciplinary nature of our study (among software engineering, organizational psychology, sociology, and economics) and, therefore, formulated the questions in consultation with a specialist in organizational psychology. The second survey used (henceforth referred to as “*supplementary survey*”) was a more generic IT Job Satisfaction Survey conducted by the ComputerWorld magazine (www.computerworld.com/careertopics/careers/exclusive/jobsatisfaction2003). This survey contains perceptions of a broad body of IT managers and workers (from CIO to help desk operator) employed at a wide range of industries and company sizes. The ComputerWorld questionnaire focused on job satisfaction only and was agnostic to the development process used; whereas our main survey was designed having different development processes (agile vs. non-agile) in mind. In our main survey, we included several questions that were identical (verbatim) to the questions of the supplementary survey. The objective for using these two surveys was to enable comparative analysis of the results: Agile vs General IT and Non-agile vs. General IT. Notice that both surveys were administered on the Web and during the same year.

In this paper we only discuss a subset of our findings based on the responses to questions dealing exclusively with overall job satisfaction and its determinants (satisfiers). Analysis of the data related to stress, desirability of movement, and relationship with management is left out.

3 Data Sources

The target population for the main study is the group of software engineering professionals. The target population for the supplementary study is wider and includes IT professionals in general. Both surveys used self-selected Internet samplings.

Table 1. Research structure: Goal/Questions/Metrics with hypotheses and tests strategies.

Goal	<i>Purpose Issue Object Viewpoint</i>	Investigate the job satisfaction of individual team members related to software development process type adopted from the view point of agile, non-agile and general IT industry
Question	Q_1	Do members of agile software development teams experience higher, similar, or lower job satisfaction than members of non-agile teams?
Metrics	M_1	Satisfaction ratings by respondents categorized by the levels of adoption/experience with agile methods (from none to 5+ years); Spearman's measure of correspondence
Null Hypothesis	H_{01}	No relationship exists between the level of agile methods adoption and the overall job satisfaction of the individual
Test	T_1	Two-tailed Chi-square test
Question	Q_2	Are the rates of job satisfaction expressed by members of agile teams higher, similar, or lower than of IT industry in general?
Metrics	M_2	Percentage difference of satisfaction ratings; Spearman's measure of correspondence
Null Hypotheses	H'_{02}	The levels of overall job satisfaction of respondents from Agile group and General IT group are the same
	H''_{02}	The levels of overall job satisfaction of respondents from Non-agile group and General IT group are the same
Test	T_2	Two-tailed Chi-square test
Question	Q_3	Are there differences in perceptions based on the role (manager, worker, consultant)?
Metrics	M_3	Percentage differences of satisfaction ratings
Null Hypotheses	H'_{03}	Levels of satisfaction by managers and workers are the same in agile teams
	H''_{03}	Levels of satisfaction by managers and workers are the same in non-agile teams
Test	T_3	Two-tailed Chi-square test
Question	Q_4	What are the relationships between the level of experience with agile methods and individual job satisfiers (Table 2)
Metrics	M_4	Ratings for each satisfier; Spearman's measure of correspondence
Null Hypotheses	H_{04+s}	No relationship exists between the level of experience with agile methods and satisfiers $\forall s \in \text{job satisfiers}$
Test	T_4	Two-tailed Chi-square test

Table 2. Job satisfiers.

1. Opportunity for advancement	}	internal	}	"factors of hygiene"
2. Ability to influence decisions that affect you				
3. Ability to influence day-to-day company success				
4. Opportunity to work on interesting projects				
5. Salary	}	financial		
6. Connection between pay & performance				
7. Job security	}	external		
8. Workload				
9. (Interpersonal) relations with IT peers				
10. Relations with users (customer)				

Table 3. Suvey samples.

Survey	Administered by	$N_{complete\ responses}$	$N_{partial\ responses}$	N_{total}
Main	Authors	459	286	756
Supplementary	ComputerWorld	936	-	936

Table 4. Main survey sample distribution by regions

Africa	Asia	Australia & New Zealand	Europe	Latin America & Caribbean	Middle East	North America	South America
3	35	10	135	3	2	253	18
1%	8%	2%	29%	1%	0%	55%	4%

Invitations in four languages (English, French, German, Cantonese) were posted to the most active newsgroups, mailing lists and wikis (total 51) specialized in software engineering, in general; as well as via the C2, Agile Alliance, DSDM Consortium, Canadian Agile Network. The limitations of such sampling are discussed in Section 5. Details of the sample distributions are presented in Tables 3 and 4.

4 Findings: Analysis & Discussion

4.1 Overall satisfaction of employees of agile vs. non-agile teams

We organized our independent variable (level of experience with agile methods) in an ordered dataset as follows: 0="you don't know what agile methods are", 1="you haven't practiced agile but are interested", 2="<6 months", 3="6-12 months", 4="1-2 years", 5="2-3 years", 6="3-4 years", 7="4-5 years", 8=">5 years".

The results of the Chi-square significance test for the relationship between the level of experience with agile methods and overall job satisfaction is presented in Table 6. It reveals a statistically significant relationship at the level $<.0001$. Hence, hypothesis H_{01} (No relationship exists between the level of agile methods adoption and the overall job satisfaction of the individual) is rejected. In order to examine the nature of this relationship, we performed Spearman's correlation test and measured the correspondence of rank ordering. To deal with non-responses, we employed pairwise deletion. The results of Spearman's rho calculation show a moderate positive correlation between the level of experience with agile methods and the overall job satisfaction ($\rho_s = 0.35$, 95% $CI = [0.26, 0.42]$, 2-tailed $p < 0.0001$, $N = 448$). In other words, those who, reportedly, practiced agile for longer, perceived their overall job satisfaction higher. This is consistent with the claims of agilists.

4.2 Overall satisfaction of agile and non-agile teams vs general IT industry

The second research question we address is whether the rates of overall job satisfaction expressed by members of agile teams (group A) and non-agile teams

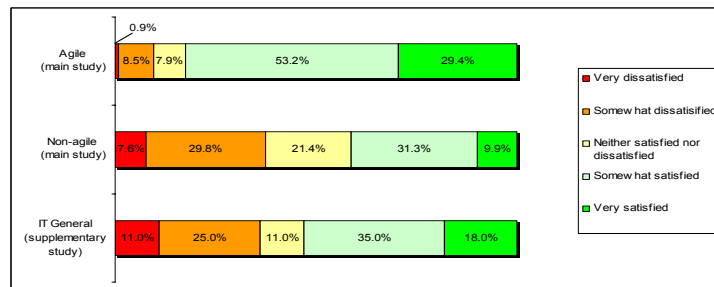


Fig. 1. Overall job satisfaction by groups: (A) members of agile teams (N=316); (B) members of non-agile teams (N=131); (C) IT professionals in general (N=936)

(group B) are higher, similar, or lower than of IT professionals in general (group C). Figure 1 illustrates the perception differences about overall job satisfaction.

Comparing percentage differences between IT in general and agile teams, several important observations can be made: IT professionals in general are:

- 11 times more likely to be “very dissatisfied” compared to agile team members;
- three times more "somewhat dissatisfied";
- 50% more indifferent ("neither satisfied nor dissatisfied");
- almost twice as few "somewhat satisfied";
- almost twice as few "very satisfied".

Comparing responses of members of agile and non-agile teams, similar trends emerge, but they are more acute:

- 8 times more very “very dissatisfied” individuals in non-agile teams;
- 3.5 times more “somewhat dissatisfied”;
- almost three times more indifferent ("neither satisfied nor dissatisfied");
- almost twice as few “somewhat satisfied”;
- three times as few “very satisfied”.

Table 5. Chi-square test for Hypothesis H_{01} (N=448)

Level of experience with agile methods	Overall Satisfaction					Total
	Very dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Very satisfied	
Don't know what agile methods are	1 (0.9)	6 (4.8)	10 (4.3)	13 (15.8)	4 (8.2)	34
Haven't practiced agile but interested	6 (2.5)	30 (13.2)	22 (12.0)	26 (43.6)	10 (22.7)	94
< 6 months	1 (1.0)	3 (5.3)	4 (4.8)	20 (17.6)	10 (9.2)	38
6 months – 1 year	1 (2.3)	9 (11.8)	5 (10.7)	47 (39.0)	22 (20.3)	84
1 – 2 years	2 (2.2)	9 (11.5)	7 (10.4)	46 (38.1)	18 (19.8)	82
2 – 3 years	0 (1.5)	5 (7.7)	7 (7.0)	27 (25.5)	16 (13.3)	55
3 – 4 years	0 (0.8)	1 (4.1)	1 (3.7)	14 (13.5)	13 (7.0)	29
4 – 5 years	1 (0.3)	0 (1.7)	0 (1.5)	3 (5.6)	8 (2.9)	12
> 5 years	0 (0.5)	0 (2.8)	1 (2.5)	12 (9.3)	7 (4.8)	20
Total	12	63	57	208	108	448
χ^2 statistic	104.67		df = 32	p < 0.0001		

Table 5 contains results of pair-wise chi-square tests for the set of hypotheses H_{02} . From the calculations, we reject only H'_{02} . Thus, there exists a relationship between overall job satisfaction and practice of agile methods (Agile or General IT). H'_{02} cannot be rejected, at a sufficiently small alpha level (0.05) so no strong conclusion regarding the relationship between overall job satisfaction and the group of non-agile and General IT respondents can be made.

4.3 Overall satisfaction by job roles

We examined the rates of satisfaction by roles (manager, worker and consultant) (Table 6). In addition, the main survey included a specific question that was

Table 6. Tests for relationships between levels of overall job satisfaction of employees-members of agile teams, non-agile teams and IT in general.

	Non-agile	General IT
Agile	$\chi^2 = 80.96$ $N = 447$ $p < 0.0001$ null hypothesis rejected ✓ $\rho_s = 0.39$ moderate positive association	$\chi^2 = 95.63$ $N = 1,252$ $p < 0.0001$ null hypothesis rejected ✓ $\rho_s = 0.26$ moderate positive association
Non-agile	—	$\chi^2 = 17.15$ $N = 1,067$ $p = 0.0018$ null hypothesis not rejected ✗ $\rho_s = 0.05$ no association

conditionally displayed to the respondents who identified themselves as those who practiced agile at the time of taking the survey. We explicitly asked to rate individual’s current experience in an agile team in comparison to the previous experiences of working in a non-agile team. The results are in Table 8. Managers of the teams who adopt agile are exceptionally positive about them (92% of “very satisfied” or “somewhat satisfied”). This is an indication that agile methods are not just a programmer-oriented movement, as some may believe. Workers (including developers and specialists) exhibit also a positive trend (80% of “very satisfied” or “somewhat satisfied” – highlighted in green in Table 7) though there are about 12% of those who are not. Majority of them have been practicing agile for 6-12 months. Further analysis of the comments provided by these dissatisfied agile workers reveal some of the reasons for dissatisfaction. One person indicated “office politics, company movement to offshore developers, incompetent executives” as the basis for her low satisfaction ranking; while another one blamed “little real project development work” available. Several individuals indicated that they were a part of a small agile team (<10) within a larger non-agile organization and, in two cases, “management resisted agile” while the developer team “tries to sneak it in”. There was one sentiment that was related to the IT crash and not agile methods per se. The person complained about working more hours leading to a lower net income – this is consistent with some of the sentiments of professional in General IT group observed in the results of the supplemental study. On the other hand, the group of workers who have not practiced agile but are interested in trying them in their organizations is largely dissatisfied with their current jobs (40%) or indifferent (27%) (highlighted in red in Table 7). Consultants, as expected, are extremely satisfied with agile methods. One data point in this category seems to be an outlier (a Telco consultant with <1 year prior experience with agile methods; who now follows a more Tayloristic process; the person provided no additional comments). Separating them from other subgroups ensures that no consultant bias is present in our analysis.

4.4 Job satisfaction factors

In order to answer the forth question of our study on whether there exist relationships between the level of experience with agile methods and individual job satisfiers (identified with the help of an organizational psychologist and listed in Table 2), we performed both Chi-square and Spearman’s correlation tests for each of them. The results are summarized in Table 9. The relationships of the *level of agile experience* and *ability to influence decisions that affect you*, *opportunity to work on interesting projects*, and *relationships with users* were most strongly positive; while the relationships with *workload satisfaction*, *opportunity for advancement*, and *ability to influence day-to-day company’s success* were moderately strong but, nevertheless, statistically significant at level $p < 0.0001$.

5 Caveats and Limitations

Among this study’s main limitations is the use of self-selected sample. The way how the study was distributed (online) might have created a selection bias – an argument can be made that many developers in the industry do not check the resources were the survey invitations were sent to. The question that matters, however, is whether self-selected participants of our main survey and the supplementary ComputerWorld survey are representative of members of the target populations. We hope that it is the

Table 7. Overall job satisfaction by job roles and levels of agile experience (N=482)

Role	Level of experience with agile	Overall Satisfaction					Grand total
		Very dis-satisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Some-what satisfied	Very satisfied	
Manager	Practice agile now		2	3	39	21	65
			3%	5%	60%	32%	100%
	Do not know what agile methods are	1	1	1	3		6
	Haven’t practiced but interested in trying	17%	17%	17%	50%		100%
	Have practiced before but not now	1	3	1	4	2	11
		9%	27%	9%	36%	18%	100%
Worker	Practice agile now			2	2	2	6
				33%	33%	33%	100%
	Do not know what agile methods are		1	1	1	1	4
	Haven’t practiced but interested in trying		25%	25%	25%	25%	100%
	Have practiced before but not now	3	25	19	121	67	235
		1%	11%	8%	51%	29%	100%
Consultant	Practice agile now		5	6	10	4	25
			20%	24%	40%	16%	25%
	Do not know what agile methods are	5	24	20	19	5	73
	Haven’t practiced but interested in trying	7%	33%	27%	26%	7%	100%
	Have practiced before but not now	4	8	4	13	1	30
		13%	27%	13%	43%	3%	100%
Consultant	Practice agile now	2	3	5	2	2	14
		14%	21%	36%	14%	14%	100%
	Have tried agile in training environment			1	5	5	11
				9%	45%	45%	100%
Consultant	Practice agile now		1				1
			100%				100%
	Have tried agile in training environment				1		1
				100%		100%	

Table 8. Comparative satisfaction rankings of agile vs non-agile environments by respondents who practice agile (by roles) (N=384).

Compared to your other experiences of working in a non-agile team, how would you rate your current job now?						Grand Total
Role	Much Better	Better	Similar	Worse	Much Worse	
Manager	39 49%	28 35%	8 10%	4 5%		79 100%
Worker	114 39%	109 37%	47 16%	16 5%	6 2%	292 100%
Consultant	8 62%	3 23%	1 8%		1 8%	13 100%
Grand Total	161 42%	140 36%	56 15%	20 5%	7 2%	384 100%

Table 9. Relationships between the level of agile experience and individual job satisfiers (N=481, df=36, p<0.0001)

	Satisfiers (as per Table 2)									
	Opportunity for advancement	Ability to influence decisions that affect you	Ability to influence day-to-day company success	Opportunity to work on interesting projects	Salary	Connection between pay & performance	Job security	Work-load	Relations with IT peers	Relations with users/customers
χ^2	79.92	103.24	84.05	99.18	45.28	63.96	64.34	67.42	59.43	88.82
rho,	0.22	0.32	0.28	0.32	0.06	0.17	0.06	0.23	0.26	0.31
rel.	moderate	moderate	moderate	moderate	none	weak	very weak	moderate	weak	moderate

case: the large sizes of the samples and the breadth of the countries and organization sizes help to mitigate the risk of non-representation. All in all, we believe that our sample does not bias our significance tests substantially. Another potential caveat – ambiguity of the questions – was addressed by validating the questionnaire with two software engineers and one organizational psychologist. In addition, there is a chance of the same individual responding to both surveys. However, even if this is a case, the large size of samples compensates for this. One last caveat that we should mention is the fact that we are only looking at the start of the chain: development process \Rightarrow job satisfaction \Rightarrow voluntary turnover \Rightarrow economic losses. We rely on interdisciplinary research to make the rest of derivations. Undoubtedly, complex relationships will emerge and those are subjects of our future studies.

6 Conclusions and Future Plans

Our research evaluated the relationship between development process and overall job satisfaction. It revealed that relationship to be statistically significant at p<0.0001 and the existence of a positive correlation between the level of experience with agile methods (from none to 5+ years) and satisfaction. Comparative analysis of the way agile teams and general IT professionals in the industry perceive their work environments revealed significantly higher rates of satisfaction by agile team members. In addition, we found not only workers but managers of agile teams are overwhelmingly satisfied with their jobs and even ten points more so. This is a clear indication that agile methods are not just a programmer-oriented movement. Lastly, it is important to recognize the complex nature of job satisfaction as no single factor

usually effects satisfaction by itself. Therefore, an investigation of the relationship between the level of agile experience and individual job satisfiers was undertaken. It found the three strongest relationships were the ability to influence decisions that affect the individual, the opportunity to work on interesting projects, and the relationships with users/customers. In our future work, we'll analyze perceived desirability of movement and work stress.

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