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Differences in Views between Development Roles in Software Process Improvement - A Quantitative Comparison

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Abstract

This paper presents a quantitative study that evaluates how different roles in a software development organization view different issues in software process improvement. The study is conducted in a large Swedish telecommunication organization with the traditional roles of software development. The respondents of the study got five different questions related to process improvement. The result was that the different roles disagreed in three of the questions while they agreed in two of the questions. The disagreement was related to issues about importance of improvement, urgency of problems, and threat against successful process management, while the questions where the roles agreed focused on communication of the processes (documentation and teaching). It is concluded that it is important to be aware and take into account the different needs of different roles and that looking into other areas (e.g. marketing) could be beneficial when conducting process improvements.

1. Introduction

People are in their nature different. They think differently, they behave differently and they require different things. This has been realized for example in the marketing field, where companies and organizations divide customers into market segments, based on their inherent characteristics. Such market segments are often based on geographic (e.g. country), demographic (e.g. age), psychographic (e.g. lifestyle), and/or behavioral (e.g. brand loyalty) data [13]. Psychographic segmentation could include for example which profession a customer has because it is likely that people with similar professions have similar characteristics.

Within software development, people within an organization have different responsibilities and work tasks [9]. This means that they have different professions or roles and it is likely that people with similar roles have the same opinion about things. Further, within an organization, the different roles often are divided into departments, units, divisions, and so forth. These different organizational homes contain the same kind of people and they run into the same kind of troubles in their work. Hence, it is probable that different roles have different priorities when it comes to what should be improved in a company.

Some work around this has been done in the area of software engineering where different perceptions of different roles have been noticed. Conradi and Dybå [3] showed that managers and developers had different opinions regarding if formal routines were efficient as a communication medium or not. Generally, it showed that managers were more positive than the developers to written routines. However, no distinction of what kind of developer or manager was made. In Svahnberg [12], a study was performed to see how different roles formed groups in an architecture assessment. The conclusion was that people formed groups based on their roles when prioritizing quality attributes and based on their experience when assessing a software architecture. This result shows that different persons with similar characteristics seem to have the same opinion about different issues (as in the idea of market segmentation).

In software process improvement, it is important to know what to improve before improving. People that are going to use an improved process know the current problems very well and should be asked in order to find the right areas to improve [5]. However, it is obviously convenient to just take an average of responses in order to get the view of what is most important within an organization and then implement the most important areas throughout the whole organization.

However, as is noticed in the marketing field and the two papers mentioned above; different roles may have different priorities. The main question is if this is true in software process improvement as well. Do programmers, testers, managers and so on have different issues on their personal agendas?

It is important to know the information about differences in opinion for two reasons. First, it is important to know which roles that are interested in which improvements. Second, it has been reported that people have an inner resistance to change [5]. If knowing the priorities of different roles, it is easier to provide these with the "correct" improvements at the same time as it is easier to sell-in the concept. This is especially true when people refuse changes due to the "not invented here syndrome" [5]. If knowing their personal agendas, it should be easier to convince them about the fitness of the proposed improvement.

Based on the above discussion, the hypothesis of this work is that different roles have different personal agendas, and hence priorities, when it comes to software process improvements. This paper aims to find out if the opinions about issues in software process improvement differ between roles and if such differences could be used in order to provide more tailor-made process improvements within an organization. This is done through a quantitative case study, performed in a rather large organization with several different kinds of roles involved.

In Section 2, the performed study is presented. In Section 3, the results of the study are presented and the different questions in the study are discussed. Further, Section 4 presents an analysis of the results. Section 5 provides a discussion of how the result affects the process improvement work and Section 6 discusses what further work that could be done.

2. Method

The performed study has been conducted as a case study and the result is based on a questionnaire that was a part of this study. In this part, we are going to describe the foundation for the results obtained. First, we describe the settings in which the study was conducted (Section 2.1). Then, the design of the actual study is presented (Section 2.2). After this, the different roles are identified and presented (Section 2.3). Finally, possible threats to this study are discussed (Section 2.4).

2.1. Research Settings

This paper is based on an investigation that was performed at an Ericsson AB site in Sweden. At the time of the study, the organization had about 400 employees that were working in different software development projects (primarily development of real-time telecommunication systems). Such projects typically include 60-120 persons for 12-18 months. The employees of the organization were organized in a matrix organization (as described in Nicholas [8]).

The framework of software processes that was used within the organization was developed by a functional area [8] similar to what Zahran [14] refers to as a Software Engineering Process Group (SEPG). However, the actual processes in the organization were mostly developed within each functional area or unit (e.g. a test unit had a test process of their own) and the organization also had some standard processes that all departments should follow (e.g. a process for inspecting artifacts). In addition, the organization followed a project management model developed by Ericsson.

2.2. Design of Study

The study conducted was performed as a three-step approach, including a qualitative, a quantitative, and a literature study. The approach was to first perform the qualitative study in order to obtain an understanding of software process related issues in the studied organization. Further, a literature survey was conducted in order to find additional issues, not mentioned in the qualitative study. Based on these two parts, a quantitative study was conducted in order to get a broader perspective of the issues and also to get quantitative results from the organization.

This paper does not present the overall result of this study. The overall result has been presented in [1], and it showed that synchronization and baselining processes were the primary concerns in the organization studied. Instead, this paper focuses on differences between how different roles perceive the software processes in the organization. To be able to focus on different opinions of different roles, only the quantitative part is included in this paper. The reason for this is that the roles were not defined until the quantitative study.

The questionnaire included eighteen multiple-choice questions, five weighted questions, four demographic questions (i.e. age, gender, department and role), and one open-ended question. In the weighted questions, the respondents were given 100 points to distribute between the answering alternatives in each question, as described in Leffingwell and Widrig [6]. This resulted in that the different answering alternatives were weighted according to each other on a ratio scale[1]. This means that not only the order of the alternatives were outlined but also to which extent one alternative was more important than another.

Before the questionnaire was sent to the respondents, a pilot study with three reviewers from the organization was performed. This pilot study resulted in some minor adjustments to the questionnaire. The adjustments mainly concerned interpretation issues, order of questions, and number of answering alternatives. In order to get all views from within the organization, all horizontal and vertical levels were represented (i.e. all management levels and functional areas) in the quantitative study. Further, this sample was evenly distributed between the horizontal and vertical levels (i.e. the number of respondents correlated to the number of persons at the functional area/management level).

The questionnaire sum up to 28 different questions. In order to do a comprehensive analysis and discussion, only the weighted questions are included in this paper. The main reason for selecting the weighted questions is that it is possible to see not only the ranking, but also the weight the respondents have assigned to the alternatives. Further, the weighted questions were used as validation of the multiple-choice questions, which implies that the multiple-choice questions are included in the weighted questions implicitly.

2.3. Roles

In this paper, the focus is on different roles within the studied organization and the study aims to find how they perceive different issues. A number of roles were identified in the demographic questions of the questionnaire. The internal names of the roles have been mapped to common roles within software engineering literature in order to make them more general. These mapping of internal roles to general roles have been validated through a review with people from the organization. However, all roles could not be mapped to general roles and in those cases, no references to literature are provided. Further, not all roles presented in this paper could be elicited from the demographic questions. Hence, a mapping of roles to functional homes is performed on these (see Others below) that did not have an explicit role. Below follows an explanation of each role:

- Functional Managers are responsible for maintaining technical competency, staffing, organizing, and executing project tasks within their functional areas [8].
- Project Managers plan, direct and integrate the work efforts in order to achieve the project's goals [8].
- Quality Assurance Supervisors establish and administers inspections and controls the quality related work [8].
- Sub-Project Managers inherit the characteristics from the project manager but manage different sub-parts of the main project (e.g. a design project).
- Team Leaders manage small teams within the sub-projects.
- Others (Staff), this category involves the personnel that have none of the above-mentioned explicit roles and can be seen as the staff of the organization. A division of this role into explicit roles such as programmer and tester is performed below.

This division of roles means that all roles except the Functional Managers are a part of the development projects. The Functional Managers provide resources to the projects, as explained in Nicholas [8]. This division also means that each project consists of one Project Manager. Each Project Manager has a number of Sub-Project Managers that runs the sub-projects within the main project. Further, each Sub-Project Manager has a number of Team Leaders that administers and leads the teams in the sub-project. Staff (or Others) can have several functions and organizational homes, even though they do not have explicit roles. They may, for example, be testers, designers, programmers, configuration managers, and so on. When running the study in the industrial environment, the answers of different functional areas were most interesting for the company. However, from a research point of view, it is more interesting to see the views of different roles. Hence, the Staff has been mapped to specific roles, based on their respective functional area.

The functional areas that the Staff are distributed on are the following (the internal names of the functional areas have been mapped to names of functional areas in literature, and have been validated with the organization):

- Design and Programming is responsible for program design and implementation of the system [9].
- Software Engineering Process Group facilitates the definition, maintenance and improvement of the software processes within the organization [14].
- Maintenance and Supply is responsible for maintenance, training, installation/delivery, and support of the system on customers site [9] [10].
- Strategic Product Management is responsible for planning activities related to the product and the product line [7] and writes a high level requirements specification for each project.
- System Architecture/Requirements Analysts breaks down the high level requirements specification to low

1. A ratio scale preserves ordering, size of intervals and ratios between intervals. The measuring starts at zero and increases at equal intervals. All aritmethics can be applied [4].

level requirements specification and generates a system-level description [9].

- Test verifies that the product works properly and according to its specification [9].

Note that the roles (e.g. Functional and Sub-Project Managers) also could be included in these functional homes. However, the aim with dividing the staff to the functional areas is that it is possible to categorize the staff into roles, based on their organizational homes. This means that we have:

- Designers and Programmers
- Software Engineering Process Group members
- Maintenance and Supply staff
- Strategic Product Managers
- System Architects/Requirements Analysts
- Testers

This should provide a better view of what specific roles that are represented in the study. All identified roles are presented in Table1 together with the abbreviation used and the number of respondents for the role. In this table, it is possible to see that there were 63 respondents to the questionnaire of which 30 had filled in explicit roles and 33 were assigned roles according to their functional homes.

Table 1. Division of people on roles.

Role	Abbreviation	#
Functional Managers	FM	6
Project Managers	PM	7
Quality Assurance Supervisors	QAS	2
Sub-Project Managers	S-PM	5
Team Leaders	TL	10
Designers and Programmers	D & P	10
Software Engineering Process Group	SEPG	1
Maintainence and Supply	M & S	8
Strategic Product Managers	SPM	2
System Architects	SA	9
Testers	T	3

2.4. Threats and Validity

One possible threat to this study is that the roles of D & P, SEPG, M & S, SPM, SA, and T was not elicited from the persons themselves but rather from their functional homes. This could mean that the role descriptions might not fully correspond to their actual work responsibilities. However, during the design of the questionnaire, people from within the organization participated when specifying the explicit roles. Hence, those who have not stated their roles should be considered as staff in their functional home. This would imply that they perform tasks that are typical for their functional home, which means that they should perform tasks that are in line with the responsibility of the department. This means that a person located in for example the Design and Programming functional area, most probably performs the specific activities for that functional area.

Another threat is that the normalization made (see Section 3) does not correspond to what the person's real answers should be. Eight respondents gave answers that did not sum up to 100. Three of these had filled in all alternatives of the question. One of them had distributed the points equally to the different alternatives (i.e. 33, 33, 33). Further, one out of the remaining four that actually missed/neglected to fill in an alternative did sum up to more than 100, which seems that it was just a miscalculation and the ratio should be the same between the alternatives. These five persons are hence not regarded as threats to the validity.

The three remaining persons missed one alternative or more, and had a sum less than 100. One of these missed/neglected one alternative and had a sum of 80. Another missed/neglected two alternatives and had a sum of 90. The third missed/neglected three alternative and had a sum of 95. The one that had 95 could probably be classified into miscalculation because it was just 5 points and it was the question with seven alternatives (see Table4). The two remaining are harder to determine, it could have been a miscalculation and it could have been that one alternative that should have been marked was missed. This means that these two persons *could* be a threat to validity.

Further, one threat that most often is a problem in questionnaires is that it is not evident that the respondents interpreted the questions and answers similarly. However, this should have been prevented through that discussions about the language used within the organization were held. Further, a discussion about the interpretation of the questions and answers were held together with the pilot study.

A final threat to validity is that some roles were only represented by a few respondents (e.g. SEPG and SPM). The threat is that their answers could reflect their personal opinion rather than the role's opinion. However, if more people had represented these roles, the sample would not have been evenly distributed (as described in Section 2.2). Therefore, in this sample, these small groups must be seen as representative for their role. However, no discussions will be based on these roles.

When having the method described, the roles outlined and the threats discussed, it is possible to discuss what results that were obtained in the study. This is done in the following section.

3. Result

The questionnaire was sent out to 84 persons in the organization. 65 persons answered the questionnaire,

which is equivalent to a response rate of 77%. The questionnaire was sent out to 22 percent of the organization (software development part), which resulted in that the respondents represent 17 percent of the organization. This sample was symmetrically distributed both vertically (i.e. management levels) and horizontally (e.g. functional areas). However, as can be seen in Table1, only 63 persons are included in the discussions in this paper. This is because two persons did not answer the weighted questions, and they are therefore removed.

Further on in this section, the result of the five weighted questions is presented. The section is divided into five parts, of which each discusses one question. The heading for each section is named after the original number of the question in the questionnaire.

The number in each cell in the tables represents the mean relative weight of the alternative in comparison with the other alternatives for that role. This means that each row in the tables sums up to 100. In each table, the answering alternative that has the highest value of each role is white while the alternative that has the lowest value is black. However, in some cases, several alternatives have been marked with black or white. This is when they have equal values. In the tables below, it could also be noted in some cases that values that seem to have equal values are not marked in the same colors. This is because when rounding the numbers, they could get the same value (e.g. 23.5 and 24.3 are both rounded to 24).

The N-value in each table represents the number of respondents on that particular question. In this study, two persons have been removed from one question each. The reason for this was that they did not answer that particular question. Further, eight persons had answers that did not add up to 100. In order to not lose these persons' answers, their answers were normalized so that their answers added up to 100 (i.e. Oldvalue/Oldsum*100). For example, if a person had a sum of 95 and answered 35 on one of the alternatives, the normalized value became 35/95*100, which is ~37 on that alternative.

In the following sections, each question and its answers are presented and briefly discussed. A more formal analysis is presented in Section 4.

3.1. Question 19

The question and the answering alternatives that was stated in Question 19 were:

When conducting process improvement, how is the relative importance divided between the following 5 factors?

1. Close cooperation of departments/units
2. Shared vision between management and staff
3. Management commitment (providing resources, time, etc.)
4. Affected users of the process involved
5. Setting realistic objectives and goals

The answers of the different roles are presented in Table2.

Table 2. Answers on question 19.

N=63	1	2	3	4	5
FM (6)	25	15	23	22	15
PM (7)	15	29	22	22	12
QAS (2)	20	15	25	25	15
S-PM (5)	12	18	25	24	21
TL (10)	15	21	24	20	20
D & P (10)	13	19	29	22	18
SEPG (1)	30	15	10	40	5
M & S (8)	19	18	15	28	21
SPM (2)	15	21	21	21	21
SA (9)	17	13	23	21	25
T (3)	30	5	8	40	17
Total:	**17**	**18**	**22**	**24**	**19**

In this table, it is evident that the different roles within the organization have different opinions of what is important and what is not. A brief look in the table reveals that all alternatives but one (alt. 4) are represented as the least important factor. Further, all alternatives have been represented as the most important. When looking at the totals, close cooperation between departments seems to be the least important area to improve. However, the Functional Managers (that should have the best overall view) thought that this was the most important issue. On the other hand, user involvement seems to be the most important to improve. This was considered as most important by five of the eleven roles. None of the remaining roles thought this was the least important area to improve, which means that it seems like there is a rather common agreement that this is an important issue. However, five roles thought that management commitment was the most important area even if one of the roles (M & S) thought this was the least important area. As can be seen in the above discussion, the answers to this question are rather diverse, which shows that the roles have different opinions of what is important and what is not.

3.2. Question 20

The question and the answering alternatives that was posed in Question 20 were:

How is the relative threat against successful process management divided between the following 5 factors?

1. Changes in work procedures are not reflected in process descriptions
2. Changes in process descriptions are not reflected in work procedures
3. Wrong persons develop the descriptions

4. Processes are not synchronized between departments
5. Inconsistent process descriptions (different notations, levels, locations, etc.)

The answers of the different roles are presented in Table3.

Table 3. Answers on question 20.

N=63	1	2	3	4	5
FM (6)	21	23	20	31	5
PM (7)	21	18	14	36	11
QAS (2)	30	18	25	18	10
S-PM (5)	21	27	12	28	12
TL (10)	20	16	23	30	12
D & P (10)	19	18	28	16	20
SEPG (1)	5	10	15	40	30
M & S (8)	23	21	23	23	11
SPM (2)	23	18	5	40	15
SA (9)	20	22	16	26	16
T (3)	48	27	4	14	7
Total:	**22**	**20**	**19**	**26**	**13**

When looking at the result of this table, a similar result as in the previous question could be identified. In this table, all but two alternatives have been chosen as largest threat to successful process improvement. Further, all but one alternative have been chosen as the smallest threat. If looking at the total, processes are not synchronized was regarded as the largest threat. However, the Designers and Programmers regarded this as the least threat of the alternatives. The Designers and Programmers (together with Maintenance and Supply) instead regarded the persons who develop the process descriptions as clearly the largest threat (8 points more that the second largest) while four other roles considered this as the smallest threat to successful process management. This shows that there are rather large differences on how the different roles regard the threats for successful process management.

3.3. Question 21

The question and the answering alternatives that was posed in Question 21 were:

How is the relative urgency divided between the following 7 problems that must be resolved?

1. Interfaces between departments/units
2. Synchronization between processes
3. Creating a good change management of processes
4. Make it possible to tailor processes to certain needs
5. Understand/document our current way of working
6. Create a holistic view over the development
7. Enforce tools to support our work

The answers of the different roles are presented in Table4.

Table 4. Answers to question 21.

N=62	1	2	3	4	5	6	7
FM (6)	24	32	10	11	7	8	8
PM (7)	14	19	12	10	25	14	7
QAS (2)	11	13	24	18	15	8	13
S-PM (5)	13	13	10	23	19	11	10
TL (10)	17	23	11	15	18	9	9
D & P (10)	14	12	14	19	15	6	21
SEPG (1)	27	18	9	5	36	3	2
M & S (8)	13	16	9	11	23	14	16
SPM (1)	10	40	20	10	10	0	10
SA (9)	16	16	14	12	24	4	14
T (3)	27	32	5	18	15	2	2
Total:	**16**	**19**	**12**	**14**	**19**	**8**	**12**

The views of what are the most urgent problems to resolve are also rather scattered within the organization. Here five out of the seven alternatives have been chosen as the most urgent while four have been chosen as the least urgent. In this case, it seems like creating a holistic view, enforce tools, and having a good change management process are those areas that are least urgent to resolve. However, when studying the Designers and Programmers, it is possible to see that these thought that enforcing tools were the most urgent. The Designers and Programmers was the only role that thought this was urgent while others thought it was not urgent at all (e.g. Testers and Project Managers). It could also be seen that some roles (e.g. Project Managers and System Architects) considered documenting the current way of working as a very urgent (between 6 and 9 points before the second most urgent) problem to resolve while Line Management considered this as a not very urgent area (only 7 points). Based on the above discussion, it seems like the roles have rather scattered views of what is urgent and what is not.

3.4. Question 22

The question and the answering alternatives that was posed in Question 22 were:

How is the relative importance divided between the following 6 factors regarding content of a work description/ process?

1. Communication scheme between people in the process
2. Workflow (with entry and exit criteria's for documents, artifacts, etc.)
3. Role definitions
4. Templates
5. Work instructions/guidelines/checklists
6. Training Material

The answers of the different roles are presented in Table5.

Table 5. Answers to question 22.

N=62	1	2	3	4	5	6
FM (6)	13	38	10	11	18	10
PM (7)	23	31	19	7	14	5
QAS (2)	15	25	15	20	23	3
S-PM (5)	6	33	21	11	17	12
TL (10)	12	25	21	17	20	6
D & P (9)	15	21	15	16	26	8
SEPG (1)	7	25	30	15	20	3
M & S (8)	13	27	24	10	23	4
SPM (2)	15	25	40	10	8	3
SA (9)	15	24	14	15	23	8
T (3)	2	50	28	10	7	3
Total:	13	28	19	13	20	7

In this question, there are clearly two alternatives that were considered as the most (workflow) and least (training material) important contents of a process. Those three that did not consider workflows as the most important way of documenting the processes, considered this as the second most important. When it comes to the least important, training material was regarded as least important by all but two roles. However, the Testers thought this as the second least important issue while Sub-Project Managers considered it as the third least important issue. Both Testers and Sub-Project Managers considered communication scheme as the least important. The result of this is that even though there are slight differences between the roles, the overall opinion is rather aligned between the roles. This is not at least evident when looking at the totals of the answers (workflow is 8 points more important than the second most important and training material is 6 points less important than the second least important).

3.5. Question 23

The question and the answering alternatives that was given in Question 23 were:

How is the relative effectiveness divided between the following 5 ways to communicate/teach processes?

1. Games
2. Role-plays
3. Workshops
4. Seminars
5. Presentations

The answers of the different roles are presented in Table6.

Table 6. Answers to question 23.

N=63	1	2	3	4	5
FM (6)	3	15	30	29	23
PM (7)	11	19	31	21	18
QAS (2)	7	17	31	25	21
S-PM (5)	2	19	31	26	22
TL (10)	16	23	28	16	18
D & P (10)	10	10	35	20	26
SEPG (1)	15	30	10	5	40
M & S (8)	6	11	33	19	31
SPM (2)	10	21	22	12	36
SA (9)	4	11	38	22	26
T (3)	17	20	23	3	37
Total:	9	16	31	20	24

In this question (as in the previous), the views within the organization are rather similar. Workshops are regarded as the most effective way to communicate processes while games are regarded to be the least effective. All but three roles considered workshops to be most effective, two of these considered workshops as the second most effective while the third role (SEPG) considered it to be the second least effective way. However, SEPG is only represented by one respondent, which should be taken into account. When it comes to the least effective, all but two roles considered games as the least effective way to communicate processes. One of the two that did not consider games as least effective was the Testers, which considered it second least important. The other, SEPG, considered it as the third least important. However, as in the case with the most important, SEPG is only represented by one respondent and this answer reflects only this person's view. To conclude, the different roles are aligned in their view of what is most and least important. This is not at least showed in the large differences of weight in the totals (workshops are 7 points more effective than the second most important, and the games are 7 points less important than the second least important).

4. Analysis

The above results indicate that there are both differences and similarities between the roles. A correlation analysis is conducted to investigate this further and to study whether there is an agreement or disagreement between different roles. The correlation study is done based on the ranks and not on the actual weights. This was done since it was judge more important to identify agreements in terms of ranking than actual values. Moreover, it would have been hard to interpret the correlation for the actual values.

To minimize the risk for correlations based on individual viewpoints and randomness, some measures have been

taken. First, the roles with less than three respondents are removed from the analysis. It was considered whether a higher threshold should have been set. However, this would have resulted in that the testers would have been left out from the analysis, which was judged as being unfortunate due to testers are one of the most common roles. Thus, the following roles are removed from the analysis: QAS, SEPG and SPM. Secondly, it was decided to be rather conservative when claiming that the different roles were of the same opinion. It was decided that the actual correlations were of less interest than judging whether correlations were positive or negative. In addition, it was decided to look at the number of high correlations as a measure of agreement between different roles.

The results from the correlation analysis are presented in Tables 7-11 and the number of observations presented in the tables are equal to the number of answering alternatives on the different questions.

Table 7. Correlations question 19.

Correlation Matrix

	FM	PM	S-PM	TL	D&P	M&S	SA	T
FM	1,000	-,121	-,121	-,243	-,121	-,243	-,121	,364
PM	-,121	1,000	,200	,800	,600	-,600	-,600	-,600
S-PM	-,121	,200	1,000	,700	,900	-,100	,600	0,000
TL	-,243	,800	,700	1,000	,900	-,600	0,000	-,600
D&P	-,121	,600	,900	,900	1,000	-,300	,200	-,200
M&S	-,243	-,600	-,100	-,600	-,300	1,000	,200	,800
SA	-,121	-,600	,600	0,000	,200	,200	1,000	,200
T	,364	-,600	0,000	-,600	-,200	,800	,200	1,000

5 observations were used in this computation.

From Table7, it can be seen that the Functional Managers mostly have a different opinion than the other roles. The only high correlations are between Sub-Project Managers, and Designers and Programmers, as well as between Designers and Programmers, and Team Leaders. However, the table also includes a number of negative correlations, which indicate disagreement between roles. This analysis supports that the different roles have rather different views regarding question 19.

Table 8. Correlations question 20.

Correlation Matrix

	FM	PM	S-PM	TL	D&P	M&S	SA	T
FM	1,000	,900	,970	,600	-,900	,289	,970	,500
PM	,900	1,000	,849	,700	-,800	,481	,849	,600
S-PM	,970	,849	1,000	,485	-,970	,093	1,000	,485
TL	,600	,700	,485	1,000	-,300	,866	,485	-,100
D&P	-,900	-,800	-,970	-,300	1,000	,096	-,970	-,600
M&S	,289	,481	,093	,866	,096	1,000	,093	-,096
SA	,970	,849	1,000	,485	-,970	,093	1,000	,485
T	,500	,600	,485	-,100	-,600	-,096	,485	1,000

5 observations were used in this computation.

In Table8, it can be seen that there is a larger number of high correlations. However, it is also notable that there is a number of very high negative correlations. The results for this question show that there is some agreement between certain roles, but on the other hand there are also large disagreements. Overall, the results show that there are disagreements between different roles.

Table 9. Correlations question 21.

Correlation Matrix

	FM	PM	S-PM	TL	D&P	M&S	SA	T
FM	1,000	-,043	,120	,372	-,341	-,303	,063	,749
PM	-,043	1,000	,345	,695	-,633	,563	,539	,423
S-PM	,120	,345	1,000	,650	,119	,237	,182	,606
TL	,372	,695	,650	1,000	-,198	,474	,760	,869
D&P	-,341	-,633	,119	-,198	1,000	-,036	,070	-,237
M&S	-,303	,563	,237	,474	-,036	1,000	,523	,119
SA	,063	,539	,182	,760	,070	,523	1,000	,529
T	,749	,423	,606	,869	-,237	,119	,529	1,000

7 observations were used in this computation.

From Table9, it is visible that the correlations are in general low and there are a number of negative correlations, although mostly rather low. Once again the analysis indicates that there is a disagreement between people having different roles.

Table 10. Correlations question 22.

Correlation Matrix

	FM	PM	S-PM	TL	D&P	M&S	SA	T
FM	1,000	,655	,327	,524	,851	,589	,943	,262
PM	,655	1,000	,371	,657	,371	,829	,632	,371
S-PM	,327	,371	1,000	,829	,257	,771	,230	,829
TL	,524	,657	,829	1,000	,543	,943	,574	,886
D&P	,851	,371	,257	,543	1,000	,486	,919	,314
M&S	,589	,829	,771	,943	,486	1,000	,574	,714
SA	,943	,632	,230	,574	,919	,574	1,000	,345
T	,262	,371	,829	,886	,314	,714	,345	1,000

6 observations were used in this computation.

In Table 10, it is notable that all correlations are positive and there are also more high correlations than for the other questions. The correlation analysis supports the interpretation in the previous section, i.e. the different roles are mostly in agreement with respect to question 22.

Table 11. Correlations question 23.

Correlation Matrix

	FM	PM	S-PM	TL	D&P	M&S	SA	T
FM	1,000	,655	,327	,524	,851	,589	,943	,262
PM	,655	1,000	,371	,657	,371	,829	,632	,371
S-PM	,327	,371	1,000	,829	,257	,771	,230	,829
TL	,524	,657	,829	1,000	,543	,943	,574	,886
D&P	,851	,371	,257	,543	1,000	,486	,919	,314
M&S	,589	,829	,771	,943	,486	1,000	,574	,714
SA	,943	,632	,230	,574	,919	,574	1,000	,345
T	,262	,371	,829	,886	,314	,714	,345	1,000

6 observations were used in this computation.

The result in Table11 is even clearer with respect to agreement between the different roles. Thus, the result supports the findings in Section 3.

In summary, there is a disagreement between the roles regarding questions 19, 20 and 21 and an agreement between the different roles for questions 22 and 23. There is a disagreement regarding important issues and threats for process improvement as well as issues that need to be addressed. However, there is an agreement when it comes to process communication issues both with respect to the written material and ways of communicating the process. These disagreements and agreements are important input to any process improvement activity at the company. The knowledge of the disagreement may be used when discussing improvements and the knowledge of the agreements help when it comes to communicating any changes made.

5. Discussion

The presentation of the results that was made in Sections 3 and 4 showed a variety of results. In questions 19, 20 and 21, the different roles had a rather large difference in terms of what was highest prioritized. In questions 22 and 23, the different roles agreed rather much on that specific issues were higher prioritized than other. The first question is: Why is there a difference with regard to agreement between the first three and the last two questions? On this question, there is probably not a straightforward answer. However, when looking on the characteristics of the questions, it is possible to see a difference between the two (questions 19-21 and questions 22-23). The first three questions were concerned with issues about importance of improvement, the urgency of problems, and threat against successful process management. The last two questions were focused on the content of the process definitions and how to teach the processes.

The difference lies in the nature of the topic. The first three questions are about what to improve and the last two is about how to communicate the processes. But what is the difference between the topics? As described in Section 2.1, the organization has a SEPG that administrates processes and gives instructions about processes. In these guidelines, there are rules of what to include in a process description and how to document them. This means that these are based on several years of experience within the company and should provide a good solution. Further, processes have been communicated in the organization for several years and a good practice for communicating processes has been established. This might be one of the reasons to why there are no major differences in how the different roles answered these questions.

As previously stated, it is evident that the different roles have different priorities in the first three questions. This verifies the suspicion of that opinions differ between different roles, as was stated in the introduction. However, this discovery also reveals some questions. The main questions in relation to this are:

- Why do different roles have different priorities?
- How could this information be used in a good way?

The first question is rather easy to answer. As stated in the introduction, it is a well-known fact that different kinds of persons (or roles) have different priorities, and it would be strange if this would not apply within a software development organization.

The second question is somewhat trickier to answer. A first thought would be to personalize every effort in the process improvement work. However, this is not very realistic due to that this would not solve all problems (e.g. if improving the synchronization, several or all roles must be involved). Hence, some kind of problems must be solved at a general level. This would generally be the problems that are ranked the highest in total (with all roles involved). However, when it comes to specific issues where one or a few roles or functional areas think that one issue is important but the others think it is unimportant (e.g. Designers and Programmers want to enforce tools in question 21) it should be possible to personalize these efforts to specific roles or functional areas. This would again mean that it is possible to compare with common marketing and product management principles.

Just as in marketing and product development, it is important to satisfy the different needs of the different users of the processes. Therefore, it seems natural to investigate what requirements the different roles (and functional areas) have on the processes. When having both the information of the importance in total and with regards to different roles, it is possible to decide what should be done at a general and a role-specific level. This is similar to what is done when developing products for different markets. When developing products in a product line setting, common functionality (general improvement issues) are put into the core assets while product specific functionality (role-specific improvement issues) are just put into the specific product (process, e.g. design process) [2]. This parallel have also been discussed in Sutton and Osterweil [11].

This means that it seems rational to first address the issues that are common for the whole organization and then trying to solve the issues that are regarded as most important by different roles. The discussion in this paper have shown that there are differences between roles and that it might be good trying to tailor-made different improvement issues on a role level.

6. Further Work

There are some ways in which further work in this area is needed. First of all, it would be interesting to see if different companies and settings have the same differences in views. This study and some previous studies have indicated this and it is worth further studies to investigate how this affects the process improvement work and how this information could be used effectively. Further, studies that investigate if other demographic choices (e.g. age, gender, functional area) also find differences in the opinions about software process improvement would be interesting.

In general, it would be beneficial to increase the understanding regarding the importance of roles when it comes to views and opinions of software process improvement. The agreements and disagreements are part of the environment in which any improvements should be made and a good understanding is most likely very important to have a firm foundation for improvements.

7. Conclusions

This paper has presented a study that aimed to find out whether there are disagreements between different roles when it comes to process improvement issues in a software environment. The study was based on a quantitative questionnaire and contained five weighted questions. The result of the study was that the respondents disagreed in three out of the five questions while they agreed in two of the questions. When analyzing the questions with this knowledge, it was possible to see that the three questions where the different roles did disagree focused on issues about importance of improvement, urgency of problems, and threat against successful process management. The two questions where they agreed, on the other hand, focused on communication of the processes (documentation and teaching).

The result of this paper should not be interpreted as there is always disagreement in some kind of questions and always agreement in others. Instead, the results indicate that it is important to have different roles in mind when processes evaluations are conducted. With the information at hand, it is possible to provide improvements tailored for specific roles. This helps satisfying needs of different stakeholders and probably helps to overcome resistance of process improvements. Finally, it seems like it is important to look at other areas that are not directly related to software process improvement. In this article, parallels have been drawn to other areas where different types of artifacts/ persons get different treatment based on their needs (e.g. marketing and product line development). However, other areas could also provide valuable information (e.g. Requirements Engineering).

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