Adaptation of Agile Project Management Methodology for Project Team

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Abstract – **A project management methodology that defines basic processes, tools, techniques, methods, resources and procedures used to manage a project is necessary for effective and successful IT project management. Each company needs to define its own methodology or adapt some of the existing ones. The purpose of the research is to evaluate the possibilities of adapting IT project development methodology according to the company, company employee characteristics and their mutual relations. The adaptation process will be illustrated with a case study at an IT company in Latvia where the developed methodology is based on Agile Scrum, one of the most widespread Agile methods.**

Keywords – **Agile, agile team, agile project management adaptation, case study, scrum.**

I. INTRODUCTION

Today only 2.5 % of all companies worldwide manage to complete a project 100 % successfully. IT industry is considered to be the worst offender. Studies have shown that one of the reasons is the excessive emphasis put by the company on rational factors (the process itself) rather than on the people involved in the project, cooperation among these people and their emotional status. Companies attempt to suit people to the project management (PM) processes and procedures, thus rendering the process even more vulnerable. As a result, cost of such ill-considered PM reaches astronomic heights [1].

Many studies have shown that a majority of the projects exceed their initial costs and deadlines or even remain incomplete. Study [2], which analysed 1471 IT projects, found that the average excess spending per project reaches 27 %, while each sixth project exceeds its initial costs twice. Studies from previous years show that IT project failures cost the European Union 142 billion euro in 2004 alone [2].

Why a majority of the projects fail? The answer lies in the company PM approach which is process, company policy and procedure centred. In most companies, each task as well as each step is defined in detail with a set of rules. Many companies implement strict processes which dictate behaviour and use statistical methods in order to control quality. The number of failed projects does not reduce despite the application of the approach. It is due to the fact that project participants are more concerned about how to do their work than how to accomplish the goal. Companies pay insufficient attention to employee mutual relations, emotional, social factors and problems of the involved parties. These activities subsequently reduce project potential success [1].

Adapting PM methodology to the employees, it is possible to improve the working environment taking into account employee mutual relations, satisfaction and motivation factors. A number of methods are used to accomplish the goal in order to analyse company employees, their mutual relations and motivation factors [3].

The purpose of the research is to evaluate the possibilities of adapting IT project development methodology according to the company, company employee characteristics and their mutual relations. Considering the fact that Agile PM methodologies are most popular today [4], the authors use Agile PM methodology as an example for adaptation. The adaptation process will be illustrated with a case study at an IT company in Latvia where the developed methodology is based on Agile Scrum [5].

The rest of the paper is structured as follows: Section 2 describes the used method; Section 3 presents case study description, our findings and best practices and open research issues. Conclusion and future research are presented at the end of the paper.

II. EMPLOYED METHODS

The present research uses a number of methods in order to analyse the company and its employees: a sociometric method and motivation research methods.

In order to adapt the PM methodology to the specifics and mutual relations of the development team, a group member analysis has been performed. For these purposes, a survey is used (Table I). The survey has been developed on the basis of the selected sociometric and motivation research methods. The first part of the survey consists of a sociometric questionnaire (Q1–Q8), while the second part of the survey asks for responses to questions on the study of motivation (Q9–Q10).

A. Sociometric Method

Sociometric method [6] is used as the primary research method – it is a method for collection of social information on mutual relations within a small social group. The method allows solving two tasks. First of all, it helps study interpersonal relations and relations between micro-groups with a goal to improve and complement relations within these groups. Secondly, the sociometric method allows studying the formation factors for small social groups with an emphasis on the study of informal relations. This method is used for the study of small social groups (from 12 to 15 persons). The sociometric method is based on the sociometric questionnaire that allows determining the following factors [6]:

- Mutual relations among members of the group;
- Formation of informal groups;
- Outcasts;
- Status of group members;
- Micro-groups and relations amongst them;
- Level of cohesion;
- Level of integration;
- Level of consolidation;
- Satisfaction with the position of the employee in the group;
- Referral index.

The sociometric questionnaire (Table I) consists of two blocks of questions. The first block (Q1–Q4) – choice is directly related to a situation at work, the second block (Q5–Q8) – the choice is outside the work situation. Questions have been posed in a manner that the situation of choice would be clear (positive or negative). Questions have been constructed so that they would be suitable and engaging to members of the group.

TABLE I

QUESTIONS OF SURVEY

No.	QUESTION
Q1	With whom of your co-workers would you most preferably work on a common project?
Q2	With whom of your co-workers would you least preferably work on a common project?
Q3	Whom of the colleagues would you select for representation of company interests?
Q4	Whom of the colleagues would you rather not select for representation of company interests?
Q5	You are going on a leisure boating trip on the Daugava, and there is suddenly a free place. Whom of the colleagues would you invite along?
Q6	You are going on a leisure boating trip on the Daugava, and there is suddenly a free place. Whom of the colleagues would you not invite along?
Q7	Whom of the colleagues would you ask for advice in case of personal problems?
Q8	Whom of the colleagues would you not ask for advice in case of personal problems?
Q9	I would happily abandon a company project if...
Q10	I would not abandon a company project if...

Answers to the questions have been summarised in a sociometric matrix (example in Table II) using formal and informal choices for each respondent. As a result, the individual status and emotional expansion indices have been determined. The sociometric factors are determined using social network graph and formulas described below [6].

Mutual relation index has been calculated in accordance with (1) where N is count of respondents and R is the number of mutual positive choices.

$$Mutual\ relation\ index = \frac{R}{N-1} \qquad (1)$$

Mutual relation index maximum is calculated depending on the number of mutually positive choices (in this case it is 2).

The closer the result to maximum is, the better the mutual relations among members of the group are [6].

Level of cohesion has been calculated in accordance with (2) where P is a number of mutual positive choice pairs.

$$Group\ cohasion\ degree = \frac{P}{((N-1)/2)} \qquad (2)$$

Acceptable level of cohesion starts from 0.5, but the maximum value is 1. The closer to maximum the result is, the more coherent members of the group feel towards one another. The level of cohesion shows to what extent the group unity and common goal achievement are oriented [6].

Equation (3) is used for the purposes of calculation of group integration level where S is a number of respondents who do not receive any choice.

$$Group\ integration\ index = \frac{1}{S}. \qquad (3)$$

The minimum value of group integration index is 0, the closer the result to the minimum is, the easier it is for new group members to integrate into the group [6].

Level of consolation has been calculated in accordance with (4) where U is a number of unilateral choices, p is calculated with (5) and q – (6), where d is a number of choices permitted to be made by one respondent.

$$Intragroup\ consolidation\ index = \frac{Rq}{Up} \qquad (4)$$

$$p = \frac{d}{N-1}, \qquad (5)$$

$$q = 1 - p \qquad (6)$$

The maximum for the level of consolidation has been calculated with the use of the number of maximum choices (in this case, it is 1.01). The level of consolidation may be considered satisfactory from half of the maximum value upward – the closer it is to the maximum, the better the level of consolidation is. This level indicates the consolidation between micro-groups [6].

Referral index has been calculated in order to determine the level of mutual respect among members of the group. The index has been calculated in accordance with (7) where A is a number of positive choices.

$$Referral\ index = \frac{P}{A} \qquad (7)$$

The maximum value of the referral index is 0.5. The closer the result to maximum, the greater the respect amongst them.

B. Motivation Research Methods

Motivation research method is used to identify employee motivation factors, which directly motivate employees to work. Motivation has been studied by analysing members of the group via survey questions Q9 and Q10. Upon analysing the answers, it has been established to which groups of motives the given answers belong [7]:

- Transformation motives – attempting to achieve a result, satisfaction;
- Communication motives – in order to communicate with others (desire to communicate);
- Utility-pragmatic motives – an action that is oriented towards generating benefit for oneself and others;
- Cooperation motives – a desire to cooperate in order to obtain a common gain and achieve self-realisation;
- Competition motives – a desire to be the first, the best and to receive recognition;
- Achievement motives – to achieve greater results.

The Maslow hierarchy of needs [7] forms the basis of human motivation (see Fig. 1). No higher levels will emerge as long as the needs of lower levels are satisfied. Since a man generally attempts to satisfy the needs of the lower order, it is only that after satisfaction of those needs the needs belonging to the next order shall become most vital, thus increasing the motivation to satisfy them [7].

Additional to the previous two, also the document analysis method and observation method need to be applied in order to achieve a greater understanding of employees and their relations.

Fig. 1. Maslow's pyramid – hierarchy of human needs [7].

III. CASE STUDY AND DISCUSSION

Organisation analysed in the case study is an IT company in Latvia. Company customers are both representatives of state and that of the private sector. Company specialises in the development of various technology based automation systems and solutions. The company is represented in various business industries: real estate, state governance, transportation and traffic, medical industry, finance, election etc.

Company employs more than 20 employees and the analysed development team consists of 4 programmers, 2 testing specialists, 2 analysts, 1 designer, 1 development project manager (scrum master), 1 marketing specialist and 2 project managers. The age of the employees ranges from 23 to 57 years. Professional experience of the team members within the company ranges from 2 to 9 years and total working experience in IT ranges from 3 to 25 years.

In recent projects, the company has used the new company PM methodology, which is based on Scrum framework and Agile principles. Company and company project specifics were considered upon creation of the new methodology. The principal differences from classic Scrum are as follows:

- Change roles including:
  - Implementation of a "Business owner" who is the sponsor of the project, representing the interests of the customer, makes crucial decisions and is responsible for project financing;
  - "Product owner", unlike the classic Scrum, is a representative of the development side;
  - Implementation of an "Analyst" who is concerned with a detailed analysis of project requirements and maintenance of project requirement specifications, which are crucially important for state projects.
- Additional artefacts have been introduced, such as:
  - "Project agreement" that sets out the initial requirements of the project that must be implemented over the course of the project;
  - "Test scenarios" that serve as input data for automated testing;
  - "Test results" that are the test scenario results.
- Additional processes have been introduced, such as:
  - "Requirement analysis" where the "Analyst" reflects on customer requirements in greater detail and describes them in project requirement specification.
  - "Project risk analysis" – special meeting attended by the entire project development team in order to determine project implementation risks on the part of the developers.

In order to accommodate company's PM methodology for development team characteristics and mutual relationships, a group member analyses have been carried out using the survey. Survey has been taken by the development team. Result contains 13 responses that have been summarised in the sociometric matrix (Table II) and motivation study results (Table III).

The left and top parts of the sociometric matrix (Table II) reflect respondents, their choices and frequency:
- "f+" – positive choices in formal relations (Q1, Q3);
- "f−" – negative choices in formal relations (Q2, Q4);
- "n+" – positive choices in informal relations (Q5, Q7);
- "n−" – negative choices in informal relations (Q6, Q8).

Considering the number of choices received from members, the individual status indicator C has been calculated for each group member (8), where C^+ and C^- are calculated using (9) and (10).

$$C = C^+ - C^-   \qquad (8)$$

$$C^+ = \frac{\text{No. of positive choice}}{N-1}   \qquad (9)$$

$$C^- = \frac{\text{No. of negative choice}}{N-1}   \qquad (10)$$

Group member choices are reflected in formal relation graph (Fig. 2) and informal relation graph (Fig. 3) to illustrate group member choices, thus speeding up the further analysis.

Blue arrows in the graph illustrate positive choices and red – negative choices. Lines below the arrows at both ends denote mutual choices. On the basis of choices made by the group members, the sociometric factors of the group have been calculated.

TABLE II

SOCIOMETRIC MATRIX

| RESPONDENT (FROM)		RESPONDENT (TO)												
		1	2	3	4	5	6	7	8	9	10	11	12	13
1			f− n− n−			f−			f+ n+ n+		f+			
2					f−	n+			f+			n+	n−		f− f+ n−
3				f− n−				f−	f+	n+ n+					f+ n−
4		n+	f− n−						f+ n+	f+	n−	f−		
5		f+	f−	n−	n+		n−	n+		f+		f−		
6		f+	f− n+		n−	n−					f+ n+	f−		
7			f− n−	f+	f−						f+	n−	n+ n+	
8		f+ f+ n+ n+										f− f− n−n−		
9		f+ n+ n+	f− n− n−								f+			f−
10					n−	n−	f+ n+ n+					f− f−		f+
11		f+	f−							n+ n+	n−		f+	f− n−
12			f− n− n−				f−	n+ n+	f+ f+					
13		n−			n−	f−					f+ f+ n+ n+	f−		
NUMBER OF RECEIVED CHOICES	C^+	0.92	0.08	0.08	0.17	0.00	0.25	0.42	0.75	0.33	0.83	0.00	0.25	0.25
	C^-	0.08	1.50	0.17	0.33	0.33	0.25	0.00	0.00	0.00	0.17	0.92	0.00	0.42
TOTAL	C	0.83	−1.42	−0.08	−0.17	−0.33	0.00	0.42	0.75	0.33	0.67	−0.92	0.25	−0.17
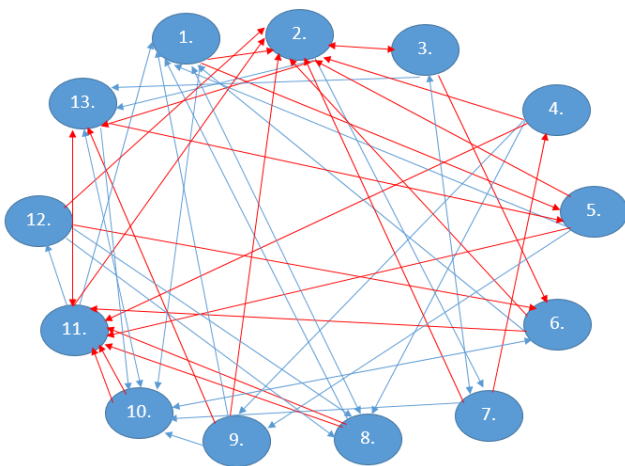
Fig. 2. Formal relation graph. List of group members with formal positive (blue) and negative (red) choices.
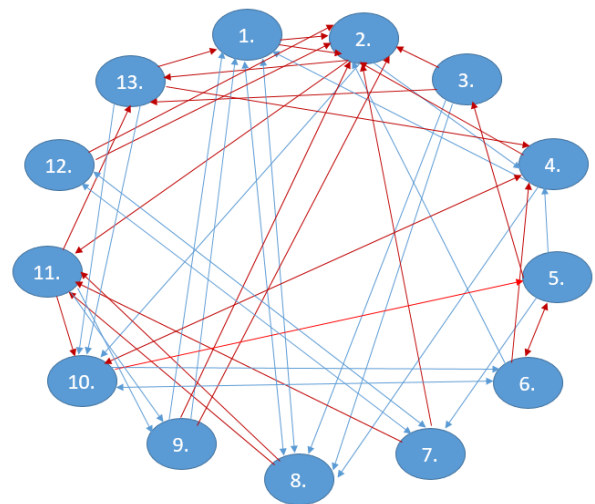

Fig. 3. Informal relation graph. List of group members with informal positive (blue) and negative (red) choices.

Group cohesion degree has been calculated for formal (0.19 of max 1) and informal (0.15 of max 1) relations. This level indicates that the group is not unity-oriented, interpersonal relations are not close and there is no distinct sense of unity. In order for the Agile PM methodology to translate into a result, the group must be as amalgamated as possible since there is a large stream of communication among members of the group on a daily basis and if group members have a negative attitude towards one another, their work shall also be ineffective. It is necessary if a group has scored a non-satisfactory cohesion index (lower than 0.5). In this situation, it is recommended to pay more attention to the problem in order to understand its

cause. A team with a low level of cohesion shall not be able to achieve self-organisation, thus the classic Agile PM methodology may not yield the desired results. Attempting to solve the problem, it can be proposed to adjust the PM methodology so that the role of project manager becomes more urgent. It is necessary in order to assist the team in dividing its tasks among those members of the group amongst whom there is low cohesion. Upon organisation of the work, a project manager shall consider the mutual positive responses in formal relations.

By considering the mutual positive choices in formal relations (Fig. 3), it is possible to divide work among group members since cohesion exists among them. For example, as evident from Fig. 4, there are mutual positive formal relations between respondents 1, 10 and 6; thus, these formal relations are good. However, the informal negative choices are considered by the project manager in order to reach less disagreement between these members and to avoid intersection of their opinions since improvement of this factor is difficult.
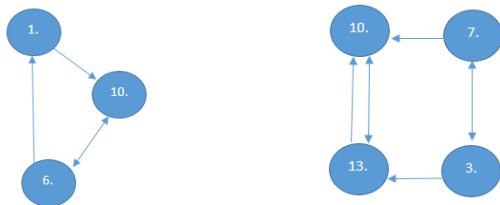

Fig. 4. Positive formal relations among group members (1, 10, 6 and 10, 7, 13, 3).

For example, there are negative mutual choices in informal matters among 1, 2, 13 and 11; thus, the project manager must be careful when organising a complex task among these members since their mutual disputes may affect the outcome of the work. Thus, it is more desirable to organise prompt and simple tasks among them in order to minimise interaction and communication between these group members.
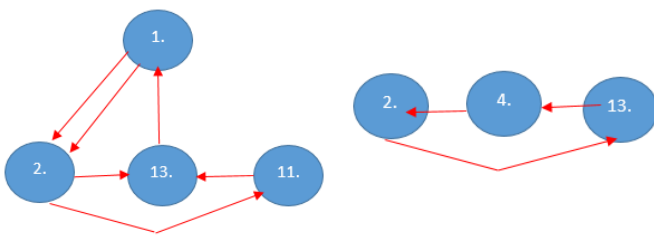

Fig. 5. Informal, negative relations of group members (1, 2, 13, 11 and 2, 4, 13).

The internal consolidation index for the group has been rated as low both in formal relations (0.169 of 1.01 max) and informal relations (0.216 of 1.01 max). This indicator suggests a low level of cohesion among micro-groups. Micro-groups are not oriented towards accomplishment of group's common goal. This factor reiterates that the team finds it difficult to organise itself and to resolve complex tasks independently since there is a lack of mutual harmony among micro-groups. Similar as before, it is recommended to underline the role of the project manager in order to improve the organisation and

correct distribution of work in the group on the basis of these factors. It is necessary for the project manager to be more involved in those sections of work where micro-groups are required to communicate with one another and implement a common goal.

On the basis of a 2-stage analysis, it can be stated that the role of project manager in the methodology is important since without one on the basis of the given results the group faces mutual problems due to the lack of cohesion.

Upon reviewing integration in a group, it may be observed that there is no member of group who would not receive a choice (Fig. 2 and Fig. 3); thus, the group's level of integration is very close to 0. This fact is observable both in formal and informal relations. It indicates that it will be easy for new members of the group to become involved in both formal and informal relations of the group. On the basis of this factor, it is possible to adjust the methodology to project team formation principles or upon creating a team it is possible to use new group members from other groups. However, if the group's level of integration is low, then upon involving new members of group, it will be necessary to assist them to integrate into the group. Project manager or scrum master (in case of Scrum) is required to implement special measures for new group members to integrate into the rhythm of the group.

Next, satisfaction with one's place in the group has been analysed. In formal relations, the satisfaction is low (mutual relation index 0.096 of max 0.5), which shows that role reassignments are possible in the near future. However, in informal relations, the satisfaction with one's place in the group is significantly higher (0.13), but it can still be characterised as being low. Upon analysing the present results, it is suggested to introduce an additional practice into the methodology – Personal Retrospective where each of the group members analyses their own work and answers the three following questions:

- What did I accomplish in the past sprint?
- What could have gone better in the sprint?
- What did I learn from this in the past sprint?

Such practice allows group members to arrange their thought and understand themselves since people often blame others and miss that they have themselves to blame.

The group lacks such inter-personal relations that the group members would feel mutual connection and dependence. The lack of this relation is evident from the group's referral index in formal relations (0.15 of max 0.5). However, in informal relations this indicator is slightly higher (0.19 of max 0.5), but it is still considered to be insufficient since it shows a lack of respect. From the viewpoint of project manager, it may be concluded from these results that members of the groups are not interested and involved in the work of other group members; thus, there might be problems in the project when one member of the group needs to substitute another. In order to improve this situation, it is recommended to introduce additional practices into the methodology – Pair Programming, Pair Analytics and Pair Testing. These practices mean that group members form pairs for performance of the work at a single computer [9]. The computer is operated by

one member, while the other acts as an analyst and supervises the work of the pair. Such a practice shall not only improve the quality of work but also may improve relations among members of the group. Additionally, group members shall become more informed about operation of other group members. In this way, a team may improve mutual formal connections. The use of such a practice is not mandatory over the entire course of the project, but it may be used for resolution of very complex tasks or in order to raise the spirit of the group if a low point is observed [10], [11].

While generally characterising the internal relations of the group, it is observed that the relationship in the group is short-lived. Cohesion and internal consolidation, as well as the referral index shows dissatisfaction of group members with their place in the group. This set of characteristics significantly affects group's general activity. Thus, in the methodology it is necessary to emphasise the managerial roles – project manager and scrum master – since the group is not ready for independent and self-organised work. The group members that have received most choices in formal relations shall be very suited for the role. In the present group, these would be respondents 1, 8 and 10. However, in order to improve informal relations among group members, it is necessary to involve the leader of informal relations more (the member of the group who has received most choices in informal relations, in particular). In this group, it is respondent 8. This member of the group is required to select the correct role in the methodology in order to use his potential for improvement of informal relations. This member of the group may perform the role of scrum master, project manager as well as organise the process of complex problem resolution or assist in organisation of company's informal events [11], [12].

The second large step is the analysis of motivation. The motivation questions have been analysed and the motivation study result table (Table III) has been drawn up, in which answers given by the group members are divided in six categories. Upon studying the given group, it may be concluded that utility-pragmatic and cooperation motives take

front row. Group members have high regard for the working team but low – reward. Upon looking at the motives that make group members think of leaving work, it is evident that among all factors the only satisfactory aspect is the working environment. It shows that until reward is brought up to a satisfactory level, there will be no security, employees will not want to compete, achieve anything and shall not feel a sense of affiliation towards their place of work. First of all, when improving any of the following factors, starting from reward, it will be possible to achieve a higher level of motivation. Group members have high regard for the working team, which shows that cooperation motives are of importance to the group [12], [13].

It is important from the viewpoint of Agile PM methodology to find out which of the group member needs are satisfied. If the basic needs of group members are not satisfied (utility-pragmatic motives), then group members are not motivated towards more important motives for development of Agile projects – personal growth, competition, challenge and creative activity. Thus, the methodology requires introducing additional motivating activities that may increase the motivation among the members of the group. One of the recommendations in this situation is to introduce a special rewarding measure for all members of the group after each implemented project. Such an event may be a retrospection of the previous project when the project team discusses only the good aspects and each member of the group is praised for the work done [14].

IV. CONCLUSIONS AND FUTURE RESEARCH

Analysing research results, it has been concluded that there are a lot of problems in the development team that may affect the application of Agile PM methodology and successful implementation of the project. During the study, a survey data analysis has been performed, as a result of which a number of problems have been found.

TABLE III
MOTIVATION STUDY RESULTS

MASLOW HIERARCHY OF NEEDS	1. WORKING ENVIRONMENT	2. REWARD	3. SAFETY	4. PERSONAL GROWTH	5. AWARENESS OF AFFILIATION	6. INTEREST, CHALLENGES
MOTIVES	Utility-pragmatic motives	Utility-pragmatic motives	Utility-pragmatic motives	Achievement motives	Cooperation motives	Competition motives
WHY NOT TO ABANDON THE PROJECT?	Comfortable work schedule (2x)			Career opportunities	Working team (5x)	Interesting work
WHY TO ABANDON THE PROJECT?		• No social guarantees • Inappropriate remuneration (2x) • No remuneration guarantee • Unstable remuneration • No bonuses	• Instability • Lack of respect	No career development (2x)	Lack of trust (3x)	• No challenges • No opportunity for creative work

The development team from the case study has the following problems:

• Low level of cohesion among members of the group and micro-groups;
  • Low satisfaction of one's place in the group;
  • Poor inter-personal relations;
  • Low work motivation

On the basis of the obtained results, for adaptation of Agile PM methodology according to the development team it has been suggested to adapt the following processes in the methodology:

- To introduce a role of project manager, which is not popular in Agile projects. The role of project manager is necessary for the organisation of group members' work, since a low level of cohesion has been found. Thus, the principle of self-organisation in the group may not yield the desired result;

- To adjust the project work organisation and work division on the basis of mutual relations among members of the group (choices);

- To adjust project development formation principles considering the research results – new group members may quickly integrate in the group;

- To introduce additional practices – personal retrospective, pair programming, pair analytics and pair testing. These practices shall improve group member satisfaction with the place in group as well as they will improve mutual connections;

- To assign most important methodology roles (scrum master, project manager) to formal and informal relation leaders in order to improve team's cohesion since the team will listen to these members;

- To introduce additional work motivation factors in the methodology since there are group members with a low level of motivation.

Despite the fact that the group has a number of problems, there are some positive traits too – there are distinct leaders both in formal and in informal relations of the group. It means that a correct involvement of group members in the life of the team may have a significant improvement in terms of mutual relations and in the level of cohesion. In this case, one must reiterate the importance of assigning the correct roles to group leaders. Group leaders must be involved in the organisation, planning of the group work as well as in resolution of complex tasks as much as possible.

Future research includes planning for implementation of PM methodology changes and harmonisation thereof with company management. It is recommended to prepare a change implementation scenario after completion of the plan. Prior to the implementation of the changes, it is necessary to introduce the team to the improvements in the methodology and implement the changes based on the plan and the developed scenario. Upon implementation of the changes, it is required to analyse team work and if necessary, react with correction of the change implementation considering team's or management's requirements.

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