Impact of the Communication Issues: *A Case Study of IT Start-Up*

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Abstract. This case represents a brief story of a start-up company producing innovative IT solutions for the forest industry. The start-up was launched in 2015 as experts had suggested the necessity of the digital transformation for the industry. The development process was accompanied by a number of management faults which ultimately led to the lack of commercial success of the developed product. The most critical mistakes were made in the sphere of project communication management with almost all the stakeholders in the project. Thus, the analysis from the viewpoint of communication management is given here followed by some recommendations.

Keywords: Case studies · Business-case analysis · Project management · Collaboration exchanges · Patterns

1 Introduction

To the date of the 1st of November, 2018 the total income of Xemeria company was 87 000 rubles. Thus, I had to fire all the personnel and begin the bankruptcy procedure. Looking back, I am trying to remember all milestones and twists on our path to the current catastrophic situation.

It started 3 years earlier, at the beginning of 2015, when the grant for innovative project development was won and, as a result, Xemeria company was founded. The R&D project was aimed to develop a complex solution for forest enterprises that will allow them to monitor and control the turnover of raw material, such as roundwood, in automated mode. The idea of this project has come from one of the industry experts, ex-owner of a logging plant. He helped with the grant application and act as an investor in the project. With the investor's money and grant, I was able to initiate this ambitious project.

The project for automatic monitoring and control of forest enterprise activity consists of two parts:

1. Manufacturing execution system (MES) for dispersed data processing for the purpose of forest enterprise operations management, i.e. automatic processing of such operations as:

G. Succi et al. (Eds.): ICFSE 2021, CCIS 1523, pp. 113–132, 2021.
https://doi.org/10.1007/978-3-030-93135-3_8

- Accounting of incoming timber products from the declared cutting areas as a result of the logging team output and wood skidding,
- Accounting of the timber processing operations at the roundwood yard connected with transportation and crosscutting,
- Accounting of the timber shipment in terms of vendor contract and destination,
- Low landing stockpile analysis,
- Generating of the shipping document,
- Generating reports on productivity of logging chews, handling chews and truckers.

2. Software for automatic calculating of volume of the log batches via image processing.

According to the plan, the primary product to be developed is software for automatic volume calculation which can be used as a separate product. Xemeria had hired two programmers, so at the beginning, it consisted of four persons: a director, two programmers, and an accountant. Due to the limited size of the team and the lack of management experience, the development process was ad hoc, with periodical (usually, weekly) reporting of programmers to me about current progress. The approximate plan was established in grant application, so the team was aware of current progress of the project.

In 9 months the first version of the software for the PC was produced, so it was a time for industrial testing of the program. Hopefully, two months before this date I met the director of the medium-sized logging enterprise Nova-LesProm, who became interested in our project and agreed to test our programs at his plant. In October, 2015 we provide the employees of Nova-LesProm with software and cameras for tests. The communication with the responsible person of the plant was established via email. The feedback that we obtained shown us that the solution has a low level of usability - it is uncomfortable to make a photo on the camera, upload an image to the computer, and process it in our software. Thus, I decided that the software should be adapted to mobile devices. Unfortunately, it involved a complete redesign of the GUI and some modules of the algorithm. It was the end of 2015, thus I decided to start a new development iteration the next year.

In 2016 we started with the development of a new version of automatic volume calculating software - for mobile devices. The grant was prolonged for one more year with additional funding. This time Nova-LesProm had become the investor of the project. Because of the re-development of the software, I found the project behind the schedule. Furthermore, it became clear that the project is much more complex than I thought at the beginning. These facts led to the decision to outsource the development of the MES system. On the recommendations, I contact the local IT company Polus, who has experience in the development of such systems. They agreed to modify their own solution to our area (the forest industry) and add interfaces for interaction with our software for the purpose of a completely automated monitoring and control process. We start from the several interviews with the director and personnel of the Nova-LesProm to elaborate the activity diagrams and use cases for the developing

system. We provide three meetings - one in February and two in March - to gather all necessary information and after that Polus was working on the system alone with monthly reports to me.

In parallel with it, our key partner introduced me to the rector of the Forest Engineering University (FEU). I assumed it as an opportunity for the rapid growth of Xemeria, since this university has many contacts with enterprises all over the country. The rector found our project extremely important for the industry and expressed a willingness to support it. We agreed on presenting of our software at some industrial exhibitions and directly to particular companies. At this time, in the middle of 2016, one of the programmers left the project. It was a massive blow to the company, and I devoted 2 months to find new personnel for this project. Thus, it was September when we presented our new software to the Nova-LesProm. Polus delivered their system in November.

The industrial tests of the software and system were conducted till the end of April, 2017. The director of Nova-LesProm explained such a huge delay with the high workload of the staff and inability to introduce new technologies in the manufacturing process in this period - i.e. high season. Finally, I received feedback on our complex solution with several shortcomings described, mostly on system performance. This feedback was addressed to Polus and Xemeria, in turn, started modifying several parts of the software. As far as Xemeria still has no sales, I transferred employees to piecework.

During the modification stage I conducted several meetings with directors of forest plants which contacts were given to me by the rector of FEU. The result of this meeting was that the idea is interesting and perspective, but each enterprise needs some specific features and not ready to buy our solution right now.

Therefore, I decided to concentrate all effort to Nova-LesProm, but the process of our solution implementation still was extremely slow. Employees of the Nova-LesProm were accustomed to Excel and discovered the new system hard to use. Tallymen were afraid of using innovative technology for log batches measurement and it was hard to convince them. In fact, the introduction of a novel approach was faced with rejection from employees, and the director, in spite of his interest in the project, was not ready to force it against the will of employees.

I spent the rest of 2017 and the beginning of 2018 in negotiation with Nova-LesProm. Finally, all complaints were resolved and in June 2018 Xemeria was ready to deliver the whole system to its primary client. At this moment I found out that the director of Nova-LesProm decided to sell his company to the large forestry concern against the background of an unstable economic situation. Up to this moment, Xemeria has only several sales of the software for automatic volume calculating of the log batches. The funds, received in 2015–16 years come to an end and there is still no customer for our system. There were a lot of mistakes done in the management process for Xemeria project. However, in my opinion, the most important one is that I gave too little effort to the development and management of the communication along with the project. Investors, partners, development team, new clients - for the overall success of the project, it was necessary to pay more attention to all the stakeholders, even it looks impossible for me at the moment.

In the next chapters, I will try to provide an analysis of possible techniques and approaches to project communication management, which can help you to avoid the described mistakes and lead to a successful project.

2 Literature Review

Principles of communication management are discussed in a broad number of sources. Foremost, Project Management Institute (PMI) provides a thorough description of tools and techniques involved in project communication management [17]. In [15] a number of articles present current trends in digital communications as well as analysis of their impact on various types of organizations. More details on communication tools and techniques and communication obstacles analysis are given in [20]. Paper [23] describes some communication management practices, which apply not only for the given domain but in any sphere as well. Focus on communication between project team members is given in [12] where specific practices which help to significantly improve cross-communication among team members also provided. A survey on the implementation of communication management techniques in companies with different organizational structures is provided in [19]. Impact of communication on organizational processes during its change investigated in [21] in respect to postmodernism, chaos and complexity theories of management. Problems of communication management faced by project managers are thoroughly observed in [13].

Some research papers are devoted to the problem of communication management in the software development process. These are the most relevant to the described problem. In [5] several approaches for effective communication are proposed: active listening, consistent understanding of the development effort, and communication infrastructure. VCSD tool for visualizing various types of communication flows between developers is presented in [22]. The problem of weaknesses in definitions of project-critical terms as a critical aspects of the communication process is observed in [24] with a novel method for a higher-quality glossary construction. Some fundamental aspects of communication in agile projects are investigated in [11,16], indicating the hidden threats of external communications in SCRUM and XP practices. The investigation of communication management in the agile projects continues in [3,8,14], where authors analyze the impact of communication channels and practices in Agile Software Development.

3 Case Study Analysis

This chapter provides a thorough explanation of the drawbacks of communications management. Communication channels are investigated. As far as communication management is about the exchange of information, this aspect of the project (the lack of infrastructure) is also taken into account. At the end of the chapter, the decision on the critical level and possibility for surveillance of the case project is provided.

Let's return back to the given case study and perform its thorough analysis in the context of communications. Foremost, the stakeholders of the project should be structured in some way for further analysis. One well-known approach is stakeholder register [17, p. 514] which includes the classification of stakeholders based on their relation to project or impact, identification, and assessment information, like the name, role, expectation, etc. The initial stakeholder register can be created as given in Table 1.

Table 1. Project's primary stakeholders

Company	Name	Position	Role	Time period
Xemeria	Kirill	Senior developer	Development of core functionality of the software	Untill June, 2016
	Ilya	Developer	Software functionality and GUI development	All along
	Stepan	Developer	Development of interfaces for MES and software integration	Since August, 2016
	Svetlana	Accountant	Bookkeeping	All along
Nova-Les Prom	Oleg	Director, investor	Contract execution. Successful example for future sales	Jul., 2015–Jun., 2018
	Pavel	Tallyman	System (MES + software) acceptance	Oct., 2015–Jun., 2018
Polus	Irina	Senior developer	Contact partner from organization who responsible for MES development	Feb., 2016–Apr., 2017
FEU	Evgeniy	Rector	Provide support for product testing, sales. Direct contacts with logging companies. Collaboration in sales	Since Feb., 2016
–	Daniil	Expert, investor	Mentoring, participating in company development. New investors engagement	All along (periodically)
Fund	Ksenia	Inspector	Contact person from government investment fund	Mar., 2015–Sep., 2017

This table serves as the basis of the stakeholder register for our communications problem analysis. It can be expanding in terms of stakeholders' numbers (we can also include additional investment funds and logging enterprises) and their descriptions. However, it is excessive effort as far as the main goal here is to keep all stakeholders in mind during communications analysis. To characterize project communications, we need to define their possible grouping categories, or dimensions [17, p. 361]:

- Internal/external - stakeholders within organization or external stakeholders.
- Formal/informal - reports and formal meetings or general daily communications.
- Upward/downward/horizontal hierarchy - the comparative position of the stakeholder in social hierarchy.
- Official/unofficial - reports to regulators and government bodies and contracts or establishing and maintaining of the project and building strong relationships.
- Written/oral.

Also for communications description it is important to take into account such factors as [17, p. 364]:

- physical location of stakeholder - whether they are in the same geographical zone or globally separated; distance and time zones are taken into account,
- communication technology - tools and techniques for direct and indirect communication,
- language and culture differences - usage of one or more languages, specific vocabulary.

Fortunately, the given project is a local one, so physically stakeholders were located in one region (except the investment fund, which located in Moscow) with a maximum distance of 150 km (to Nova-LesProm). The language barrier is absent, however, there are sufficient cultural differences as far as some stakeholders related to IT industry and others - to forest one. Regarding the communication technologies, the commonly used are telephone calls and face-to-face communication for oral communications and emails for a written one. Based on this classification the determination of Xemeria director communication channels with each stakeholder can be performed. (Table 2).

Table 2. Communications' classification

Name	Internal (I)/external (E)	Formal (F)/informal (I)	Hierarchy	Official (O)/unofficial (U)	Written (W)/oral (O)	IT/Forest (F) Domain	Location
Kirill	I	I	D	U	O	IT	Ekaterinburg
Ilya	I	I	D	U	O	IT	Ekaterinburg
Stepan	I	I	D	U	W	IT	Pervouralsk
Svetlana	I	F	D	U	W	–	Ekaterinburg
Oleg	E	I	U	U	O	F	Rezh
Pavel	E	F	D	U	W	F	Rezh
Irina	E	F	D	U	W	IT	Ekaterinburg
Evgeniy	E	I	U	U	O	F	Ekaterinburg
Daniil	E	I	U	U	O	F	Ekaterinburg
Ksenia	E	F	H	O	W	–	Moscow

Another instrument for communication analysis is the communication matrix (who-to-who matrix) [10]. It shows how many contact channels on the project

exist and to which extend each stakeholder is involved in project communication. The rows in the table show the initiation of the communication by this person. For better understanding, the analysis is given for the 3 time periods: 2015,

Table 3. Communication matrix 1 (2015)

	Artem	Kirill	Ilya	Stepan	Svetlana	Oleg	Pavel	Irina	Evgeniy	Daniil	Ksenia
Artem		+	+	–	?	+	–	–	–	+	?
Kirill	+		+	–	–	–	–	–	–	–	–
Ilya	+	+		–	–	–	–	–	–	–	–
Stepan	–	–	–		–	–	–	–	–	–	–
Svetlana	?	–	–	–		–	–	–	–	–	–
Oleg	?	–	–	–	–		?	–	–	–	–
Pavel	–	–	–	–	–	?		–	–	–	–
Irina	–	–	–	–	–	–	–		–	–	–
Evgeniy	–	–	–	–	–	–	–	–		–	–
Daniil	?	–	–	–	–	–	–	–	–		–
Ksenia	?	–	–	–	–	–	–	–	–	–	

\+ - the person often initiates communication (on daily or weekly basis)
? - the person rarely initiate communication (on monthly basis or less often)
– - the person never initiate communication
- the person was not involved in project at the moment

Table 4. Communication matrix 2 (2016–2017)

	Artem	Kirill	Ilya	Stepan	Svetlana	Oleg	Pavel	Irina	Evgeniy	Daniil	Ksenia
Artem		?	+	+	?	?	?	+	+	?	?
Kirill	–		–	–	–	–	–	–	–	–	–
Ilya	+	–		–	–	–	–	–	–	–	–
Stepan	+	–	–		–	–	–	?	–	–	–
Svetlana	+	–	–	–		–	–	–	–	–	–
Oleg	–	–	–	–	–		?	–	–	–	–
Pavel	?	–	–	–	–	?		–	–	–	–
Irina	+	–	?	?	–	?	?		–	–	–
Evgeniy	?	–	–	–	–	–	–	–		–	–
Daniil	–	–	–	–	–	–	–	–	–		–
Ksenia	?	–	–	–	–	–	–	–	–	–	

Table 5. Communication matrix 2 (2016–2017)

	Artem	Kirill	Ilya	Stepan	Svetlana	Oleg	Pavel	Irina	Evgeniy	Daniil	Ksenia
Artem		–	?	+	?	?	?	–	?	–	–
Kirill	–		–	–	–	–	–	–	–	–	–
Ilya	?	–		–	–	–	–	–	–	–	–
Stepan	?	–	–		–	–	–	–	–	–	–
Svetlana	?	–	–	–		–	–	–	–	–	–
Oleg	–	–	–	–	–		–	–	–	–	–
Pavel	–	–	–	–	–	–		–	–	–	–
Irina	–	–	–	–	–	–	–		–	–	–
Evgeniy	–	–	–	–	–	–	–	–		–	–
Daniil	–	–	–	–	–	–	–	–	–		–
Ksenia	–	–	–	–	–	–	–	–	–	–	

2016–17, and 2018 years. Some of the relations are given approximately, as far as communication rate was not constant and stable, but has peaks and gaps. Thus, these tables show an approximate evaluation of the communication rate.

From the data given above and some additional explanations on case study the following statements could be given:

1. Communication of the project manager with team members was based on the informal agile approach, which seems to be a good solution for a small start-up company. However, some necessary ideas of agile were not fulfilled, for example, Product Owner was never presented in the team, and it is not a good practice when the project manager takes this role. The project had a government contract in form of grant in 2015–16, which means the detailed plan of R&D works with clearly defined milestones and set of activities. In this case more formal, waterfall-based approaches seem more suitable [17] for project management. That also leads to more formal communications between the team and the project manager.
2. In fact, it was a reason why Kirill had left the company. Initially, he started work with relative freedom of what and how to do in the project. Over the course of the project, his tasks had become more strict and prescriptive, which also result in a formal way of communications between him and the director. He was not ready to accept a new model, so the conflict had arisen and he quitted.
3. Another aspect related to the proper usage of formal and informal communication styles is communication with Oleg, director of Nova-LesProm. As can be seen from Table 2 the most often used style was an informal one. It is natural and only welcome in the case of first client, when relations are usually based on enthusiasm and emotional aspect. However, during the project, this communication channel should become more formal at certain point, which means the contract negotiations. The mistake of Xemeria director was that he postponed this activity until it became too late. That is the result of the missing project communication plan and schedule [17, p. 378].
4. By analysis of the communication matrix, it can be concluded that about 90% of all project communications were held with the participation of one person - the director. It is a common situation for project communications, as far as the primary role of a project manager is communications. In case of a start-up company, the role of communication is even bigger because the manager also involved in technical aspects of the project. This scenario is described in [4] and demonstrated in Fig. 1.
5. It can be seen that all communication threads go from one group to another through the project manager, the technical team is limited to a few people and there is no Project Management team. The case study closely matches this template. However, the communication rate is low for most stakeholders: only with the technical team, it keeps on a sufficient level.
6. Regarding the communication within the team, we can also see that contacts between members were weak. In fact, all conversations were performed through the director - even the development and testing issues for the phase

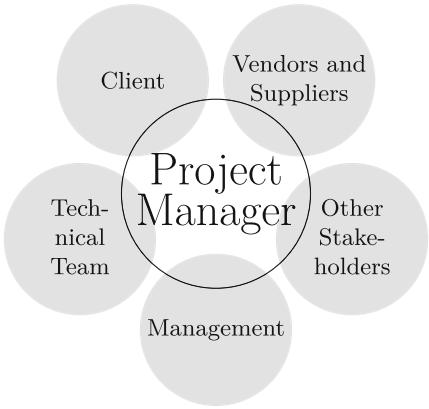

Fig. 1. Project manager's communications

of MES and software integration pass from one developer to another through the director. That is a big problem of project communications, as far as an extra node in the communication chain significantly reduces the effectiveness of communication due to noise and additional factors [17, p. 373].

7. Analysis of the communication matrix also demonstrates the decline of involvement of the stakeholders in the project. It is reasonable for such persons as Kirill (leave the project), Irina and Ksenia (complete their work). However, for others, it may mean a loss of interest in a project. It is critically important to control this parameter on regular basis and perform correction actions.
8. For example, Oleg, director of Nova-LesProm, has started with a moderate interest in the project, as far as it was not critically important for his own business. The primary task of Xemeria director was to maximize the involvement of Oleg by providing him with weekly reports on current status, performing interviews and regular industrial tests. However, as we can see from Tables 3, 4, the communication rate become low in a few months which finally led to an overall decrease of Nova-LesProm involvement in the project. The same results obtained for other influential stakeholders - expert and rector. The problem is again in proper managing of communications: it is highly important to maintain a high communication level with all key stakeholders of the project. This problem is thoroughly observed in [7], where the stakeholders analyzed through an influence/interest matrix (see Fig. 2) to choose the appropriate way of interaction.

The last communication matrix (Table 5) demonstrates the overall decline of the project as far as most communication channels do not work and key stakeholders show no interest to the project. It means that project is at the hazard of being terminated. However, some positive aspects also exist:

- Product successfully developed and ready for industrial testing and installation
- Communication channels with key stakeholders are not completely lost yet

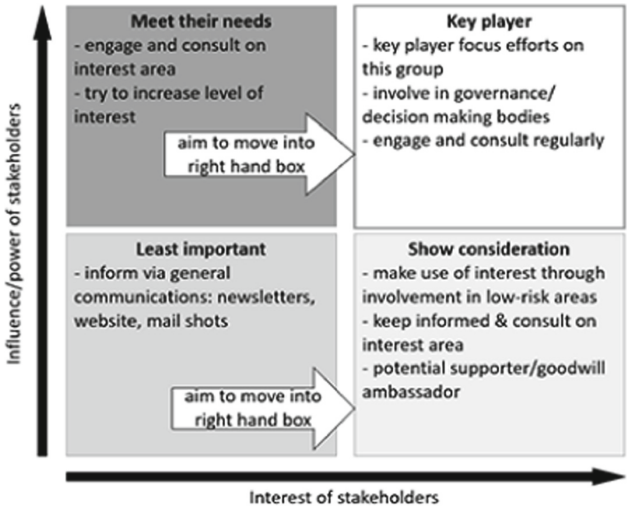

Fig. 2. Stakeholders' interaction strategy based on their influence/interest

Thus, by taking into consideration the current situation and trends in project communications, the project closure hazard is highly possible. Nevertheless, it seems still possible to get project back on track by performing some corrective actions related to project communications management.

4 Recommendations on Communications Management

Tools and techniques for project communications management provided in this chapter. It starts from the observation of up-to-dated tools. They will be analyzed in the view of the given case study and the most appropriate ones will be suggested for implementation.

In [18] it is said that "communication is the basis for project performance in any organization". The author analyzed project communications management based on the "Triple C model", where project success based on communication, cooperation and coordination [6]. The result of this analysis are 5 main areas of project communication that should be simultaneously taken into consideration (see Fig. 3).

There are two main approaches for performing project communication management were discovered:

- International standards and methodologies [1,2,17], and
- Project Communication Management patterns [12].

4.1 Communication Management Patterns

Each described pattern consists of the following fields: context, problem, solution, q-effect (what communication quality aspects are affected by the pattern

Table 6. Pattern "Clear rules at the start"

Context	While planning various aspects of the project, the area of communication and documentation management is neglected. There is no regular contact with the client to inform them about the progress of the project and for keeping in touch for quick reaction to possible changes and new requirements
Problem	There are no designated persons and tasks related to planning and managing communication and documentation processes. Team members feel no need to communicate the status of their tasks, nor do they feel responsible for informing the client about the status of the project
Solution	Development of a clear, practical and high-quality communication plan with assigned persons responsible for communication management, description of communication and documentation tasks
Q-effect	Positive on the following communication quality aspects: meeting needs of communicating participants. Possibly negative on the following communication quality aspects: in case of excessive formalism and bureaucracy participants may be discouraged to communicate effectively and all communication quality aspects can be threatened
Applicability	The pattern should be used for any kind of project and team, although it is especially useful for teams with different working cultures and fixed price projects. The pattern applies to all stakeholders. All persons assigned to any communication and documentation tasks should be clearly informed of their responsibilities
Consequences	Ensures that all team members and project stakeholders know their communication and documentation responsibilities. Client is instantly informed about the status of the project tasks. It is important to let the communication plan evolve and alter throughout the project to make it better tailored to the given project and team
Implementation	Preparing a high-quality communication plan requires time and effort, so that it is then easy to realize and not burdensome for the project team; too much formalism may discourage the team; the communication plan should be communicated already during the project kick-off meeting, or at least during the initiation phase of the project

and if it is a positive or a negative influence), applicability, consequences, and implementation. There are some patterns [12, pp. 10–14] presented in Tables 6, 7 and 8 that fit the case study project.

Based on given patterns the strategy of project communications management could be established and appropriate practices and tools chosen.

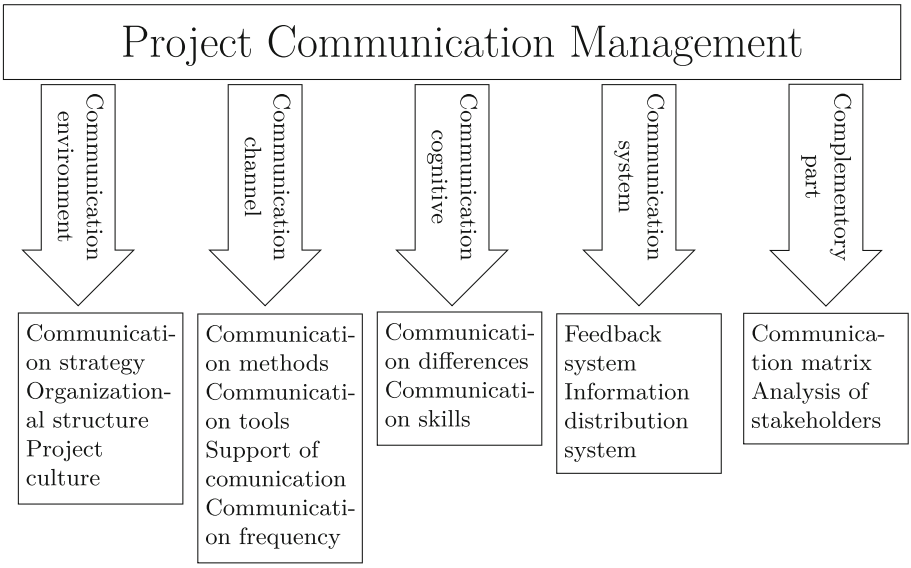

Fig. 3. Main areas of project communication management

Table 7. Pattern "Visits and team rotations"

Context	Project is characterized by having a distributed team and a long realization time. The direct contact of the contractor's team with the client's team is limited to the kick-off meeting and a few other project meetings
Problem	Lack of trust and willingness to communicate within the project team, because of the lack of direct contact and familiarity of team members
Solution	Regular visits of individual team members at the client's site, as well as delegating team members to the client's site for a longer period of time. Rotation can also be used, so that different team members can get to know each other and break the communication barrier
Q-effect	Positive on the following communication quality aspects: meeting needs of communicating participants, communication workflow supporting openness, feedback
Applicability	The pattern is designed for big projects with distributed teams. Only willing team members should be chosen for delegation to other locations, to avoid discontent and frustration. Shorter visits should be realized by all key team members
Consequences	Building non-professional relations among team members fosters effective and direct communication. Delegated team members facilitate communication between the client's team and the contractor's team
Implementation	Realization of the pattern should be preceded by an analysis of predispositions and willingness of individual team members to delegations, so that appropriate plan of visits and team rotation can be developed and included in the budget

4.2 Standards and Methodologies

There are several methodologies consider project communications management. In [18] three of them are analysed: ICB, PMBoK and PRINCE2 (see Table 9).

Table 8. Pattern "Basic communication principles"

Context	The team consists of inexperienced members. Basic principles of communication are not respected
Problem	Misunderstandings, hostility or animosity among team members
Solution	Reminding team members about the basic principles of transparent, effective and positive communication, and desired behavior, that is, among others: justifying requests, asking rather than telling, keeping promises and showing up for appointments, writing positive e-mails (even criticisms and dissatisfaction in a positive way)
Q-effect	Positive on the following communication quality aspects: clearness and cohesion, meeting needs of communicating participants
Applicability	The pattern can be used for any kind of project and team, although it is especially useful for immature and inexperienced teams, or where there are many introverts, team members are age or culture diversified
Consequences	Good atmosphere in the team, clear and positive relations among team members and their responsible behavior - all promoting successful project completion
Implementation	Usually the basic principles of transparent, effective and positive communication are something that every person knows and feels, and it should not be required to state it explicitly, but in the cases mentioned above it may be desired to bring them to the attention of some team members. It is also a good practice to set the maximum time for response to an email, to ensure the dynamics of asynchronous communication. If possible communication rules should be agreed upon together by the whole team, preferably during the kick-off meeting

The most engaged one in project communication is PMBoK, its project communications management consists of 3 processes: plan, manage and monitor [17, p 360]. However, by taken into consideration the type of the project and additional factors, it is possible to exclude some parts of communication management. In [18] the analysis of project communications management is given (see Table 10), so the options for small project can be assumed as compulsory for the observed case study.

Thus, standard-based approach with tailoring to small-scale project prescribe the following actions in project communications management, which are also advised for case study project:

Table 9. Comparison of project communication in international methodologies and standards of project management

Monitored elements	Project management methodologies or standards		
	ICB	PMBOK	PRINCE2
Communication environment			
Communication strategy	–	–	✓
Organizational structure	?	?	?
Project culture	–	–	–
Communication channel			
Commnunication methods	?	✓	?
Communication tools	?	✓	?
Support of communication	–	–	–
Communication frequency	?	?	?
Communication cognitive			
Communication differences	–	?	–
Communication skills	–	–	–
Communication system			
Feedback system	?	?	?
System of sharing and distribution of information	–	✓	–
Complementary part			
Communcation matrix	?	?	?
Analysis of stakeholders	?	✓	✓

– - methodology or standard does not include a specific element
? - methodology or standard describes the element only briefly
✓ - methodology or standard describes in detail, what the specific element addresses

- Communication strategy
- Analysis of stakeholders
- List of stakeholders
- Stakeholder's expectations
- Identification of methods, tools and support of communication
- Verbal communication through personal meetings

Table 10. Project communication tailoring to different project scales

Project size	Small project	Medium-sized project	Large project
Main characteristics of the project			
Number of team members	<5	5–9	>9
Number of teams in the project	1–2	2–3	>3
Project duration	min 2 months	min 3 months	min 12 months
Initialization of project communication			
Commnunication strategy	✓	✓	✓
Organizational structure of project communication	?	✓✓	✓
Planning of project communication			
Analysis of stakeholders	✓✓	✓	✓
List of stakeholders	✓✓	✓	✓
Stekeholder's expectations	✓✓	✓✓	✓
Responsibility matrix of project communication	?	✓✓	✓
Identification of methods, tools and support of communication	✓✓	✓✓	✓✓
Groupware matrix	?	✓✓	✓
Communication schedule	?	✓✓	✓
Communication matrix	✓	✓	✓
Implementation of project communication			
Rules of personal meetings	✓✓	✓✓	✓✓
Phone call policy	?	✓✓	✓
Rules of email communication	?	✓✓	✓
Non-verbal communication	?	✓✓	✓✓
Project website	?	✓✓	✓✓
Control of project communication			
Report about management of project communication	?	✓✓	✓
Administrative closure of project communication			
Control of documents	✓	✓	✓

✓✓ - compulsory
✓ - recommended
? - optional

4.3 Best Tools and Practices

In [23, p 5] author identifies the communication practices as 4 main categories, which are shown in Table 11.

Table 11. Communication management practices

Category of communication management practice	Communication management practice
Strategic (involves communication planning and project environment)	– Clear lines and responsibilities established up front – High-quality communication planning – Good public relations – Adopt common working language among members – Well-defined client authority – High process visibility for clients
Informational (generating, collecting, storing and retrieving project information)	– Shared virtual space, websites, project tracking software – Instant messenger, e-mails – Traditional phone calls – Using various communication channels
Emotional (regarding relationships and trust building)	– Face-to-face communication, audio and video conferencing, more than written communication – Support members to communicate informally with social media – Kick-off, review and stand-up meetings – Feedback from members
Practical (clear, positive communication and behavior rules)	– Employ basic rules for communication – Eligible attitudes and behaviors – Short, asynchronous communication loops

Among the given practices it is necessary to provide additional clarification for some of them.

Shared Virtual Space, Websites, Project Tracking Software. The one of the interesting approach to the shared virtual channels is provided by FOLIO [9]. In this project communication channels divided on primary and secondary ones. The structure of its shared space is given in Fig. 4.

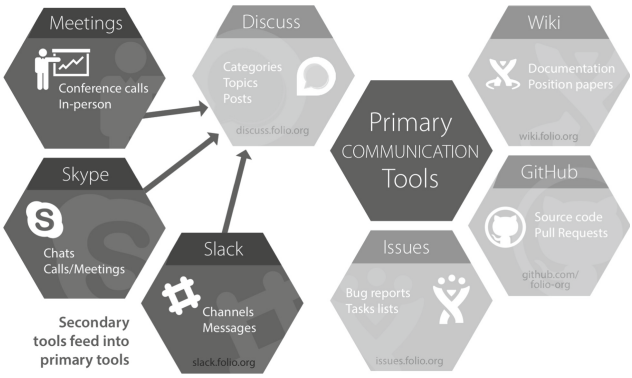

Fig. 4. FOLIO communication spaces

This idea and tools could be successfully implemented in case study project for improving internal communications.

Adopt Common Working Language Among Members. This problem is thoroughly investigated in [24]. The idea is in creating the vocabulary with definitions of specific turns, as far as project involve stakeholders from IT and forest disciplines. The method consists of following steps:

- Determine which meaning elements are required to identify the concept and distinguish it from others
- Draft a candidate definition that includes the selected meaning elements.
- Assess the draft for the common weaknesses and renegotiate the content and form accordingly until none of the weaknesses are present.

It is highly important to have the shared domain knowledge among all key stakeholders and to be able to speak with them on the same level of understanding.

Eligible Attitudes and Behaviors. Communication with key external stakeholders, especially at contract negotiation phase is an art of persuasion. For the project manager it is essential to be able to implement specific tools and techniques in this area. It is a large topic which cannot be observed within this paper, however, the 5 general strategies of negotiation with different type of personalities [25, p 5-6] are given in Table 12 for understanding the basic principles.

Table 12. Five decision-making styles

Style	Characteristics of the decision maker	Persuasion strategies
Charismatics	He is easily carried away but makes final decisions based on balanced information. Highlights final results	Pay attention to the results. Give direct arguments. Emphasize benefits with visuals. Use the following keywords: proven, action, easy, clear
Thinkers	Hardest of all amenable to conviction. Prudent, thinks logically. Avoids risk. Need a lot of details	Present marketing research, customer surveys, case studies, cost-effectiveness analysis. Use the following keywords: quality, numbers, experts, evidence
Skeptics	Disputes every data item. Decides intuitively	Establish trust, citing the opinion of the person whom he trusts. Use the following keywords: to capture the essence, power, suspect, trust
Followers	Making a choice in the present based on their own or others' previous decisions. Late accepts new ideas	Use low-risk evidence. Present innovative, yet proven solutions. Use the following keywords: experience, similar, innovative, previous
Controllers	Non-emotional, analytical. Hates uncertainty. Implements only own ideas	Provide highly structured arguments. Make him recognize your idea. Avoid aggressively defending your own opinions. Use the following keywords: facts, reason, strength, just take and make

5 Conclusions

This paper presents the case study of the Xemeria company project related to IT systems for forest industry. During the project a number of mistakes in project management were done, thus the analysis of project communication management is performed. Analysis shows that project is in the critical stage and some corrective actions should be done to improve current situation. For the corrective actions the analysis of two approaches to project communication management is given: by using templates or project management standards. For second variant the list of actions that should be performed is obtained, by taken into account the size of the project and number of current (and potential in short-term period) external stakeholders. The analysis of stakeholder is provided in second section of the paper, with recommendation on future interactions with stakeholders. The only aspect that could be recommended for implementation is weekly analysis of communication matrix as indicator of project status. The description of specific tools and practices is given in third section of the paper. There are a number of tools for online and offline communication. The most appropriate ones for the given project (as IT start-up) are given. Finally, two important aspect of com-

munication process are briefly observed: using of specific language vocabulary as part of shared domain knowledge strategy and negotiation techniques as important skill for interaction with key external stakeholders (clients or investors). This set of practices and tools, being applied to the given case study project may help to get it back on track. This case study is a good example of necessity to plan and control project communications right from the project initiation stage. The result of neglecting communications can be catastrophic. "Communication is a critical part between people, ideas, and information. Therefore, it is necessary to be constantly engaged with communication" [18].

References

1. IPMA standards (2021). https://www.ipma.world/individuals/standard/. Accessed 15 Mar 2021
2. PRINCE2 methodology (2021). https://www.prince2.com/eur/prince2-methodology. Accessed 15 Mar 2021
3. Ahmad, M.O., Lenarduzzi, V., Oivo, M., Taibi, D.: Lessons learned on communication channels and practices in agile software development. In: Proceedings of the 2018 Federated Conference on Computer Science and Information Systems. IEEE (2018). https://doi.org/10.15439/2018f72
4. Ajam, M.A.: How can we define project manager effort in term of project's communications? (2021). http://blog.sukad.com/define-project-manager-communications/. Accessed 15 Mar 2021
5. Atwood, M.E., et al.: Facilitating communication in software development. In: Proceedings of the Conference on Designing Interactive Systems Processes, Practices, Methods, & Techniques - DIS '95. ACM Press (1995). https://doi.org/10.1145/225434.225442
6. Badiru, A.B.: Triple C Model of Project Management. CRC Press (2008). https://doi.org/10.1201/9781420051148
7. Colonna, J.: Forgotten stakeholders (2016). http://www.johncolonna.com/forgotten-stakeholders/. Accessed 29 Nov 2020
8. Coman, I.D., Robillard, P.N., Sillitti, A., Succi, G.: Cooperation, collaboration and pair-programming: field studies on backup behavior. J. Syst. Softw. **91**, 124–134 (2014)
9. A. Inc.: FOLIO communication spaces (2021). https://wiki.folio.org/display/COMMUNITY/FOLIO+Communication+Spaces. Accessed 15 Mar 2021
10. ITWORX: ITWOcx user guide. https://confluence.itwocx.com/pages/viewpage.action?pageId=3080224. Accessed 15 Mar 2021
11. Janes, A., Succi, G.: Lean Software Development in Action. Springer, Heidelberg (2014). https://doi.org/10.1007/978-3-642-00503-9
12. Muszynska, K.: Communication Management in Project Teams: Practices and Patterns, pp. 1359–1366. ToKnowPress (2015). https://EconPapers.repec.org/RePEc:tkp:mklp15:1369-1366
13. Odine, M.: Communication Problems in Management, vol. 4 (2015)
14. Pedrycz, W., Russo, B., Succi, G.: A model of job satisfaction for collaborative development processes. J. Syst. Softw. **84**(5), 739–752 (2011)
15. Peña-Acuña, B. (ed.): Digital Communication Management. InTech (2018). https://doi.org/10.5772/intechopen.70959

16. Pikkarainen, M., Haikara, J., Salo, O., Abrahamsson, P., Still, J.: The impact of agile practices on communication in software development. Empir. Softw. Eng. **13**(3), 303–337 (2008). https://doi.org/10.1007/s10664-008-9065-9
17. PMI (ed.): A Guide to the Project Management Body of Knowledge (PMBOK Guide). Project Management Institute, Newtown Square, PA, 5 edn. (2013)
18. Samáková, J., Babčanová, D., Chovanová, H.H., Mesárošová, J., Šujanová, J.: Project communication management in industrial enterprises (step by step). In: Digital Communication Management. InTech (2018). https://doi.org/10.5772/intechopen.75160
19. Samáková, J., Koltnerová, K., Rybanský, R.: Project communication in functions, process and project-oriented industrial companies. Research Papers Faculty of Materials Science and Technology Slovak University of Technology, vol. 20 (Special-Number), pp. 120–125 (2012). https://doi.org/10.2478/v10186-012-0020-7
20. Sońta-Draczkowska, E.: Project management as communications management. Kommunikationsmanagement in polnisch-deutschen R&D-Projektteams (2015)
21. Ströh, U., Jaatinen, M.: New approaches to communication management for transformation and change in organisations. J. Commun. Manag. **6**(2), 148–165 (2002). https://doi.org/10.1108/13632540210807008
22. Suliman, M., Bani-Salameh, H., Saif, A.: Visualizing communications between software developers during development. Int. J. Softw. Eng. Appl. **10**(3), 131–140 (2016). https://doi.org/10.14257/ijseia.2016.10.3.12
23. Taleb, H., Ismail, S., Wahab, M.H., Rani, W.N.M.W.M.: Communication management between architects and clients. vol. 1891. AIP Conference Proceedings (2017). https://doi.org/10.1063/1.5005469
24. Wasson, K.S., Knight, J.: Development: Identification and Repair of Weak Definitions (2001)
25. Williams, G.A., Miller, R.B.: Change the way you persuade. Harvard Bus. Rev. **80**(5), 64–73, 133 (2002). http://europepmc.org/abstract/MED/12024759