THE MEASUREMENT AND EVALUATION OF THE INTERNAL COMMUNICATION PROCESS IN PROJECT MANAGEMENT

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Abstract: *Internal communication is among one of the most important factors for success in project management. It helps the project managers take correct decisions, implement the right strategies and finish a project on time and within budget. Measuring internal communication and keeping track of its development is a crucial asset that a manager should posses so that the project deliverables are handed out correctly. In this paper our goals are to illustrate how important internal communication is in a project and also to create an analysis model of internal communication in projects based on characteristics of communication. We developed the ICAM model based on a systemic approach with inputs – a processing box – outputs. For the inputs we used the communication characteristics data that we obtained from the questionnaires and the interviews which were later structured in a communication instance relationship. Each communication instance reflects through its attributes the characteristics of internal communication in a project. Processing this information is done by using the data mining tool called Weka. In the data processing stage classification, decision tree classification algorithms were used and also algorithms from the Naïve Bayes belief networks. Applying these algorithms in the model facilitates the interpreting and analysis of the communication characteristics in a project. The outputs of the model consist of summarized representations of the communication characteristics such as: texts, diagrams graphics, tables. These outputs of the model, as a result of the processing helps us in obtaining practical conclusions related to the improvement of project communication, for the successful completion of projects.*
The model is a useful tool for improving the internal communication process of a project and help the project raise its efficiency. It has been created based on the characteristics of the information flow within a project. Also the Internal Communication Analysis Model – ICAM – helps improve the projects' deliverables by making sure that everyone in the project understood their roles correctly.

Keywords: project management, internal communication, modelling.

JEL classification: C11, C15, M14.

1. The communication process as a part of project management

Communication is a central feature of the human endeavours. Being a good communicator as a project manager assures, in the end, the successful completion of the project. If the communication process is a poor one, it can lead to differences in expectations, meaning in terms of what needs to be delivered at the end of the project, people being unprepared when changes occur, not knowing in-depth information about the status of the project and team members not knowing what is

expected from them. Because the project climate is an ever-changing one, the project manager must always be up-to-date with everything that is involved in the project. Communication is the common thread that holds the project together and keeps it from falling apart.(Kliem 2008)
If attention is paid on the outcome quality of the project then a well glued together communication process must be established. Since the project manager is the leader, he is responsible for maintaining the communication flow going. The manager is the main link between the project team and the exterior of the project. So his role should be the one of a facilitator in the internal communication process. Internal communication lays the foundation of proper functioning for the entire project by promoting its identity. Also internal communication is a way to solve the need of the project members of belonging to a group and also a way of implementing managerial strategy. Studying internal communication in a project means establishing methods and techniques of organizing the communication flow in the process of project management to achieve optimal results from its activities and tasks. The inheritance of the communication characteristics is illustrated by the conceptual hierarchy in figure 1.

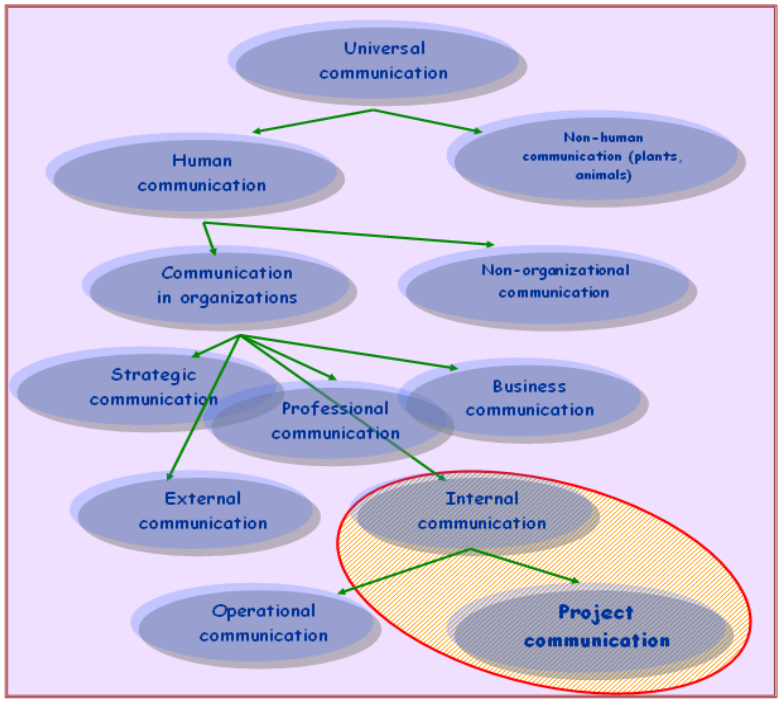

Figure 1: Communication paradigm: conceptual hierarchy.
Source : Pop A-M (2013) An analysis model of the communication features in research project management.

By analyzing the work breakdown structure of the project we can determine the direction of the communication flow among the components of the project. Usually there are five ways in which information can flow in a project: top-down, down-top, horizontal, on diagonal and with the exterior. (Kerzner 2010)

Information flowing from top to bottom is part of the communication that takes place between management (the manager) to team members. This communication flow is used by managers to convey information to the team member about work. Team members need this information in order to complete their tasks successfully. The down-top flow of communication serves the following purposes:

a) Gives feedback on performance from team members.
b) Provides instructions for correctly performing the project tasks.
c) It communicates the mission and the vision of the project to the team members.

It provides detailed and complete information about the team members' job description.

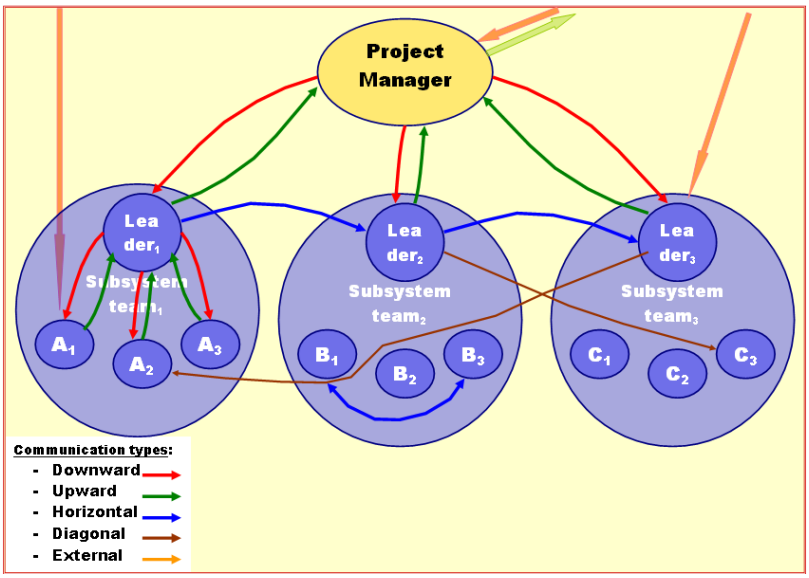

Figure 2. Information flow in a project
Source: Pop A-M. (2012) 2-th Report of Doctoral theses Contributions towards communication management in projects, Sibiu, Romania, November, 2012.

The communication flow from team members to managers is called „down-top" communication. This flow provides feedback on how well the project is evolving and also through this type of flow, members can express their own views and report their performances to their managers. A „down-top" communication that works well allows the team members to participate in the decision-making process and can create much better communication channels between the two parties.

Internal communication analysis is also directly influenced by the development model of the project. There are several approaches to the development model of a project. Figure 3 illustrates the main approaches used most often in project management.

The approach based on the life cycle phases includes project tracking and communication in this type of model is maintained at an average level. As the models become more and more complex, the internal communication process becomes increasingly more pronounced because their steps requires closer collaboration

between project members. The highest level in internal communication is achieved in the agile model. This is because the very essence of this model is the existence of a strong communication process between team members.
For a very thorough analysis of internal communication we can establish different classifications based on criteria chosen in relation with the characteristics of internal communication. (Stoica 2011)
This classification of internal communication in project management provides a relevant ranking of its characteristics, which will be analysed using a model presented in section three of this paper.

	Phased	*Iterative*	*Incremental*	*Agile*
Methodological characteristics	A traditional phased approach identifies a sequence of steps. Typical development phases: initiation, planning and design, execution and construction, monitoring and controlling systems, completion. Some projects do not follow a structured planning and/or monitoring process, and some projects will go steps 2, 3 and 4 multiple times.	Is a repeatable, practical and proactive methodology that ensures project success while decreasing an organization's negative environmental impact. The methodology encompasses the management, control and organization of a project with consideration and emphasis beyond the project life-cycle and on the five aspects of sustainability.	Is a methodology of planning and managing project execution designed to deal with uncertainties inherent in managing projects, while taking into consideration limited availability of resources (physical, human skills, as well as management & support capacity) needed to execute projects. In multi-project environments, resource should be performed across projects.	Agile project management approaches based on the principles of human interaction management are founded on a process view of human collaboration and a strong communication.
Methode	**PRINCE 2**	**PRiSM**	**CCPM**	**Agile familly**
Model	**Waterfall,**	**Spiral**	**CCPM**	**Lean model**

Figure 3. Project management development models.

2. Methods of measuring internal communication in projects

Finding the right methods for project communication is a challenge for the project manager. Project metrics have the role of informing both the stakeholders and the project members on the status of the project throughout its development. Also based on metrics, the project manager may determine the validity or invalidity of an action that must be undertaken (Kerzner 2011). Measuring communication is a fairly new concept with which managers increase efficiency in a project and cause a positive result. The complexity of the communication process in a project cannot be fully understood unless the process is measured one way or another. Therefore, if there are ways to measure communication in a project this confirms that an active communication process exists in that project. Metrics can be used for tracking performance even related to the organization's objectives, as shown in figure 4.
One method of measuring the communication process is the chosen by Angela Sinickas. As far as communication within organisations is concerned, one of the most used methods of evaluating communication performance is calculating the Return of Investment (ROI). The formula used for this is the ratio between gain minus cost and cost:

$$ROI = \frac{Gain - Cost}{Cost} \quad (1)$$

Sinickas argues that the Return of Investment method (1) can also be used in projects for measuring the communication process. In order to receive an accurate information about the ROI in communication we must divide the communication cost to the net value and the result is an approximation of the ROI. With the help of surveys, the project manager, who is the communication facilitator, can track down what impact different communications has on project members decisions with a cost impact on the project itself. When calculating the ROI in communication, the difficult part is finding out what is the role of communication in helping the project to reach the desired outcome (Sinickas, 2007).

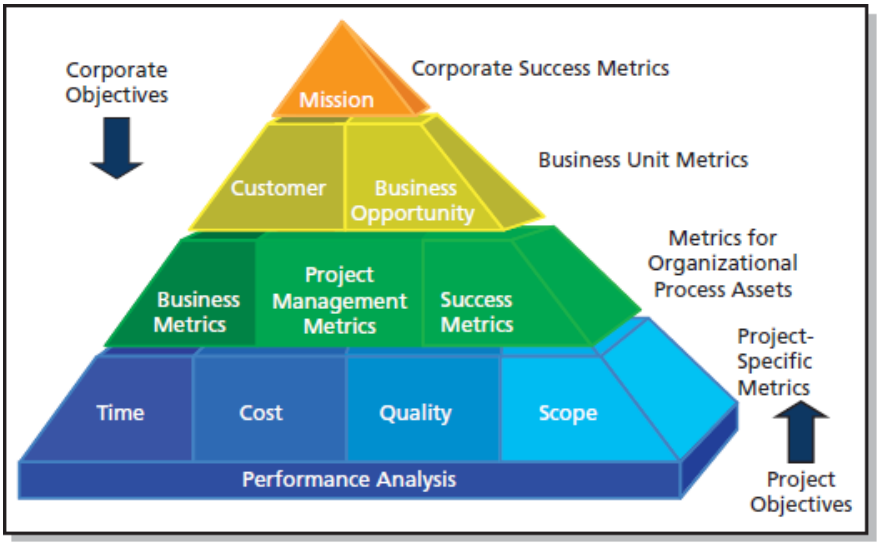

Figure 4. The debriefing pyramid.
Source: Kerzner, 2011.

To prepare the questionnaires and interviews we used the classification summaries of the communication characteristics presented in the first section.
Formulating the questions from the interviews and questionnaires was based on several rules to ensure that the answers are directly related to the problem in question. We formulated the questions based on two principles enunciated by the communications expert Angela Sinickas (Sinickas, 2007).:

- Questions must be raised to the point and ambiguous questions are to be avoided.
- We must use questions whose answers are more detailed so that the questionnaire is relevant to the sample studied.

In gathering the information that best describes the communication features in project we took into account the Likert scale with five gradations to express the intensity of the staff's agreement.(Jamieson 2004). In order to capture the information as faithfully as possible we determined that the five nominal graded responses on the Likert scale will be: Never, Seldom, Sometimes, Often, Always.

These nominal values that we obtained will be discretized on a numeric scale from 1 to 5. A reliable interpretation of the data accuracy will be done by using the Weka analysis tool and several classification and clustering algorithms from Machine Learning. In order to process the information at a performance level several abstract models will be created which will serve for efficient analyzes and interpretations in communications management within projects. In this paper we present a model designed for the analysis and interpretation of the communication characteristics based on the criteria called „communication flow in a project".
The data collection methods used were the questionnaires and the interviews. Then data is entered on spreadsheets which will be later summarized on communication characteristic categories and coded so that they can be pre-processed with the Weka tool (Weka-3.7.8 2013).

3. A model of analysing internal communication in projects

The Internal Communication Analysis Model (ICAM - Internal Communication Analysis Model) was created with the help of the data mining development tool Weka from Waikato University in Prinston, New Zeland. Once the data measured in internal communication was collected from all the 96 projects, it was structured as input data for the ICAM model in a communication relation which includes 254 communication instances. In the structure of this relation, 7 attributes of communication were selected for the analysis which express the same number of communication features from the research project surveyed in universities and research organizations. The criteria followed in analysing internal communication in projects was the one that expresses „the communication flow in projects". Table 1 presents these features together with the values that were surveyed.

Table 1. Communication stream characteristics.

Code	Characteritics	Probabilistic Values
FI	Communication stream	Likert Scale: Nominal = (Always, Frequently, Sometimes, Rarely, Never) Numeric = (5, 4, 3, 2, 1)
FIsj	TopDown	
FIjs	UpDown	
FIo	Horizontal	
FIt	Transversal	

The seven input attributes for the ICAM model are presented in figure 5. Here we have an attribute that identifies the project investigated „Pnn", where nn=number of the project. The attribute „Person" has two nominal values: Manager and Member (team member or stakeholder or an expert). The TopDown, UpDown, Horizontal and Transversal attributes express the direction and the way of the communication process in a project and their values were numerically discretized to the {1, 2, 3, 4, 5} set. The last communication attribute is called Class and its role is to help the model clarify internal communication. It has the nominal values {yes, no} where the yes values is assigned to an instance if the average number of communication numeric values is more than 3. If not the value of the class is no. Figure 5 illustrates statistical values for the 7 communication attributes (minimum, maximum, average, standard deviation).

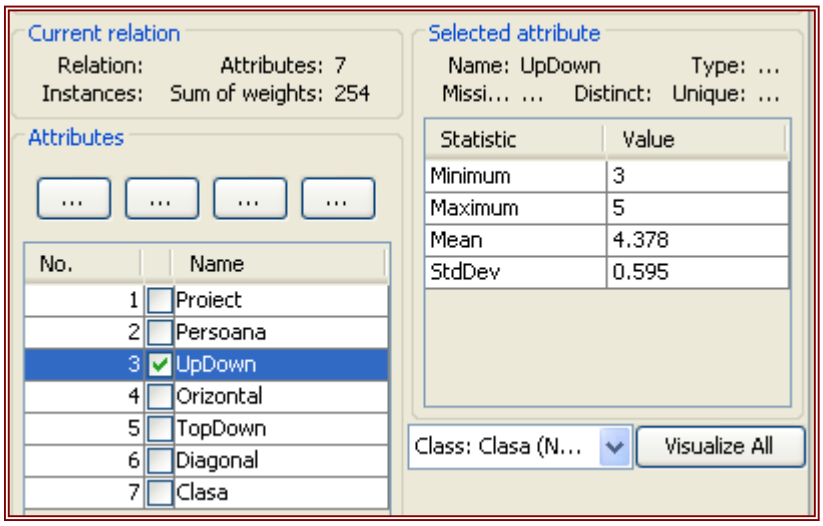

Figure 5. Statistical values for 7 communication attributes
Source: MIFC Application in Weka-3.7.8 (2013).

Figure 6 presents graphically the pre-processed statistics of the communication instances from ICAM input relation.

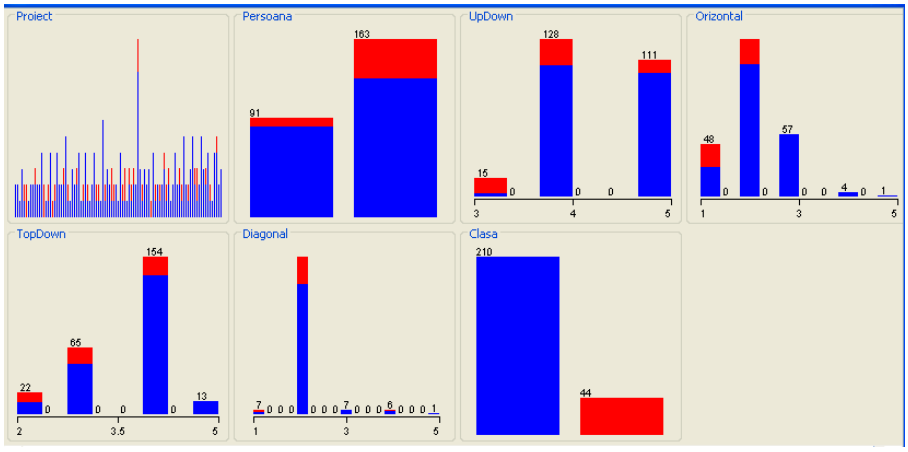

Figure 6. Statistic graphics of the internal communication.
Source: MIFC Aplication in Weka-3.7.8 (2013).

The ICAM model has various classifications for the communication characteristics which are applied by various algorithmic methods in Machine Learning. For example in figure 7 we have a textual result of a classification instance after using the J48 „Decision Tree" method. In the text resulting from this classification we presented some statistics regarding the correctness and the accuracy of the communication characteristics classification. Also, here, we presented the „Confusion Matrix" with numerical elements which indicates the number of THRU communication instances

on diagonal (for example, an instance is „a” and it was predicted as being „a”). The other elements are false.

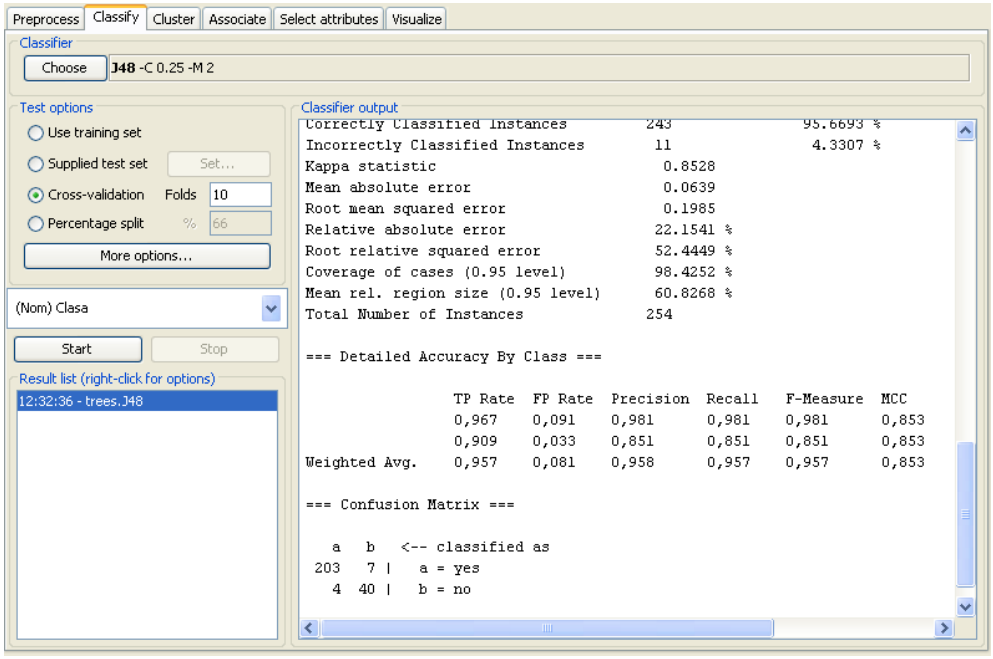

Figure 7. The textual result of the J48 classification
Source: MIFC Application in Weka-3.7.8 (2013)

Figure 8 illustrates the decision diagram resulting from the communication instances classification with the help of the J48 algorithm. From this classification tree we can highlight several decision rules in the communication flow. The most powerful classification rule of the communication characteristics is marked with red in the diagram from figure 8. This route has as a starting point the attribute node „UpDown” and follows the decision test „Valoare comunicare” > 3, which leads to the Horizontal attribute node, then passes through the decision test „Valoare comunicare” > 1 which leads to the attribute node TopDown. Further, passing through the „Valoare comunicare” > 2 test we reach a final communication characteristics class with 170 classified instances, from which 2 are incorrectly classified here. By interpreting this route in classifying communication instances we can say that this rule is the most efficient way in which we can use the communication characteristics of project management. The other routes from the classification tree are less important for this model, but maybe in another context we can identify other relevant routes for the characteristics of internal communication.

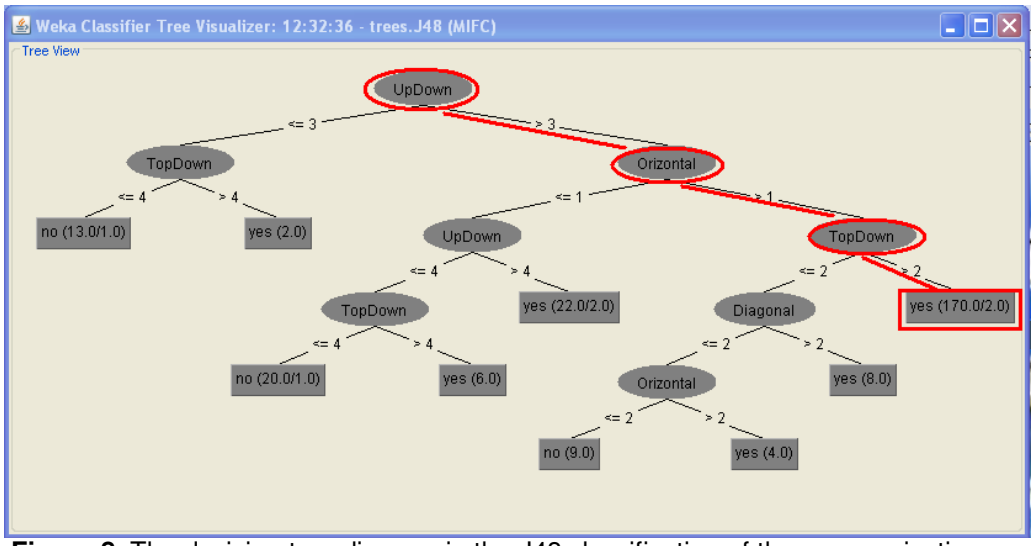

Figure 8. The decision tree diagram in the J48 classification of the communication characteristics.
Source: MIFC Application in Weka-3.7.8 (2013)

4 Conclusions

Measuring internal communication helps in quantifying, analysing and evaluating its value for a more efficient management of the project's tasks. Also by analysing the communication process project managers and project portfolio managers can effectively manage the projects' resources.

The ICAM model is a useful tool for performing retrospective analyses of the characteristics of internal communication. With the help of this model we can obtain several interpretations of the characteristics of project communications which help improve the communication process and also the project management process.

The model has the possibility to provide a consistent series of communication analysis tools through different classifications and clustering of the communication instances. The deliverables obtained after applying the model on the questioned data can be presented as graphics, diagrams and statistic summaries that establish the accuracy and efficiency of internal communication in projects.

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