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Carlos Costa
ISCTE, Lisboa, Portugal

Pedro Antunes
University of Lisboa, Portugal

Joao-Ferreira Dias
ISCTE, Lisboa, Portugal

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Carlos J. Costa
Departamento de Ciências e Tecnologias de Informação
ISCTE, Lisboa, Portugal
carlos.costa@iscte.pt

Pedro Antunes
Department of Informatics,
Faculty of Sciences
University of Lisboa, Portugal
paa@di.fc.ul.pt

João Ferreira Dias
Departamento de Ciências de Gestão
ISCTE, Lisboa, Portugal
fdias@iscte.pt

Abstract

This paper discusses the evaluation of Meeting Support Systems (MSS). More specifically, it tackles the problem of evaluating the perceived organizational value of these systems and in what extent they fit with other information systems and also other organizational dimensions. MSS lay down one sub area of research crossing Computer Supported Cooperative Work (CSCW) and information systems. Based on these multiple perspectives, we developed an evaluation grid for MSS. The evaluation grid identifies several MSS components as well as different levels of organizational impact. Our hypothesis is that with this grid it is possible to analyze and evaluate the organizational, group and individual impact of MSS. The paper presents an application of the grid to a real organization: a building construction project.

Introduction

Meetings are probably the most used, regulated and documented group process. The informal pub meeting (e.g. Dialogues of Plato), Senate's sessions (in Rome), Round Table, Councils of the Bishops, Parliaments' Assemblies, the corporate General Assemblies, the institutes' and schools' management board meetings are just some of many examples showing that meetings play an important role in society.

Often, the meetings are a fundamental element for the definition of the group itself (Jay, 1976).

The literature reports several MSS aiming at supporting several meeting roles, tasks and processes. Unfortunately, using MSS brings many gains to meetings but some losses as well (Romano & Nunamaker, 2001). Furthermore, extensive use of MSS in organizations highlighted the tendency of MSS to be self-extinguishing in the long run (Briggs et al., 2001).

One factor that contributes to this situation concerns the reduced levels of integration and assimilation that MSS achieve in organizations. So, in order to analyze to what extent organizations value MSS, an evaluation action must be performed.

As pointed out by Ramage (1996), five different types of CSCW evaluation can be identified: (1) evaluate the effects of CSCW in organizations; (2) evaluate CSCW systems per se in order to develop better systems; (3) evaluate the concepts that underline the system and whether those concepts are applicable; (4) evaluate CSCW in context, not just the technology but the whole socio-technical system; (5) evaluate what CSCW to acquire.

This paper proposes an evaluation scheme whose purpose is evaluating MSS implementations in order to identify weaknesses and critical items to be incorporated in the system design.

From now on, this paper is organized in five sections. In section 2 we review the literature on different approaches to evaluating information systems in organizations. In section 3 we identify and characterize meeting components. The section 4 appeals to the importance of evaluating MSS impacts at various levels. The section 5 proposes an evaluation grid and a formula to measure MSS impact. Finally, in section 6 we report an application of the proposed approach in the building construction industry.

Literature Review

An information system may be evaluated by identifying its functionality, effectiveness, usability and other quality factors. A checklist may be a possible tool to perform this evaluation.

More specifically, a possible way of evaluating a MSS consists in analyzing the quality of results produced by the meeting, relying either on experts' opinions or the participants themselves.

More sophisticated approaches regard meetings as production systems, with inputs, processes and outputs. This approach was proposed by Pinsonneault and Kraemer (1989) and later adapted, extended and enhanced by several researchers (e.g. Nunamaker et al., 1991 Fjermestad & Hiltz, 1999, Tung, & Turban, 1998). Other researcher proposed the use of an adjusted value chain (Porter & Millar, 1985), or an adjusted ROI - Return on Investment (Parker et al., 1989).

Another line of research departs from the observation that MSS evaluation is a specific case of CSCW evaluation, and CSCW evaluation is also a specific case of HCI (Human Computer Interaction) evaluation. The CSCW perspective emphasizes the aspects of communication, coordination and cooperation: how a group organizes work, builds a common perspective and achieves high performance ability (Joahanson et al., 1991). The Media Richness Theory (Daft & Lengel, 1986) is one example of this approach. The HCI dimension introduces a user-centred perspective, emphasizing usability and ergonomics (e.g. Hayes, 1998, Wickens, C. et al., 1998).

Another important issue to ponder concerns the existence of a multiplicity of methods to evaluate systems. Heuristic Evaluation (Nielsen, 1993) relies on the evaluator's immediate reactions, intuitions and predictions, categorized under a set of Design Principles and Usability Attributes. Much advocated in the HCI field (Tognazzini, 1992), usability testing takes generally the form of studies conducted by system designers with real users in a semi-realistic use context.

Various methods involving direct user reactions can be used to obtain various qualitative data about users' experiences with systems (either immediately or a little while after use). They have been used particularly as a way to capture data prior to further analysis (Beck & Bellotti, 1993) and to improve a commercial product by collecting customer feedback (Abbott & Sarin, 1994). Laboratory experiments are quite widely used to evaluate CSCW systems (e.g. Ishii et al., 1993; Wan & Johnson, 1994; Olson & Olson, 1991). These are used to collect quantitative data about a single specific factor, attempting to screen out other influences. However, as with user testing, there are significant problems with the de-contextualized and artificial nature of these experiments. Another way to evaluate a system is to go into the work place and watch real users using it over time. Traditionally, ethnography requires a long period of immersion. This approach has been widely used to evaluate CSCW systems such as air traffic control rooms (Mackay, 1999). Some researchers, e.g. Hughes et al. (1994), proposed "quick and dirty ethnography" techniques to make this method less time consuming and still provide useful amounts of data. Others have proposed using contextual inquiries, a combination of observation with directed interviews (Beyer & Holtzblatt, 1998).

So, as briefly discussed in the above lines, MSS systems should be evaluated using different perspectives encompassing the human, group and organizational levels, like the effects on the individual (psychological, social, political questions), effects on the workforce as a group (socio-political questions) and effects on the organisation (profitability, workplace satisfaction, bureaucracy, organisational structure and culture change). Another dimension considers the effects on the wider society.

Roles, Processes and Resources

The components of meetings that may be analyzed in order to evaluate MSS are roles, processes and resources.

Roles correspond to categories of recognizable behaviors, objectives and motivations linked to the execution of an organizational, group or individual function.

When playing a role, individual, group or organizational agents are autonomous and responsible for accomplishing a task. The MSS support that is relevant in this context considers: (1) Mechanisms that support identifying and defining objectives; (2) Mechanisms that support identifying motivations and defining strategies (e.g., SWOT analysis); (3) Time management mechanisms (e.g. scheduling systems); (4) Mechanisms that support the learning process; (5) Mechanisms that help or guide the agent performing the assigned role (e.g., expert systems; Aiken et al., 1990); (6) Mechanisms that help identifying responsibilities and allocating resources.

Another component of meetings is the process. Processes organize collections of interrelated activities executed by multiple agents to reach complex goals. In the perspective of system support, the following dimensions may be identified (Nunamaker et al., 1991): Process structure, Process support, Process automation, Task support and Task automation.

Resources are artifacts used, shared or produced by agents while participating in meeting processes. From an information processing perspective, the following elements have to be considered: Save data, Structure/index data, Store data and Associate data with user(s).

At this moment we have identified the several components of a meeting. Once again we should emphasize that these components should be regarded at three different levels: organizational, group and individual. These three levels are necessary to evaluate the organizational value of MSS.

Individual, Group and Organizational Level

The main purpose of MSS is to support groups accomplishing their goals with increased quality, productivity and satisfaction. We have asserted in this paper that our purpose is to go beyond the group towards the more broad organizational perspective and, at the same time, towards the more specific individual perspective. Why do we need to bring together all these perspectives? Basically, because success or failure depends on the combined impact of these three factors. We give some concrete examples: (1) CSCW success depends on whom benefits and who has to do additional work. The agents that do not get benefits from the technology undermine its use to the point of failure (Grudin, 1990). (2) MSS have proved to decrease significantly organizational costs but, nevertheless, failed because this technology needs champions and this type of agent is very scarce in organizations (Briggs, et al., 2001). (3) MSS require good agendas, defined before meetings and, in fact, one of the most significant advantages of MSS has been attributed to this strong requirement. However, 1/3 of meetings do not have any kind of agenda (Romano & Nunamaker, 2001) and, thus, MSS may be perceived as awkward.

Our purpose, then, is to evaluate MSS simultaneously at the individual, group and organizational levels. At the individual level, we propose to evaluate the technology support to individual agents, executing individual tasks and managing individual resources while cooperating with other agents in the scope of processes.

The other level is the group level. In fact, MSS support agents playing group roles, executing collaborative tasks, and producing and using shared information.

Finally, at the organizational level, we address the MSS aptitude to support organizational roles, processes and resources.

The Evaluation Grid

By crossing the role-process-resource dimension with the organization-group-individual dimension, we created the evaluation grid.

The grid consists of nine cells, each one classifying relevant MSS **features** that should be analyzed and evaluated (**Figure 1**). Agents may play several **organizational roles**, (e.g. general manager). In a meeting, a person may play one or several **group roles**, like participant, facilitator, sponsor or secretary (Aiken & Vanjani, 1998). Besides organizational and group roles, persons also act upon individual aspirations, motivations and specific skills (**Individual roles**). For example, a person, even playing an

organizational role of managing director, and participating in a meeting as chairman, has personal objectives, interests and skills. Those objectives, should be coherent with the organizational objectives (Barnard, 1956), but this is another problem.
In what concerns **organizational processes**, a great number of processes may be identified, but a small number are critical (Porter, 1985, Hammer, 1990). Groups execute several processes in meeting environments according to the issues that need to be dealt with, e.g. relationship development or conflict management (Dubs & Hayne, 1992). **Individual processes** correspond to processes that have meaning at an individual level, such as prioritizing and scheduling individual tasks.

In what concerns **organizational memory**, the identification of organizational databases is specially important in this dimension, as well as identifying to what extent the system being analyzed may be linked with them (Concklin, 1992). The **group memory** allows identifying information produced either during the actual meeting or in previous sessions (Nunamaker et al., 1991). The personal calendar is one example of **individual memory** supported by computers, but other forms of individual memory may be identified and analyzed in detail.

	Role	Process	Resource
Organization	Organizational role	Organizational process	Organizational memory
Group	Group Role	Group process	Group memory
Individual	Individual role	Individual process	Individual memory

Figure 1. The Evaluation Grid

There are still some decisions about the framework adopted that must be put explicit. In fact, some of those items were already identified, but here we identify our choices.

The variables analyzed may correspond to just one **criteria**, other perspective is identifying a set of criteria (multi-criteria). The last one was the perspective adopted. Another dimension is the identification of the **agents involved** in the evaluation. One perspective consists in identifying just one agent; other consists in identifying a group of users (e.g. stakeholders). The last one was adopted.

In what concerns **data types**, the evaluation may be quantitative or qualitative. Qualitative data may be quantifiable, in certain specific situations. In this evaluation grid we made an effort to associate the MSS functionalities with quantities.

In what concerns **what is evaluated**, the evaluator may be interested in evaluating the system (technical aspects), users operating the system (operational aspects) or the economic dimension of the system.

The **source** of data to be used in the evaluation process may be questionnaires, direct observation and documents; all of them were adopted.

The system may also be evaluated in different **phases of the development** process. Consequently, what may be evaluated can be just a description of the features of a system, a prototype, a system being developed or a ready-made system. The purpose here consisted in employing all the perspectives.

In what concerns the **environment**, the systems may be evaluated in a real environment or in a simulated environment. As long as the purpose is to identify the level of integration of the system, a real environment must be used.

The **impact of the system** may also be analysed. In this perspective, it is important to evaluate the effectiveness of the system, the efficiency and satisfaction. The risk may be also an aspect to be considered in the evaluation process.

Based on the detailed evaluation grid, we finally defined a way to measure MSS value, using the following formulas:

$$V_i = \left[\frac{r_i}{c_i \times f_i} \right] \times 10 \qquad V = \sum_{i=1}^{9} \left(\left[r_i / (c_i \times f_i) \right] \times 10 \right)$$

C is the number of concrete **items** that are selected to the evaluation process. These items may be roles, processes or resources and are selected after an analysis of the organizational context and specific MSS being evaluated. **F** is the number of **detailed features** relevant to MSS evaluation and considered in each cell of the evaluation grid (see Figure 1). **R** corresponds to the sum of the **rates** given by the evaluators to the **items** in each cell of the evaluation grid. Currently, the ratings are 0 for "no support" and 1 for "support." $\mathbf{V_i}$ is the partial score of each cell of the evaluation grid. V is a total measure of the organizational value given to the items selected by the evaluation process. Since the maximum value that can be measured in each grid cell is 10, V has a maximum of 90 and a minimum of 0.

Now, it is important to discuss how to use the evaluation grid. Here we propose an approach composed of the following steps: The **first step** consists in context analysis to clarify the overall MSS objectives and boundaries. An ethnographic approach may be adapted to that purpose. The **second step** is the role, process, system and data identification. This task may as well be accomplished with an ethnographic approach, complemented with document analysis. The use of focus groups may also be necessary to evaluate the main organisational processes, roles, resources, data and systems. The **third step** consists in the implementation, installation and configuration of the system. In this phase, prototypes are developed and software is parameterised for an experiment. The **forth step** consists in the use of the system. In this phase a laboratory approach is followed. Sometimes, it is impossible to follow the laboratory approach, since systems are not available or there is no time to set up the experiment. Then, the system is presented in a workshop and the functionality is discussed with users. During this phase, opinions are collected from the system users or workshop participants. In the **evaluation phase**, the data collected is used to produce the evaluation grid.

Using the Evaluation Grid

The MSS evaluation process was performed in the context of a building construction project. A Corporation that operates in the real state Portuguese market since 1979 launched this project. The purpose of the project is developing, marketing and selling condominiums in Lisbon. The total amount of investment of this project is around 20 million Euros. The team involved in the project is composed of a designer, an engineer, a market specialist and a financial executive. A department of the same firm performs the construction, but does not participate in the product development.

Context

The system evaluation was performed in a building construction project. In **Figure 2**, the main types of organisations involved in a construction building project are identified. In what concerns project meetings, we identified: project and conception meetings (A), construction and implementation meetings (B) and marketing and selling meetings (C). But we were specifically interested in meetings involving the staff of real state investors, composed of a designer, engineer, marketing specialist and a finance executive (D). The main purposes of this team is defining a general strategy for the investment, identification of market needs, identification of apartments' typologies, materials to be used in order to contract architects and engineering teams, construction contractors and real state agencies. This team is also responsible for the co-ordination of the groups involved in the building project.

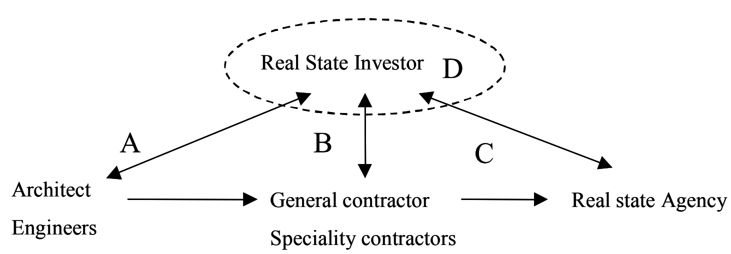

Figure 2. Organizations Involved in the Project

Role, Process, System and Data Identification

After collecting data and clarifying the situation, it was possible to identify the MSS main roles. With the help of several firm members, we could identify these main organizational roles: designer, engineer, market specialist and financial executive. In what

concerns group roles, we identified the participant, the sponsor and also the facilitator, this last one was considered as an imposition of the MSS, as long as the "normal" meetings generally do not need him. No individual roles were discriminated.
In what concerns organizational processes, the main processes that were identified are: defining a general strategy for the investment (1), identification of market needs (2), identification of building typologies (3) and selection of materials to be used (4).

Among the group processes listed by researchers (e.g. Dubs & Hayne, 1992), the firm members found that the production of meeting agendas, the support to meeting decisions and the production of meeting reports were the most important to their organizational context.

Considering resources, at the organizational level, the most important were the CAD system and an organizational database supported by an Intranet, which the firm called Web-database. Those systems, allowed the creation of complex hypertext documents, involving also CAD files, that are called "general specification of the project", producing an organizational and project memory, as well as "Memos" necessary to deal with architects, engineers and contractors.

In what concerns group memory, the most significant resource is the actual meeting data, as well as data from the previous meeting.

Finally, in what concerns individual memory, the personal calendar is the most important resource used, and tools like Palm Desktop, Navigator Calendar or Microsoft Outlook generally support it.

	Roles, Processes and Resources
Organisational role	– designer – engineer – marketing specialist – finance executive
Group Role	– participant – sponsor – facilitator
Individual role	
Organisational process	– defining general strategy for the investment (1) – identification of market needs (2) – identification of typologies (3) – materials to be used (4)
Group process	– meeting Agenda (1) – meeting decision (2) – meeting reporting (3)
Individual process	– schedule process (1)
Organisational memory	– general specification of the project (1) – memos used to deal with architects, engineers and contractors (2)
Group memory	– actual meeting data (1) – previous meeting data (2)
Individual memory	

Figure 3. Role, Process, System and Data

Implementation, Installing and Configuration of the System

We prototyped a coordination tool that supported the particular needs of the meetings held by the target organization (designated EMS2PDA; Costa et al., 2001).

	Roles, Processes and Resources	Systems Support/Automate (r)	1	2	3	4	V
Organizational role	designer engineer marketing specialist finance executive c=4	– definition or clarification of objectives of agent playing organizational role	0	0	0	0	
		– definition and clarification of motivations of agent playing organizational role	0	0	0	0	
		– time management of agent playing organizational role	0	0	0	0	
		– learning of agent playing organizational role	0	0	0	0	0
		– performance support agent playing organizational role	0	0	0	0	
		– responsibility, authority and power agent playing organizational role	0	0	0	0	
Group Role	Participant (1) Sponsor (2) Facilitator (3) c=3	– definition or clarification of objectives of agent playing group role	0	0	0		
		– definition and clarification of motivations of agent playing group role	0	0	0		
		– time management of agent playing group role	0	0	0		
		– learning of agent playing group role	0	0	0		
		– performance support agent playing group role	1	0	0		0
		– responsibility, authority and power agent playing group role	0	0	0		
Individual role	c=1	– definition or clarification of objectives of agent playing individual role	0				
		– definition and clarification of motivations of agent playing individual role	0				
		– time management of agent playing individual role learning of agent playing individual role	0				0
		– performance support agent playing individual role	0				
		– responsibility, authority and power agent playing individual role	0				
Organizational process	General strategy (1) Market needs (2) Typologies (3) Materials (4) c=4	– organizational process structure	0	0			
		– organizational process support	0	0			
		– organizational process automation	0	0			
		– organizational task support	0	0			
		– organizational task automation	0	0			0
Group process	Meeting Agenda (1) Meeting decision (2) Meeting reporting (3) c=3	– group process structure	1	1	0		
		– group process support	1	1	1		
		– group process automation	0	1	1		
		– group task support	1	1	1		
		– group task automation	0	0	1		7
Individual process	Schedule process (1) c=1	– Individualprocess structure	1				
		– Individual process support	1				
		– Individual process automation	1				
		– Individual task support	1				
		– Individual task automation	1				10
Organizational memory	General specification of the project (1) Memos used to deal with architects, engineers and contractors (2) c=2	– save data	0	1			
		– store data	0	1			
		– structure/index data	0	1			
		– retrieve data	0	0			
		– user identification	0	1			4
Group memory	Actual meeting data (1) Previous meeting data (2) c=2	– save data	1	0			
		– store data	1	0			
		– structure/index data	1	0			
		– retrieve data	1	1			
		– user identification	1	0			6
Individual memory	Personal calendar (1) c=1	– save data	1				
		– store data	1				
		– structure/index data	1				
		– retrieve data	1				
		– user identification	1				10

Figure 4. Evaluation Grid (The Case of EMS2PDA)

Use of the System

The forth step of the methodology concerns analysing the prototype. Four member of the target organization had the opportunity to experiment the prototype. Then, we had a discussion to clarify the characteristics of the system. Finally, we had a second group discussion about the characteristics of the system, analysing in detail the roles, process and resource support.

Evaluation

The evaluation grid was based on the evaluation grid presented in **Figure 1**, tailored to the specific characteristics and interests of the target organization. The tailoring process results from the identification of the specific roles, processes and resources pertaining to the firm and relevant to the system being evaluated (**Figure 3**).

With this list of concrete items, we prepared the evaluation grid and asked the firm members to evaluate our prototype according to the grid. The obtained results are presented in **Figure 3.** The total score of the system is 44.

This overall value is meaningless if not compared to the values obtained with other systems. In what concern our case, it was more important to identify partial scores. For instance, the system has as major strengths in the support to individual memory, individual processes and group processes. There is no support to organizational processes, individual roles or organizational roles.

Conclusion

The purpose of this paper is the evaluation of EMS value to organizations. We identified three major components of EMS: roles, processes and resources.

Three different levels of integration were also identified: organizational, group and individual. These two dimensions were then combined and produced the “evaluation grid.” The evaluation grid was applied to a building construction project.

Note that this approach shows several limitations. One is that we may need different weights to measure value according to the relative importance of each item and detailed feature. Another minor limitation is the possible confusion between organizational, group and individual levels when each item is being analyzed. The way to solve this problem is to use always the same criteria for all the options in the evaluation.

A characteristic of the proposed approach is the situated nature of the evaluation process and the impossibility of comparing data obtained in different contexts. In fact, considering that the evaluation grid was constructed for a particular organization, we can compare different MSS selected by the same firm, but it is difficult to compare if a specific solution fits better this firm than another firm.

This characteristic of the evaluation grid is also linked to its flexibility. Since the firm involved in the evaluation process was a small department and time was a very precious good, we had to use a simplified version of the grid. If the enrolled organization had more time to spend on the evaluation process, we could have increased laboratory experiments.

The approach showed that it might be adjusted to simple organizations and contributes to the situated evaluation of cooperative systems (Twidale et al., 1994) applied to the specific case of MSS.

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