

Understanding the Relationships between Organizations and Information Technologies. The Role of Mapping

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Abstract. In a socio-technical approach, particular attention could be devoted to understanding the relationship between the social side (for instance the organizational charts, the processes) and the technical side (for instance the software applications and the hardware network) of the organizations.

In this activity the role of maps and mapping for describing the relationships between social and technical environment could be useful for exploring, recoding, fixing relationships and modifying social behaviour.

These topics are described through a cluster of experiences of my practitioner activities developed in large sized companies where exploring the context could be difficult and time consuming and maps could be a useful support. The paper focuses on the organizational structures and/or the role of people with reference to IT technologies and on the maps that described these relationships. For instance the relationship: user-application-support (hardware and people) described through an effective map has been useful for updating and for integrating the topics of the quality management in IT applications. Two experiences are presented: a success and a failure. In the first experience the integration of quality management requirements was successfully performed in an application already conceived for health and safety management systems. The second one, planned with a social approach in the design of an ERP was a failure. The lessons learned by both experiences are presented.

Keywords: Conceptual Modeling, Process Analysis, Socio-technical perspective, Ethnographic Approach, Mapping

1 Introduction

This paper describes the role of mapping to understand the organizations and in particular the relationships between people and Information Technologies. These topics are challenging in my practitioner activities that deal with the development of Management Systems, in compliance with the requirements of ISO (International Standard Organization) Standard on Management systems, in particular ISO 9001 [1] “Quality

Management Systems. and ISO 14001 “Environmental Management Systems. Requirements with guidance for use.” [2]. These Management Systems strongly interact with IT systems that support data and information management.

The methodological toolkits exploited in my activity encompass Conceptual Modeling, Socio-technical Perspective and an Ethnological Approach, that are described in [3,4]. In this paper I focus on the role of Mapping, proposed in [4] as support for my analysis.

I find some suggestions coming from different contexts helpful. In Section 2, I briefly discuss the role of maps not only to describe the environment but also as an effective way of communication, presenting the history Beck’s map of London Underground [5].

The experiences, described in Section 3, are a cluster of projects developed in the last two years in large sized companies. These projects have several common points: the commitment and the organization features, in terms of size, ownership and management approach. In these experiences several maps have been exploited to explore and to communicate. The focus is on maps applied to define the relationships between people and Information Technologies. Reflecting on these relationships, a success and a failure of these projects are described.

In Section 4, comparing results and lessons learned, I suggest that, even if the maps are an effective tool, the issues that influence a socio-technical approach could be several. I suggest that to increase its effectiveness, the approach requires also a set of iconic tools (including maps) which can be used as Beck’s map even to change behaviors and to improve communication. Future actions are briefly proposed in Section 5.

2 Methodological topics. Mapping

The methodological framework that supports my practice encompasses several topics that I summarize as Process Analysis, Socio-technical Design and Ethnographic Approach. They have been progressively introduced in my methodological toolkits and applied in the experiences presented in [3,4].

In paper [4] I described the role of maps (in term of any graphical description of an environment) to find ‘my position in the field’, from the ethnographic point of view. In this paper I would like to enlarge the analysis of maps focusing on the role of maps in describing the framework of complex relationships that drive the social behavior of organizations and suggesting they can play a role even in influencing and modifying the social relationships.

To introduce this topic I briefly present two examples: Beck’s mapping of London Underground and Christian Nold’s experiential mapping.

Henry Beck created the present map of the London Underground Tube in 1931 (Figure. 1). As described in [5] the map changed the strict geographical rules that impose an exact correspondence with the represented location and presented a regular pattern of horizontal, vertical and diagonal lines. The new ‘artifact’ clearly depicted the relative location of the U-tube lines and the sequence of stations.

The map, published by The London Passenger Transport Board (now Transport For London) in 1933, was a success: after two months more than 850,000 copies circulated and it became a model for urban transportation.

But the interesting point was that this map modified the inhabitant's perception of London territory, presenting an "increasing chaotic city as an object of coherence". It was an effective way of communication with the underground users, influencing their sensibility and behavior. In this sense the map could be considered as an artefact.

Maps could be conceived as windows for viewing the world, as artefacts to modify the world, as an art form for visualizing people's reactions to the external world. In the 'emotion maps' of Christian Nold, described in [6], the maps are emotional portraits of a location. In Nold's workshops, participants re-explore their local area with the use of a unique device which records the wearer's Galvanic Skin Response (GSR), which is a simple indicator of emotional arousal in conjunction with their geographical location.



Fig. 1. H. Beck's map (from <http://active.tfl.gov.uk>)

Maps support the ethnographic approach of my practitioner activities, as well. My activities are mainly performed through interviews and they are backed up by several types of maps: organizational charts, process maps, and hardware and software networks, information networks.

These maps are helpful tools to explore and to understand the environment. Figure 2 is a patchwork of some of the graphical tools that could support my practice and that are often the basis to explore the organizations and to define the relationships in my projects. In the paper I consider any type of graphical descriptions as 'map' to underline their role in an ethnographic approach.

In the following a non-exhaustive set of these maps is described:

- Organization Charts

- Business model
- Process flows
- Hardware network
- Software application network
- Plant layouts
- Data representation
- Risk analysis tools

Maps could be useful for exploring (for instance by means of conceptual maps), for recording (for instance the hardware network), for fixing relationships (organizational charts and processes), for tracking and modifying behaviour.

Particular attention, in a socio-technical approach could be devoted to the relationship between the social maps (for instance the organizational charts), the process maps, and the technical maps, in term of IT systems. To perform contextual inquiries of large sized companies these maps are always in my hand during meetings, workshops, interviews, audits.

Some maps have an iconic appeal. For instance the square of SWOT (Strengths, Weaknesses, Opportunities, and Threats) Analysis or the for process flows are immediately recognized by the participants. In some sense they are, as Beck's map, an effective way of communication.

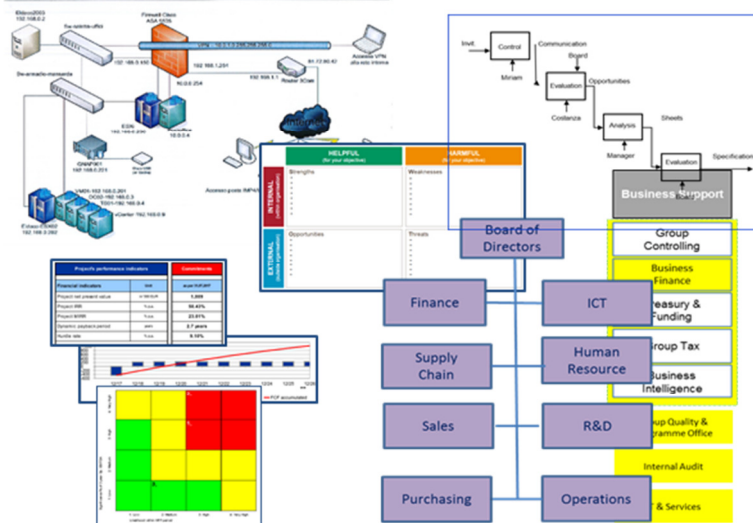


Fig. 2. Maps to explore the organizations

3 Experience. Management systems and ICT functions in large sized companies

The described experiences are a synthesis of the projects I developed in seven large sized companies in 2017 and 2018.

I summarize the methodological approach that has been presented in [3,4] and applied in these experiences, as well.

- The **Commitment** of my activity is the design and implementation of management system in compliance with the model of ISO standards. The standard requirements represent my Conceptual Modeling. In particular, due to the requirements of the new ISO standards, during the project I have to understand how the internal and external context is analyzed and considered by the organization and if/how risk management is performed. The process analysis is a key topic of my conceptual model, as well.
- My contractual interface in the companies is the 'Management System' function, usually identified as Integrated Management Systems (IMS) or Quality, Health, Safety, Environment (Q&HSE) function. In a **Socio-technical Perspective**, I try to develop my consultant activity through the involvement of all the functions that could contribute to the commitment. The involvement is based on interviews, meetings and workshops.
- Considering myself as an **Ethnographer** the first challenge is to understand my position in the organizational structure in order to plan the process of contextual inquiry [7] and for this reason I have to find answers to the key questions of 'How' to observe, 'Who' to interview and 'When' to involve people in the project.

As stated before, maps support all these activities in different ways. This paper details this topic and, in particular, focuses on the relationships between company functions and ICT functions. To describe these relationships, I present a mapping approach that has proven to be useful for describing them.

3.1 Characteristics of the large sized organizations

The cluster of large sized companies I worked with share several common features that are described in the following.

- The ownership is based on shareholders and the governance on board of directors (CEO, CFO, COO, etc.).
- The distribution of sites and markets is worldwide. My practice is in Italy, mainly with operation sites.
- The organizational structures are complex and often subject to changes through corporate projects that redesign the management approach.
- The complexity and the frequent changes of the organization make it difficult, even for the employees, to understand their 'positions in the field'.
- ICT management could be very far from my point of observation. My interfaces are often end-users or local functions, not involved in the strategic development of new applications.

3.2 The Projects

The projects, for the design and implementation of Management Systems have been developed in companies where I have never practiced before. For these reasons, understanding the social environment at a first glance has been very challenging and the support of maps helpful.

With reference to the methodological features, previously described, in the following the relationships between project steps and maps are briefly presented.

- **Planning the project with the Management System function. Practitioner: ‘observer’.** The maps in my hands could be high level descriptions of the governance and/or business model with the related organizational charts and process descriptions (diagrams, flows). With these maps, for instance, I could understand if the company is structured by market segments, by geographic area, by technology, by product and what are the relationships with staff functions and operations, with corporate and local structure, etc. The results of this phase are a plan of interviews with managers and/or of workshops with a project team.
- **Performing interviews and/or attending meetings. Practitioner: ‘observer-as-participant’.** The map’s inventory increase step-by-step because often the involved functions present their own map toolkit. For instance top management could describe the structure of the Business plan or of strategic risk tools by means of SWOT Analysis, Operation managers by means of plant layouts or manufacturing process flows. Progressively a network of relationships is sketched. The results of this phase are text notes and maps.
- **Defining a documented framework that connects the requirement of ISO standards with the company identity. Practitioner: ‘participant-as-observer’.** Several maps could be linked together and with management system tools. For instance the manufacturing process flows presented by operation functions could be exploited to develop an operating risks analysis and documented with operating risk techniques such as Ishikawa Diagram or FMEA (Failure Mode and Effect Analysis). (A detailed list of risk analysis techniques and related maps can be found in [8]). The result of this step is the construction of a network of links that could improve the internal communication.

In all the steps of the project I have to deal with IT systems and ICT functions, for several reasons.

The value chain processes, i.e. sales, supply chain processes, operation, logistics are fully supported and integrated with software applications. For instance the customer order process flows could be common in an ERP application and in a quality control plan.

Specific software applications could support the risk evaluations in the field of environment (for instance the measure of pollution impacts) and health and safety (for instance risk injury due to equipment misuse).

Furthermore, file systems, data warehouse, social network are repositories of information related to systems management, for instance procedures, instructions, guidelines.

In performing this analysis, several maps of relationships between IT and the functional areas have been presented and discussed. Among them, I describe a table (Fig. 3), shared with one of my customers, where a synthesis of these relationships has been effectively described. I collected similar descriptions in several other projects.

The map was presented by a software local support function during a meeting, when the project team was discussing the integration between software application (CRM, ERP) and ISO Standard requirements.

In the team the map was perceived as an effective way for communication (as Beck's map) and it was part of the success of the project.

In the map the Socio-technical relationships inside (and outside) the company are described in many directions through the link among Users, IT tools and IT supports.

The column 'WHO' identifies the users of the application. They could be external (Customer), internal as specific function (Sales, HR,) or generically identified as employees (All).

The column APPLICATION lists the types of the Information and Communications Technologies exploited in the company.

The rows WHO and APPLICATION are strictly linked. They could be related to the processes of a specific functional area (CRM for sales, E-Learning for human resources management, etc.), or exploited by all the functions (ALL).

The row with 'ERP' highlights a weakness: 'WHO' are not functional areas but two ERP applications. It is difficult to identify 'people' (managers/employees) as the actual 'WHO'.

The third set considers 'users' as 'all' and defines links with applications (DATAWAREHOUSE, Extranet, WEB). It highlights the increasing role of Social media in several organization processes. For instance Social media are implicated in Human Resources processes for recruitment, communication, training, on-boarding and team building [9].

The column SUPPORT, split in five sub-columns, identifies the resources that support the users. They are classified as internal (local and global) and external (supplier). A similar map, discussed in another company, linked the support to different types of users (end users, key users, business process experts).

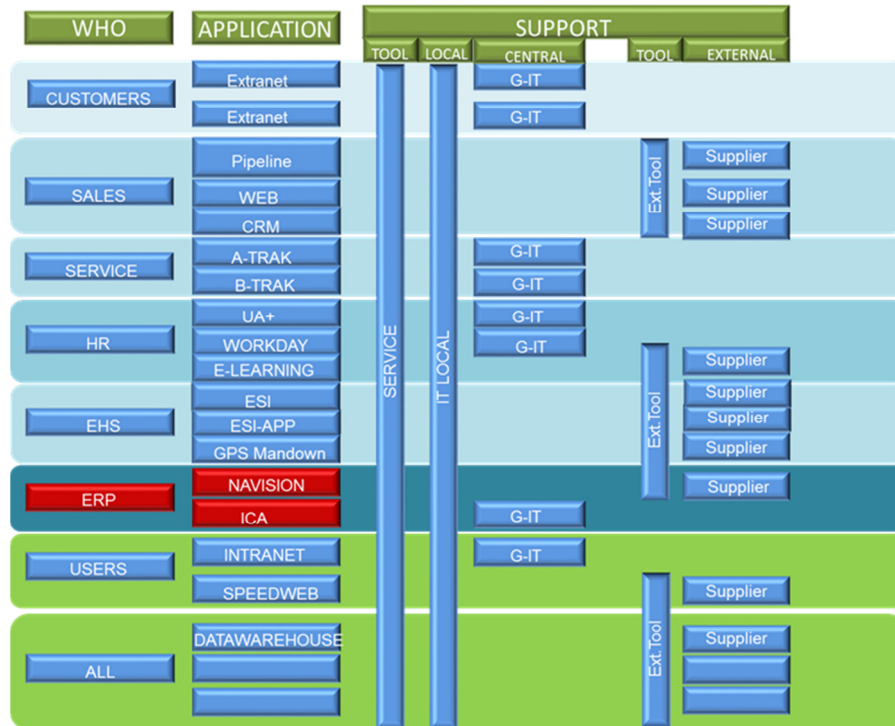


Fig. 3. Relationships between organization and IT systems

In the following I present, among the set of experiences, a success (Company A) and a failure (Company B).

Company A. Updating an area-specific application with users.

In Company A, where the previously described map was presented and shared, my interface and the project leader was the Manager of Health and Safety function, who had the role of IT internal support for the EHS Applications (ESI, ESI App, GPS Man-down), as well.

During the context analysis and risk evaluation, the project team met all the functional area (Marketing, Sales, Finance, HR, Technical service, etc.) and observed activities and processes.

Through this social approach several degrees of interaction with the IT applications were exploited taking into account the requirement of the project. For instance users interface and data structure were modified to record customer complaint management in CRM.

Due to the role of my interface, the team could suggest updating of EHS systems (ESI). This application was initially exploited only for Health and Safety Management, but through the project it was updated to encompass the new topics. The content and the exploitation of the application become fruitful for a larger set of end-users, who deal with quality management system. For instance the process analysis

finalized to employee safety was enlarged to take into account customer oriented processes and then including the points of view of different stakeholders.

This updating was possible because the project team, the application developer and I could interact and cooperate to re-design a specific software tool.

Company B. Exclusion from the project of the new ERP.

In Company B the project was developed with the same features in term of objectives and methodological approach, as in Company A. This new customer operates in a high technological field (testing equipment for microelectronics) with a complex and integrated management system, that include ethics, quality, environment, health and safety requirements. I had little time to plan and perform my activities (three months). In this project my interface was a manager with a high level of experience on management systems and with a deep knowledge on the company, but not directly involved in the IT area.

Even in this project the process maps were a useful tool. They helped me to quickly merge in the new context. My internal interface presented process/organization/IT maps that I used to explore, to learn and to share concepts with the involved employees. I sketched a framework of relationships among the management system and the processes.

The role of the IT applications that support the front-end and back-end processes was, as usual, a key point for the implementation of the management systems (CRM, design tools, customer order process etc.) and the analysis of that systems highlighted several (well known) weak points.

In the same period the company started a project to implement a new ERP application and the analysis phase almost overlapped with the context analysis of my project. The internal project leader proposed to top management an integration of the two projects and a common activity with two different suppliers. I found this opportunity very challenging and I accepted to share my methods and approach with competitors. A common activity plan was defined and a kick-off meeting defined, as well.

In this crucial phase, my customer interface and I were not able to quickly update the framework of relationships to include the IT requirements that we have defined during the project.

A few days before the kick-off meeting, the top management and the IT application supplier refused. Due to the priority of new ERP implementation, my project was stopped and I had no further feedback.

4 Results and lesson learned

My methodological approach, based on several toolkits was enriched by new mapping tools. In particular the table previously described is a good framework to describe the possible relationships among organizational areas, users, ICT specialists and IT systems.

The results of my projects are described focusing on the influence of my activities on Information Technologies and on role of maps.

The degrees of influence/modification of the projects I am following on IT systems could be classified as described in the following.

- **Low level.** The team takes the IT systems into account as reference for the management system but no modifications are produced by the project on them. For instance an E-learning application which records employee's courses produces documented information on job profiles that is an ISO 9001 requirement.
- **Medium level.** The project suggests/requires the updating of the IT systems. For instance a link between customer complaints and corrective actions management tools could be inserted in an existing CRM systems.
- **High level.** The project supports the development of a new IT system or the updating of an existing one. The IT system could be a specific application, such as a health and safety risk management tool or a system involving many processes and functions, such as an ERP.

But the use of the same methodological approach not necessarily could produce positive socio-technical results.

The described experiences are a synthesis of opposite results.

The experience in Company A was a success due to the possibility of sharing contents, methods and languages in a project team where all the 'social' side was composed by Management Systems and IT systems manager and users. This possibility was based on the cooperation with my customer interface and with the IT system suppliers. All the previously described degrees of interaction have been experienced.

Experience in Company B was a failure. Even in this case, the management system project was developed with a social approach. But the goal (I failed) was very challenging: in a short space of time I had to move from observer to participant position in a team where the project leader was a competitor and where the IT system involved several functions (ERP). The social design of a new Information system required a strong commitment and a broad vision of the top management that could also overcome the possible conflicts among practitioners of different areas.

Both the experience has been developed with the same methodological approach. Then: why so many different results?

I propose these points of discussion.

From the Ethnographic point of view maps could play an important role in exploring the context and to improve the communication inside and outside the project team. In some sense, maps are similar to icons: people catch their meaning without verbal descriptions. In the described experiences they played a crucial role even for a Socio-technical approach. If maps are able to cross-reference the different company identities, for instance business models, processes and IT systems, their support towards a social design could be effective.

The Socio-technical Perspective and the Ethnographic approach could be considered as necessary conditions to develop effective Management and IT systems. But the success of the approach is subjected to highly variable constraints.

If, as in case A, the practitioner finds the 'right' interface, that means a function that has competence and role to design and/or to update an application, the approach could be successfully applied.

If, as in case B, the constraints are less favorable the method shows some weaknesses that could be related to the lack of a defined and strong identity, easily recognized in the market scenario. This specific identity should include proper maps, acting as an iconic reference. In these cases, the 'traditional' approach for the IT analyst is evaluated by the company as more effective and then less expensive.

5 Conclusions and outlook

In paper [4] I highlighted the importance of shared methodological tools among different communities. These methods require a multifocal approach that involves educational areas and practitioners. The aim was to explore new way for transferring knowledge and skills, for instance gamification, simulation, practical stages.

In this paper I propose to add mapping as a useful way to understand the organization's environment, to modify social behavior and to improve communication, suggesting that specific Socio-technical mapping could be a strong reference as well.

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