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Extended Information And Decision Networks

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Abstract

In this article, we propose a synthetic model of information structuring and broadcasting within companies and around them. We insist on showing the relationships that must exist between network techniques, organizational structures and corporate human resources. The information systems conception method we present here permits to create ergonomic managerial decision helping tools. This paper is made in the continuity of precedent works dedicated to the building of corporate decision networks.

Keywords: **Networks, information and decision systems, protocols, corporate structures, corporate strategy.**

INTRODUCTION

It is necessary for any company to raise, stock, summarize and present more and more numerous and sophisticated information. This information, taken from external and internal sources, shall be used by many different people, for different purposes, at different levels of the organization. This implies that the information shall be centralized, but also that it is made available where and when it is needed; that is to say:

- some pieces of information will be useful at every level in the organization,
- some other will concern only several departments,
- the rest may be divided into specific parts, each part being dedicated to one single department or individual.

Once it has been correctly routed, information must be stored under a shape that will be easily usable by anyone. This is particularly true for managers in their deciders' role, as well as for all the persons who contribute to corporate management, in human resources, financial, marketing, sales or production departments.

During the two last decades, there has been an explosion of personal computer networks that has permitted to broadcast information and personalize applications; this trend was intensified under the influence of the Internet and its specific uses (intranets, extranets). Despite these evolutions, the quality and the reliability of information systems (IS) still depends on human attention, motivation and cooperation. So when the human dimension of these systems is somehow forgotten, we get powerful systems that are unable to give any accurate or useful information at all.

In order to avoid this kind of pitfall and to define performing decision helping tools, we will go through the following parts:

- show the relations that exist between information systems and information networks,
- identify the different points where human action and motivation are crucial,
- study the links between a corporate organization and the related information and decision network,
- describe the technical aspects and development stages of information and decision networks.

1. INFORMATION SYSTEMS AND INFORMATION NETWORKS

Originally conceived in a centralized way, generally towards accounting and finance, corporate IS have evolved to become decentralized and capable to adapt to different shapes of management. But though the processing, transmission and storage power provided to companies has been important and even sufficient since many years, we can hardly say the same about customized dedicated applications. Many mergers and acquisition have accompanied the rise of the market of databases and Enterprise Resource Planning (ERP) software (for example Oracle, one of the three major ERP vendors with SAP and Microsoft, now incorporates JD Edwards, Peoplesoft and eBusiness Suite).

The available technology and products seem to cover a large field of corporate management needs, but despite recent progresses, today's technical means still do not seem to answer the requirements of organizations that are in constant mutation, accordingly to more complex markets. Certain reasons for this inadequacy may be found in economic changes, but a large part of these reasons is to be seeked through the everlasting complexity of decision making processes that is normally attached to companies (NICKERSON, 1998), be they large or small, old or recent.

Information has always been an essential part in decision making processes, with or without computing means. As formalized and computerized IS have progressively become the main access to information, they are now considered as essential (HOOK, NORMAN, WILLIAMS 2002). The same process is now in progress concerning the way everyone accesses to knowledge; though the internet is only a media, it's also becoming the main one.

It's in this way that IS can be considered as primordial and touchy elements in today's economy:
- they are obviously important, since they condition the awareness, the work processes or even the evolution of organizations,
- they are also very fragile, as many parts and levels may encounter failures while all these parts and levels are necessary to keep them operational. Just as chains, their effective resistance will be measured by the resistance of their most fragile element.

In order to take these aspects into account, we propose here some principles for reliable IS creation and maintenance. These principles concentrate more accurately on avoiding the apparition of weak points, from the choice and acquisition of raw information, to the conception of decision tools and applications.

Another threat must be noticed at this point; a well conceived and efficient IS to which one provides some erroneous information will lead to misjudgments. That's why it is useful to formalize and add a set of principles that have to be enforced in order not to lose one's efforts by forgetting one single ring of the IS chain, even if this ring is outside the scope of the technical part:
- Situation assessment: study of the context, constraints and means
- Conception: objectives and guidelines definition
- Options setting and choice: type of system, devices and optional components
- Implementation: investment, installation
- Operating and monitoring phase: begin to use the system and observe how it works.

The objective here is not to lean on the usual systemic approaches of organizations (MINTZBERG, 1979, PORTER, 1980), but to insist on units that compose them (MARCEAU, TREMOLIERES, 1999). We describe ways to limit risks that are due to distortions and bad uses of information.

We notably give a major importance to individuals that compose organizations. When it comes to IS development, we focus on three related elements:
- people,
- structures,
- technique.

There are usually very few people in organizations being responsible simultaneously for these three elements. They usually represent separated management domains, though the relevance and efficiency of organizations comes from the harmony and synergies that may exist among people, structures and techniques. Indeed, the data required for a company to operate and develop properly proceed of particular circuits, or Information and Decision Networks (IDN). These IDN being made of the three elements mentioned above, one can identify at each IDN level, one of the three or one combination of the three.

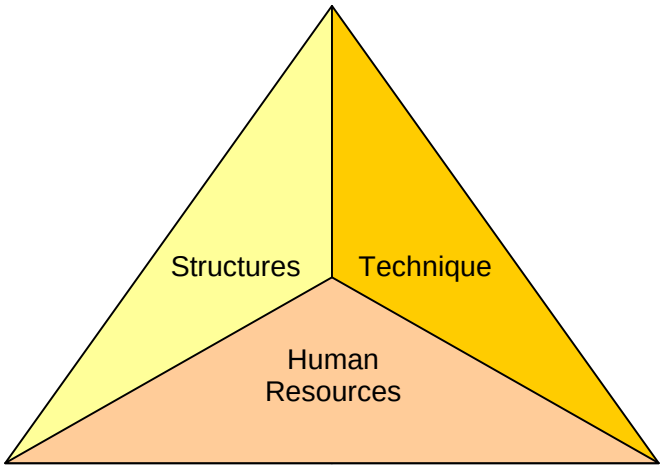

Fig. 1: The three main IDN components

2. INDIVIDUALS AND HUMAN NETWORKS

IDN shall be fed from many different sources covering a big diversity of place, time or nature, but also including an important common characteristic: all information that these sources provide are produced and typed by people who may work in good or bad conditions, with or without attention, with or without a personal interest. This aspect of IDN can be specified not only to recall the importance of individuals within the organization, but also to show the settling of a personal relationships network between individuals. At this stage, we can notice that the fluidity of data streams is directly proportional to the quality of these personal relationships.

In order to create favourable conditions for the elaboration, the development, the relevance and the everlastingness of the IDN, one has therefore to pay attention to the following points:

- ergonomics of the technical media (work stations, hardware and software interfaces…),
- users training,
- continuity of work conditions in time,
- time needed by individuals to adapt to changes that the IDN imposes or that may occur at the same time in their work in general
- will and satisfaction of those who provide the information (through profit-sharing, knowledge of the system, confidence in the company and its management…),
- relations between the people who are involved in the implementation of the IDN (those who generate information and those who type this information for example).

Taking these human aspects into account should help to avoid what is often considered as a fatality by IS administrators:
- slowness and imprecision of seizures,
- dismissal from certain tasks,
- resistance to change,
- performances decrease or department blockage every time new version of the system is implemented,
- information partitioning,
- retention or distortion of information…

3. CORPORATE STRUCTURES AND IDN STRUCTURES

As IDN are necessarily structured, there must be a consistency between:
- an organization's structure
- and its IDN's structure.

This consistency has to be established during the IDN project definition. The IDN's structure has to be flexible enough to adapt to the coming changes in the organization, which are practically unavoidable in a mid-term as in the long-term, for many objective or subjective reasons (STREET, GALLUPE, REICH, 2010).

Therefore, the structuring of an IDN must particularly take into account:
- continuous data acquisition and update,
- several levels of data validation (corresponding to the levels of data entry in the system),
- routing of data toward a concentration point, which may be preceded by a set of intermediate points,
- automated data processing that avoid the duplication of seizures (this phenomenon appears very often, usually because of a lack of conscience of the paths that data actually go through),
- identification of the main points where a human intervention will regularly be required.

These points show the importance of the structural consistency evoked before. Now we are going to examine the conditions of this consistency and of the system's everlastingness.

The capacity of mutual adaptation of the structures (technical and corporate) implies a certain flexibility level of both structures. This flexibility is obtained in both cases in a similar way, although these structures are very different from each other.

A corporate structure may be organized, for example, as a set of Strategic Business Units (SBU), each SBU being made on similar bases, which means having quite the same departments and a certain internal homogeneity among them (ABELL, 1980, CHARNES, COOPER, RHODES, 1979). The SBU may then be arranged according to a modular scheme that allows fast reengineering with the minimum of disruptions. These disruptions are essentially represented by employees' tasks disruptions, which can be avoided thanks to a good continuity of task definition within the new structure.

The same modularity has to be designed and kept within the IDN's structure, in order to allow the same kind of reengineering among the elements that constitute the IDN, without having to modify the elements themselves.

From a larger point of view, we can generalize these principles of an IDN's conception:
- definition of homogeneous corporate entities including structural aspects or parameters that will be used to tune their eventual definition,
- design of the whole IDN made of these entities and of technical parts, focusing on a flexible but ever consistent structure, and taking care of the links, relations and information flows between entities.

This general view meets notably the object oriented programming's principles. Of course, it has given great improvements in data processing, as well as many errors in human resources management, as we saw in Microsoft's story in the early eighties (CRINGELY, 1992). This was called "metaprogramming". Actually, we cannot say this was totally irrelevant, but rather that it was inappropriate in such creative activities, and even that the above statements were not completely enforced: links and personal relations in particular had obviously not been correctly evaluated; no relevant IDN was settled.

The IDN's flexibility must be definitely evaluated so that the organizational changes never become superior to its adaptation capacities. This implies to make business forecasts when choosing the system, while many people commonly focus on technical issues. Another point to be considered is the fact that every piece of information can be needed in different contexts. Therefore data should never be put only in a frozen document, but in a database; this tool and the corresponding formats being highly flexible as we will see in the next part.

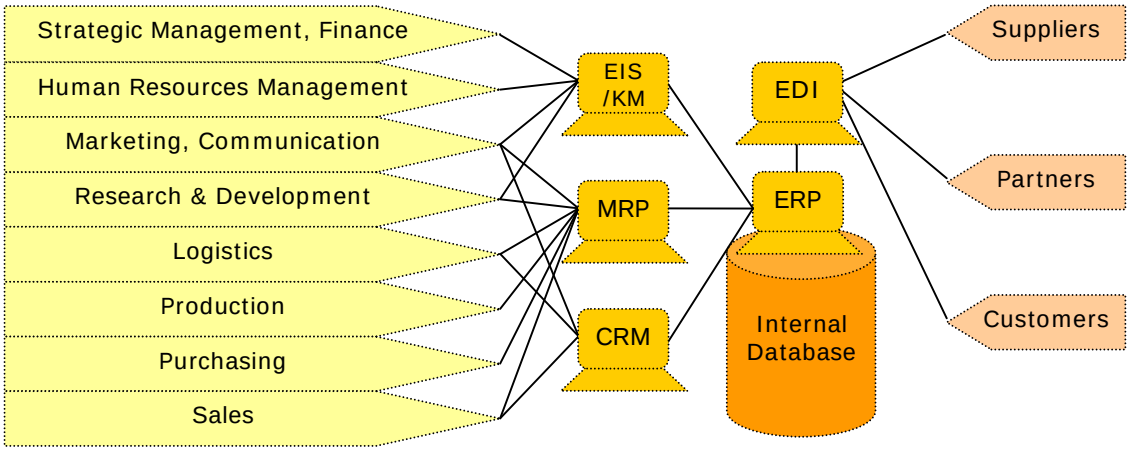

Fig. 2: IDN's technical subcomponents [(1)]

[1] **Legend**
EIS/KM: Executive Information System / Knowledge Management
MRP: Manufacturing Resource Planning
CRM: Customer Relation Management
EDI: Electronic Data Interchange
ERP: Enterprise Resource Planning

4. SCHEDULING OF AN INFORMATION AND DECISION NETWORK CREATION

The needs of each entity that constitute the organization may differ, but shall imply the stages described below. Even if the nature of the development stages of an IDN varies from an organization to the other, the order in which they occur should be the same:

- identification of topics and activities that will be concerned (production, finances, market, competition...),
- definition of necessary data on previously identified topics (quantitative or qualitative, objective or subjective, essential or secondary...),
- validation of the available information sources (internal or external, reliable or doubtful...),
- specification of data acquirement mode (integration of existing records, real time seizure...),
- formalization of exchange and transmission procedures between all the physical and logical points of the system (network architecture, updates frequency, control levels...),
- description of the concentration points and of the actions to make at these points (registrations, storages, compilations, new validations, sortings, reportings...).

The last point leads us to the first levels of processing: raw data transformations aiming to shape these data and make them usable by certain final users (BLAHA, 2001). At this stage, there is still no advanced processing that we name applications (for example ERP or CRM). Each application is usually dedicated to a corporate department, but the definition of each department may vary from one organization to the other.

A confusion between these elements may occur, as software editors have always been willing to sell complete solutions (MURPHY, SIMON, 2002), which gives them at least two advantages:

- make more business with the same customer and
- control every stage and level of the system which means not to depend on errors made by another supplier.

We may though distinguish the different technical parts in an IDN:

- physical components or hardware (servers, network, stations)
- design (architecture, topology, structure)
- basic features and programs (network protocol, operating systems)
- database (DBMS: DataBase Management System, or RDBMS: Relational DBMS)
- user applications (data acquisition forms and automated queries dedicated to the implemented DBMS, and: office suites, mailing systems, etc…)

The concentration of information and the first actions made in parallel of this concentration enforce the databases principles. Databases constitute a model of organization of information that is especially useful here, given the rigor that it imposes and the flexibility it offers, in terms operating as of evolution capacities.

When discussing about these issues, one must be careful not to mistake databases with banks of data, that just gather information on a certain topic or for a specific use, but without any particular rule; this kind of tool being far from the techniques we described as parts of DBMS.

A database is an active part of the IDN, that is to say a part where information can be transformed: raw data entered at this level are then structured, before they are used in the generation of reports (MARCEAU, 1997).

The elaboration of a database implies the following steps:
- Conception or choice of common supports and formats that will be used for all information, which does not mean necessarily that these formats will be uniform; they will however allow the storage of a large variety of data (in the two last decades, this diversity was extended to pictures and sounds, though texts were the only type of information used at the beginning).
- Data arrangement in tables, that is to say under shape of rows and columns (double entry tables): fields define columns, registrations define rows.
- Reservation, in every table, of a field as the primary key of the table: the index that differentiates every registration from the others.
- Systematic research of raw information uniqueness; the redundancy of information being contradictory to database principles (particularly inside a table, except if this redundancy represents information in itself and is then managed through to the primary key).
- Tables structuring and mutual linking.
- Drawing of processings (that are used for modifying tables or even the tables' structure automatically, to update registrations, etc.).
- Definition of database queries (which includes sortings, automated data selections according to certain criteria sets and other manipulations; queries results generally appear under the shape of new tables).
- Preparation of detailed reports: information formatting; information here being a query result. This is the end-user's part: he or she may use data for various purposes (analysis, official presentations, printings, etc.).

Thus, the functions of an office software as a spreadsheet are sufficient to achieve some simple databases, under the condition of respecting the above rules, especially the one that imposes the distinction and the strict separation between:
- raw data and
- the different results coming from their processing.

It must be stated very clearly that the multiplicity of basic processings, queries and reports is strictly distinct from the uniqueness of data tables within the referential database. The point is not to confound tables coming from a query with the referential tables that constitute the database itself.

Many companies encounter organizational difficulties when they try to gather and structure the activities and competencies that correspond to IDN's requirements, especially because of the gap existing between these competencies. That is why some consulting companies have created a division dedicated to this activity; it was the case for Arthur Andersen who made Andersen Consulting (renamed Accenture in 2001).

CONCLUSION

Although information systems are nowadays seen strictly as technical tools, they obviously depend on two other important elements: corporate structure and human resources. Information coming from inside and outside companies systematically go through the three elements of corporate information and decision networks. IDN shall effectively be named this way as far as they are conceived and used to make the three elements (people, structures and technique) operate harmoniously together.

Once the information has been generated, acquired, validated, routed and treated through an IDN, it becomes usable for decision making. But in order to become an efficient help in decision processes, it must be interpreted. The interpretation can be made directly from the given figures, amounts or rates, or may depend on certain models that will have to be transformed into software tools in order to automate the repetitive aspects of the decider's analytic work.

Management models and the corresponding software decision tools can constitute a toolbox that accompanies naturally in their daily work the people responsible for operational or strategic decisions; as long as these deciders do not mistake those means with the aims they have to define and assume.

While providing formalized processing and automated representations of management problems, IDN play the role of a hyphen between theory and practice of management. However, to make the work of management theorists and experts useful to patricians, it is essential to keep it user friendly, practical, ergonomic, and even esthetical thanks to an appropriate use of information technologies.

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