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A soft systems approach to construct an information system to organise knowledge production and dissemination, in Mexico's General Hospital.

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Abstract.

The purpose of this work is to present the preliminary results of a research in progress on the development of an information system and model so as to organise and disseminate the knowledge production in Mexico's General Hospital (MGH). The final goal is to support decision making processes related to science policy and public communication of science results. MGH is a major teaching hospital in Mexico. Located in Mexico city, MGH provides health care services to un-insured population through 36 medical specialties, 6400 staff, and 931 hospital beds. Seventy researchers conduct basic and applied health research throughout 160 registered protocols on a yearly basis. While productivity of this research is being monitored in MEDLINE, no clear picture exists as to the impact of this production; its interaction with other hospital outcome indicators; and the dissemination of this production at the local and institutional level. The above was perceived as a *problem situation* by the head of the research unit at MGH. A soft systems approach (Checkland and Scholes, 1990) was used to construct a *rich image* of the situation so as to identify the elements involved and to take action. Donabedian's (1988) model to quality of health approach was used to identify the levels of resolution of the model and to identify the quantitative and qualitative indicators involved. Quantitative indicators included MGH statistical rates, and bibliometric indicators of the scientific production. A literature search was conducted in six local and international databases so as to identify the visibility and impact of MGH production. Qualitative indicators will be obtained through semi-structured interviews to researchers. Preliminary results included a *rich image* of the situation, indicating information flows, interactions, and lack of communication of subsystems at different levels of the model. Bibliometric indicators identified the impact of the production at the local, regional and international levels; and

helped to nourish the construction of a model of communication of science in the health field (Macías-Chapula, 2002; Macías-Chapula, et al, 2004). Results will support the development of the ad-hoc information system for the research unit of MGH; and will help to define the science policy lines that the hospital will take in the near future. The authors will discuss the implications of this study in a knowledge society context.

Keywords

Soft systems methodology; Systems analysis; Models; Information systems; Bibliometric studies; Indicators; Scientific production; Bibliographic databases; Mexico; Mexico's General Hospital; Knowledge organisation; Knowledge society; Information management.

Introduction

Differences in national histories, cultures, political contexts, and the timing of a country's entry into the industrialisation process, are some of the issues reflected as diversity among countries in their policy doctrines, and also in the performance of science and technology policy (Lemola, 2002). Much of research on science and technology policy has been directed towards the search for variation rather than congruence in the structure and behaviour of national policies, or more largely national innovation systems. Several authors have pointed out that public policies tend to follow certain nationally and historically rooted trajectories which frame the choices of individuals and organisations (Nelson, 1993; Lundvall, 1992; Freeman, 1987; Ergas, 1986; Nelson and Winter, 1982).

At present, our society is increasingly influenced by science and technology developments, including modern information and communication technologies (ICT). Health care has profited greatly by this development (Anderson and Aydin, 1997). According to Haux, et al., (2002), three major goals requiring achievement have been identified; these are the following: (1) patient-centered recording and use of medical data for cooperative care; (2) process-integrated decision support through current medical knowledge; and (3) comprehensive use of patient data for research and health care reporting. These goals however do not contemplate other actors involved in a given health information system, located at different levels of resolution. For example, the information needed by the patient; and the information needed by the health policy makers to support decision-making processes on science policy. In consequence, health institutions should provide an integrated framework for networked, patient and managers centered health information systems.

Knowledge management in a broad sense is a business concept, which includes concerted, coordinated, and deliberate efforts to manage the organisation's knowledge through the processes of creating, structuring, disseminating and applying it to enhance organisational performance and create value. The knowledge management strategy of an organisation is predicated on shared learning, collaboration, and the sharing of knowledge (Holsapple & Singh, 2001; Liebowitz, 2000; Quinn, Anderson, & Finkelstein, 1998; Hibbard, 1997; Nonaka & Takeuchi, 1995). Furthermore, it is based on the belief that significant organisational productivity improvements can be achieved through retaining and reusing knowledge across the organisation.

Knowledge management involves the strategies and processes for identifying, capturing, structuring, sharing and applying an individual's or an organisation's knowledge to extract competitive advantage and create sources of sustainable growth (Alavi and Leidner, 2001; Holsapple, 2001; Liebowitz, 2000; Davenport and Prusak, 1998; Nonaka 1995). The health care industry is increasingly becoming a knowledge-based community that is connected to hospitals, clinics, pharmacies, and customers for sharing knowledge, reducing administrative costs and improving the quality of care. Thus the success of health care depends critically on the collection, analysis and seamless exchange not only of clinical and billing information within and across the organisational boundaries (Jadad, 2000; Kohli et al, 1999), but also on the organisation and management of the production of knowledge at the institutional level.

Information management can then be characterised as organisational document or content management. Knowledge management on the other hand treats knowledge as a resource by exercising selectivity, imposing order on information resources, adding structure to ill-structure information -such as the insights, understanding, and intuition of experts for solving specific problems- to increase its value, and proactively capturing information that might be useful in the future (Bose, 2002).

Clearly, information access and impact is one of the main issues discussed in the assessment of quality of health care (Donabedian, 1988, 1990). The actors involved in this process include patients, doctors, managers, researchers, and policy makers, to mention only a few. New ICTs have influenced on the decision-making processes of such actors. Patient access for example to appropriate Internet sources has found technical support to improve their health

status. Physicians on the other hand have access to electronic libraries and services to support health interventions. In this context, new ICTs influence on the quality of health care through information management and knowledge organisation systems.

Mexico's General Hospital (MGH)

MGH is a major teaching hospital located in Mexico City. Financed by the public sector, MGH provides health care services to un-insured population through 36 medical specialties, 6,400 staff, and 931 hospital beds. The hospital' research unit integrates 70 researchers, who have registered 160 research projects for the period Oct., 2003-Oct., 2004. Research output of these projects has resulted in approximately 30 publications covered yearly in MEDLINE. The hospital also provides continuing medical education courses and allocates over 400 resident doctors at the level of speciality. MGH has incorporated new ICTs through the development of an electronic library and the automation of library processes and services to in-house users. The five major causes of death reported by the hospital for the period 1999-2003, were the following in descending order: neoplasms, diabetes mellitus, liver cirrhosis, pneumonias, and AIDS. These diseases accounted for 41.11% of the hospital's mortality rate in that period (Macías-Chapula 2004).

The problem situation

Currently, seventy researchers in MGH conduct basic and applied health research throughout 160 registered projects on a yearly basis. While productivity of this research is being monitored in MEDLINE, no clear picture exists so as to measure the impact of this production; its interaction with other MGH outcome indicators; its relationship with the definition of the hospital's scientific policy; and the dissemination of the hospital's scientific production at the institutional, national and international levels. The above was perceived as a *problem situation* by the head of the research unit at MGH. The following questions emerged from a preliminary analysis of this situation:

How is the hospital's scientific production (both, national and international) being identified, organised, and disseminated?

How is this knowledge being used by the health system actors so as to impact health care processes, health education programmes, and health research projects?

How to relate the current hospital's scientific production and the hospital's mortality rate?

How does the hospital's research unit incorporate existing indicators into the definition of the hospital's research policy?

How can the hospital organise and manage institutional scientific and technical information so as to impact on its outcome indicators?

Purpose

The purpose of this work is to present the preliminary results of a research in progress on the development of an information system and model so as to organise and disseminate the knowledge production in Mexico's General Hospital (MGH). The final goal is to support decision making processes related to science policy and public communication of science results.

Methodology

A soft systems approach (Checkland and Scholes, 1990) was used to construct a *rich image* of the situation so as to identify the basic elements involved in the problem situation detected and to take action. In this process, the elements included (1) the identification of the different participating actors, including patients; (2) the clients of the system; (3) the transformation processes needed to improve the existing situation; (4) the *world-view* of Gibbons' social claim to science (Gibbons, 1999); (5) the owner of the system; and (6) the considered environment.

Donabedian's (1988) model to quality of health care approach was used to identify the levels of resolution of the model and to describe the quantitative and qualitative indicators involved. The levels of resolution considered were those of the hospital's structure, process, and outcome. Quantitative indicators included MGH statistical rates, and bibliometric indicators of the scientific production. A literature search was conducted in the following six local and international databases so as to identify the visibility and impact of MGH production: MEDLINE, LILACS, ARTEMISA, PERIODICA, CLASE, the Institute for Scientific Information's National Citation Report (NCR). Qualitative indicators will be obtained through semi-structured interviews to researchers.

Results

A *rich image* of the situation was obtained. Figure 1, shows this image; here, the different elements involved and the existing information flows among the actors are described. This

image derived from the system analysis at the first and second levels of resolution, where both the structure and processes involved are considered.

The scientific production of the hospital for the period 1990-2003, accounted for 1,647 publications. The visibility of the hospital in secondary sources of information is described in Figure 2. Here, the international visibility of the hospital in MEDLINE, LILACS, and NCR is described, and provides impact indicators to support decision-making processes on this line of analysis. On the other hand, results indicated that half the production is disseminated in local databases like CLASE, PERIODICA and ARTEMISA. A major effort is needed to incorporate this knowledge into the mainstream literature.

The actions taken to organise the above mentioned bibliometric indicators included the design and development of an institutional bibliographic database of MGH' knowledge production. This was conducted alongside the construction of an observatory of Mexico's scientific production in the health field. This was regarded as necessary in order to obtain the institutional benchmarking of the health scientific production at the national level. Further analysis of the model is needed at different levels of resolution, in order to define the scientific policy of the hospital and to improve MGH mortality and performance indicators.

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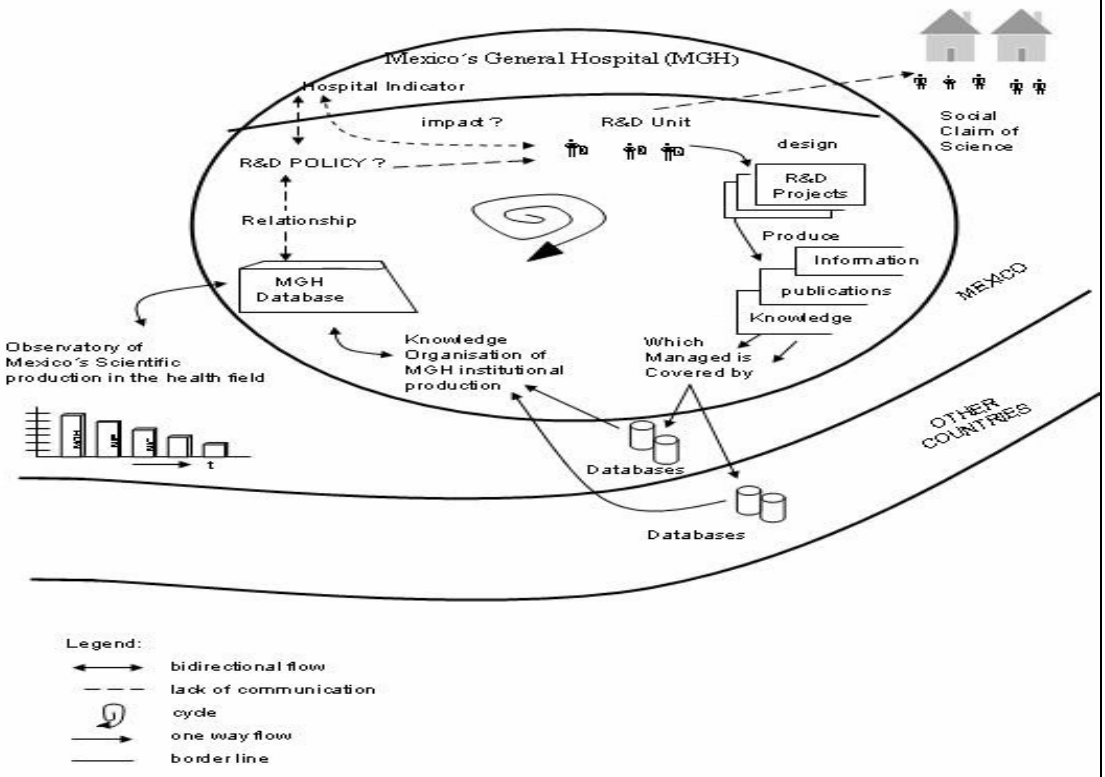
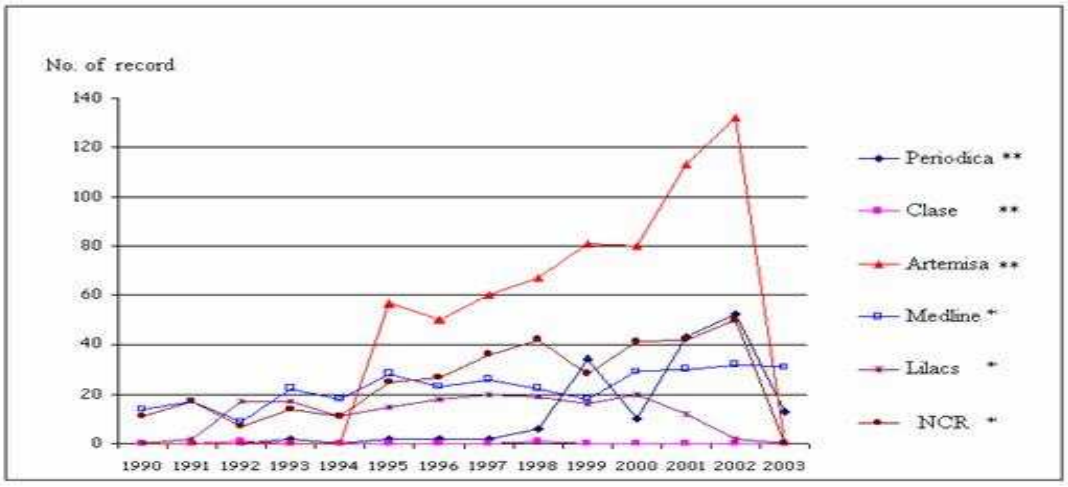


Fig. 1.Mexico's General Hospital. Rich Image at the R&D problem situation analysis.



* International database
** Local database

Fig. 2. Mexico's General Hospital scientific production and visibility in six local and international databases (1990-2003)