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Sources of Technological Innovation in Health Care Services

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Abstract

Technological innovation became one of the biggest sources of competitiveness in major sub-sectors of services. In what concerns health care services business, evidences are much more diffused, because the ownership of the business could influence the objectives in terms of competitiveness, costs and service quality. Additionally, the concept of technological innovation is very wide, if we consider new medical equipment devices, new pharmaceuticals, new ways of contact with patients / clients, or new work processes. This paper intends to define a broad approach, in theoretical terms, to the different sources of innovation technology that could create additional competitiveness to the health care services business. Another important field to explore in this paper is to try to evaluate the impact of technological innovation in the different parts of health care business. Probably the impact of technology innovation in a major hospital surgery centre is very different from a dentist consultancy office, in terms of client's satisfaction, costs, investment or training expenditures. Networks inside and around health care organisations are also part of this complex evaluation, particularly because innovation to be well succeeded needs to be adopted by the networks. Findings from this paper will help to define clearly sources of technological innovation and its relation with different types of health care service, which allow in a near future to know more about the relation between technological innovation and competitiveness in the different parts of the health care service business, and also in different types of ownership.

KEYWORDS: Health Care Service, technological innovation, competitiveness.

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Introduction

Importance of the health care service industry is increasing, year after year, everywhere, if we consider the costs by itself, or the percentage of costs versus the GDP. Like Herzlinger (1997, p. xxiv) says, "the largest service industry in the United States, whose costs stand about a trillion dollars a year". If we consider Europe, possibly we stand with same approach in terms of importance and costs, nevertheless with a different concept of health care service.

Like other services industries, health care service relies heavily on technological developments, but as mentioned by Coddington *et al* (2000, p. 78), new medical technology is the main factor driving health care costs for payers, in what concerns USA. European Union have dedicated additional attention to the public health, since the Maastricht Treaty of 1991, and particularly in a special effort to the coordination of health technology assessment at a European level. Banta *et al* (2000) referred about the technology on health care, "while health care has become increasingly effective during last decades, evidence has gradually emerged of substantial ineffective technology, as well as overuse and inappropriate use of health technology".

If we try to analyse the implication of technology in some services industry, it exists several research saying that the relation is positive, in terms of competitiveness. In what concerns health care services, the relation is difficult to establish, because this particular business is not seen as a business, like Herzlinger (1997, p. xiv) says "oh sure, you can find the cost of an aspirin, but what is the full cost of caring for a cancer patient? An AIDS victim? A premature baby? The quality of that care? Its convenience? Its effectiveness? Nada."

Yasin and Yavas (1994) say something that will help us to recognise the lack of business orientation in the hospital, even in the USA, "Hospital administrators do not understand the relationship between quality, cost and profit. They adhere to the traditional view that high quality translates into high costs and reduced profits".

Another aspect that could bring additional problems when we try to relate technological innovation and competitiveness in health care services, it is the ownership of the organisation. We can find several types of ownership: private (in the stock market or not), public (owned by the state government, or by the regional authorities, or by the municipalities) and co-operative or mutual (profit or non-profit oriented). If we go deep, we can find again several types of non-profit organisations, like religious organisations, professional organisations (normally based in Physician's associations), general non-profit organisations (like unions organisations), etc.

We will develop a global list of sources of technological innovation and it's meaning, in what concerns health care services, in order to define in a future research the possible relation between each source of technological innovation and the competitiveness it brought or not, for the different type of ownership of the health care organisation.

Technological Innovation

Tidd *et al* (2001, p. 37) referred "Edison appreciated better than most that the real challenge in innovation was not invention – coming up with good ideas – but in making them work technologically and commercially". This gives us an idea that innovation is

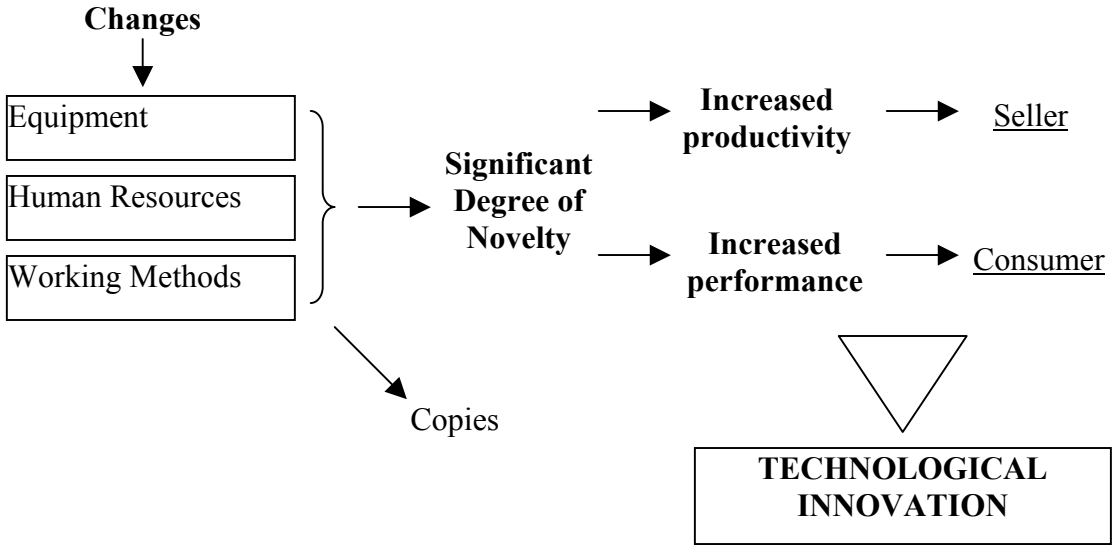
more than just an invention, and particularly relies basically in new knowledge, which will be developed in a technological base and this development will be conducted by the customers' needs, which ultimately will support the future commercialisation of the new product or service (or process). Common sense try to explain innovation from the words, "big idea" or "great invention", which does not represent possibly a great part of innovation arriving to the markets, like the small ones that strikes our lives almost everyday. To reinforce this idea, Tidd *et al* (2001, p. 39) referred "in fact, some of the most famous inventions of the nineteenth century were invented by men whose names are forgotten; the names which we associate with them are the entrepreneurs who brought them into commercial use".

In another perspective, Bell and Pavitt, edited by Haque, put the question of innovation in different terms, particularly because its research is more related to countries competitiveness benchmarking. And they referred that, in practice, the process of innovation and diffusion is hard to distinguish. For these authors, innovation is the development and initial commercialisation of new technology; in what concerns diffusion, it is the application of readily available and transferable technologies. Nevertheless, diffusion includes also a process of continuing incremental change, after the initial acquisition of the technology. It is in this specific point, that sometimes diffusion assumes some similarity with innovation, because incremental change in a second stage development for an acquired technology could be seen as a pure innovation.

The definitions brought by the Oslo Manual, about collecting data on technological innovation gave us a good support to separate clearly some real changes from the ones that are real copies, like the one mentioned by the Manual, "for example the purchase of further copies of IT equipment of a model already installed somewhere in the firm". In this Manual, we can find the concept of technological product and process innovation, from the idea that a firm can make changes in its methods of work, its use of factors production and its type of output, but these changes needs to be related with productivity and even, commercial performance of that firm.

In service industry, changes can come from different processes, different intangible knowledge, like the one provided by training, from information technology, like new software, but it is important, according to the Manual, that these changes needs to have a significant degree of novelty for the firm. Changes could come from equipment, human resources, working methods or the combination of these. But one key concept brought by the Oslo Manual, concerning technological product or process innovation, is the necessary impact in terms of productivity, of the technological innovation, or in terms of increased performance according to the consumer. In this case, it is important to analyse the opinion from the side of the seller and from the side of the consumer. Another important aspect to take additional care, it is the setting of performance characteristics according to a defined industry (health care has a performance characteristics profile different from manufacturing textiles or from financial services). Finally, it is important to have that performance characteristics related to a specific market, because the perception of innovation technological is different from, for instance, a developed country to an underdeveloped one.

Figure 1 – Technological Innovation Dynamics



Porter (1990, p. 45), in its study about the creation of competitive advantage, defined innovation as, "to include both improvements in technology and better methods or ways of doing things". And these innovations could be, according to Porter, product changes, process changes, new approaches to marketing, new forms of distribution, and new conceptions of scope. And Porter, (1990) goes on the opposite way of common sense, saying, "Much innovation, in practice, is rather mundane and incremental rather than radical. It depends more on a cumulation of small insights and advances than on major technical breakthroughs ".

Through Geoff Easton, edited by Ford (2002, p. 137), we can view technological development and innovation with different eyes, when he refers "these processes (invention and innovation) occur between firms and not solely within them", which gives us the opportunity to envisage the complexity of networks inside and around the health care organisations, that could create or not, additional competitive advantage through technological innovation.

The impact of technological innovation in health care services, particularly the new role of the Internet and the development of clinical information system, is huge. Andrew Grove, cited by Coddington *et al* (2000, p. 146), referred "We are in a period of major change that is dictated by the fact that consumers of health care services are ahead of the profession in their embrace of electronic means of getting information, participating in support groups, handling transactions and communicating". The processes in the health care services will be redone in a tremendous speed and impact, sometimes with the process without human touch. The Institute for the Future, (1999, p.5), see the near future like this, "Overall, the future of the Internet in medical care is that of a venue for real care management of many varied types, mostly achieved remotely and with a minimum human intervention".

Jonsson *et al* (2002, p. 218) gave their concept of technology, connected with health care: "is broadly defined to include the drugs, devices, medical and surgical procedures

used in health care, as well as measures for prevention and rehabilitation of disease, and the organisational and support systems in which health care is provided".

Health Care Services

Trying to define clear boundaries of health care services could be not an easy task, because like Coddington *et al* (2000, p.60) referred, "the sectors of health care showing the most growth in recent years have been drugs, nursing home care, home health, and other services (for example, personal care, administration)", which gave an idea of a big mixture of services inside the umbrella of health care services.

Lovelock *et al* (1999, p. 314), analyses the core product of a health care insurance in this form, "The core service, (…) includes a personal advisory team, health information line and immediate access to private healthcare treatment". Giving an explanation, later on, about the health insurance coverage: inpatient and outpatient treatment, use of private ambulances, home nursing, overseas medical care, psychiatric treatment and dental cover.

Hospital, surgery centre, HMO (Health Maintenance Organisation), CT (computerized axial tomography), MRI (magnetic resonance imagers), X rays, regional anaesthesia, coronary angioplasty, prevention, pharmaceuticals, etc. are common words that represents parts of the health care services, some of them with a young age, some other will loose importance through the technology obsolescence.

Another way to analyse health care services, comes from the simple idea of primary care and secondary care. The role of primary care becomes more and more important, specially, in what concerns prevention, aid in the community and immediate help. Secondary care is much more connected with surgery centres and specialized clinical care, normally located in big hospitals. After this simple picture, we can find several specialised care, like long term care, very connected with elderly and injured people, rehabilitation care, centres for treatment of drugs, child care, etc.

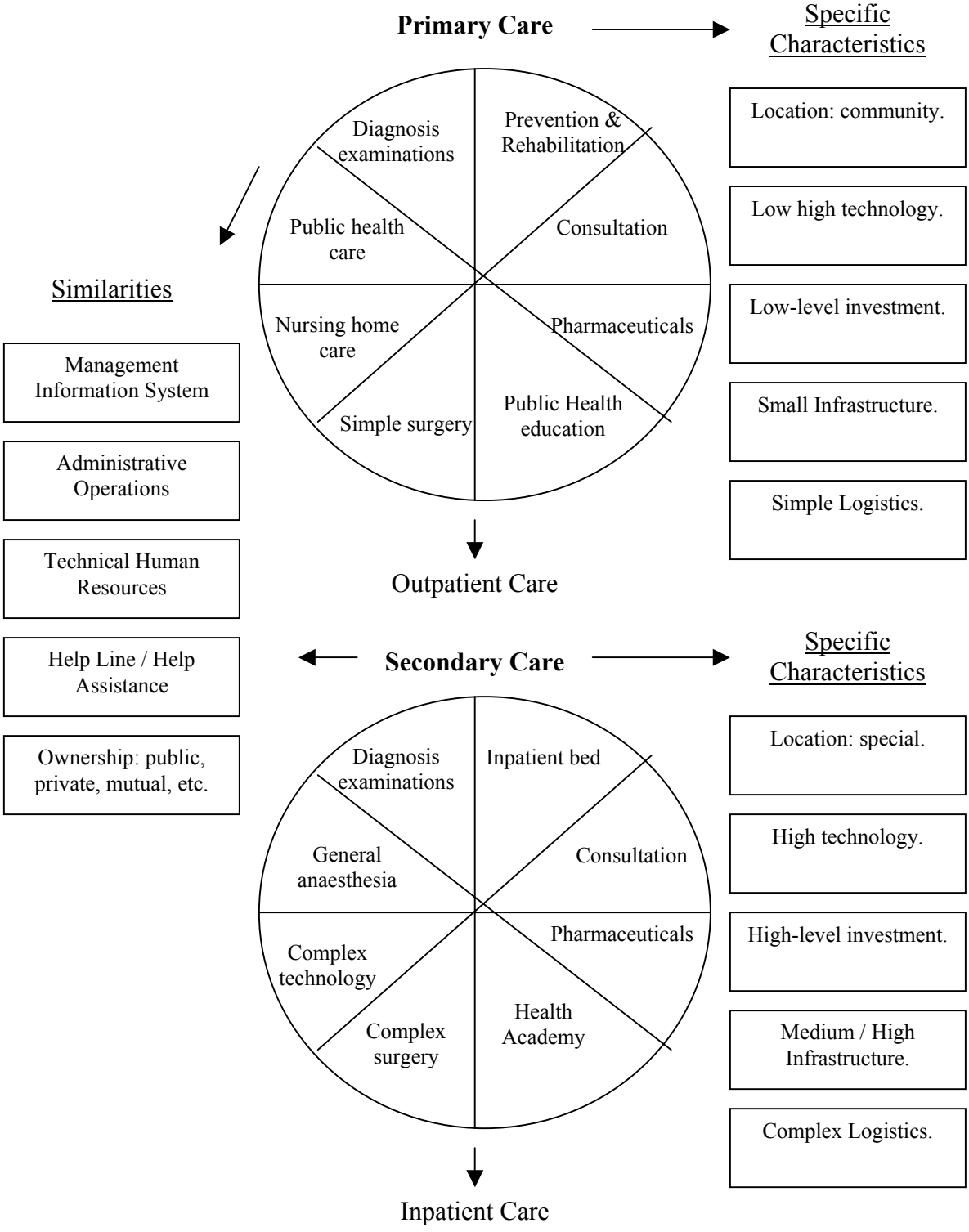
Health care services could be a right to every person, coming from the general law, normally the Constitution; or could be something that each person needs to find to himself; or could be a mixture. Bos (2000, p. 486), referred to his Dutch experience, "Since 1983, Article 22 of the Constitution obliges central authorities to take measures to promote public health". Nevertheless, arguments Bos "however, this principle has not been translated into a national healthcare system, as in the United Kingdom or throughout Scandinavia". In the opposite side, in the developed countries, we can find USA, like Herzlinger (1997, p. 51), says, "Americans value their freedom of choice and their control over their health care so much that they have always rejected proposals that would increase government control".

Around health care providers, we can find also several outsourcing suppliers or contractors, for services, such as laundry, food service or housekeeping. Nevertheless, these are supplementary services of the health care service, with high importance, in terms of quality perception of patients, which means it is necessary a high level of control from the management of the health care provider.

The Baldridge National Quality Program (2002), defined health care services, in the "Health Care Criteria for Performance Excellence", as "all services delivered by the

organisation that involve professional clinical / medical judgment, including those delivered to the community".

Figure 2 – Health Care Services boundaries



Health care services could be seen also through the view of the ownership of the business, which indicates that the different objectives of the different owners could give to a single concept of quality of care, a different meaning. A state owned hospital possibly has a different concept of quality of health care provided to patients, versus a private hospital or versus a religious administration hospital. This different view of the same concept could be the trigger to determine a different relation between technological innovation and competitiveness. Possibly to a private hospital will be more difficult to invest in high tech solutions without the necessary economical view, versus a non-profit health care organisation, nevertheless both will have the patient's satisfaction as a major objective to achieve.

Health Care Services – The Networks

According to Rubin *et al* (2001, p. 489), "before developing quality measures, it is important to clarify the goals and purpose of the quality measurement effort including the intended audience or consumer of the information", this brings us to the complexity of networks inside and around the health care services business. The state government and its different agencies are a permanent presence in all countries, with a minor or a major role. Even in countries with a significant part of the health care business in the hands of private companies, the role of the government agencies are important in order to maintain same behaviour, patterns and outcomes. In this case, the state government will act as a regulator and as a player of the market, which could be difficult to evaluate. In a different way, the perception of quality of a physician from a patient point of view versus a provider of health care services could be very different.

The health care organisation is surrounded by several types of networks that brings, sometimes difficult, to perceive the entire relation between them and how could be possible to get some efficiency from its relationship. From physicians, to paramedics and other technicians, administrators, industrial and services companies with a common relation or through an outsourcing contract, all of this entities manages everyday in a common real and virtual space trying to deliver high standards of quality of care. More and more, health care organisations need to have deep links to survive, in what concerns clients, but also with suppliers and with the entire community.

The existence of a European body that coordinates health technology assessment is a real picture of the several networks around the health care business. According to Jonsson *et al* (2002, p. 219), the European Collaboration for Health Technology Assessment/Assessment of Health Interventions (ECTHA/ECAHI) aim "is to develop and strengthen the network(s) (of Health Technology Assessment organisations) in the EU by promoting cooperation among various centers and activities concerned with assessments of health interventions in the member states". This organisation came after several countries concluded for the need of an efficient system for sharing information and exchange experiences in the field of health technology assessment.

The main objective of Health Technology Assessment organisations was to advise, particularly policy makers, about the several scientific issues concerning investment on health care and its implications in terms of medical, social, economical and even ethical aspects. This gives us an idea of how complex is the network around the process of purchasing new technical health care devices or equipments. The decision to purchase a new health care equipment with real high technology innovation, demands a complex evaluation from owners of the health care organisation and physicians, but also from

lawyers, economists, engineers and other specialists, which gives to the decision makers a much more difficult task to fulfil.

The idea beyond ECTHA/ECAHI is to work through cooperation between several decision makers and specialists in different countries, instead of explicit competition. The reason for this approach, beyond others, is the risk connected to the investment in high technology health care equipment and devices. Sometimes the innovated product works in some unique and rare diseases, with the additional difficulty of a human relationship (physician / paramedic versus patient); the trials and experiences related with the new product bring high risk and future possible errors, when it will be introduced in the market; this determines the cooperation choice from all actors in health care scene, instead of a competitive risky positioning.

The importance of health care services is increasing without any slowdown in sight, with the governments and its national and international agencies, big multinational industrial and services companies, several technical corporative organised people, and overall, the public opinion always together with the media, are paying much more attention everyday to this sector. This means that any specific analysis on health care services, needs to pay attention to all these networks, in what concerns relationships, cooperative and competitive behaviour and the management of power between them.

Health Technologies

The importance of health technologies, in terms of health care effectiveness and costs, are expressed by the support given by the European Community Commission to the creation of the EUR – ASSESS project, which intends to establish an European (15 countries from EU, plus Switzerland) coordinated policy of health technology assessment, in order to accomplish following objectives, according to Banta and Oortwijn (2000, p. 300):

1. Contribute to the effectiveness and cost-effectiveness of health care in Europe through improved HTA (health technological assessment);

2. Contribute to the development of institutions for healthcare technology assessment in Europe;

3. Strengthen coordination of healthcare technology assessment in Europe;

4. Contribute to the development of methods of information transfer between European countries; and

5. Furnish guidance to the European Commission concerning how to strengthen and aid coordination of HTA activities in Europe.

Jonsson *et al* (2002, p. 213) referred “health technology is an indispensable part of any nation’s healthcare system” and supports the idea with this affirmation “during the past 50 years, all member states that comprise the European Union have increased their technological base for health care, both in terms of knowledge and by investments in equipment, devices, and pharmaceuticals”.

Woof and Henshall (2000, p. 598) prefer to put its focus in costs rising pressure on new technologies, “a major contributor to rising costs is the rapid emergence of new and

expensive technologies (e.g. medical imaging, gene testing and therapy, and new drugs)". And these Authors expressed some figures "Economists estimate that technological advances cause NHS (National Health System, from U.K.) costs to rise an average of 0,5-1% per year".

One of the latest developments of European Union Commission, in relation with health technology, was the creation, in 2000, of ECHTA/ ECAHI, which intends broadly:

- To disseminate information across European countries, concerning health technology issues.

- To develop and to promote best practices on technological assessments.

- To identify and share successful approaches to technological assessment and health indicators and the connection with healthcare decision-making.

Hagenfeldt *et al* (2002, p. 305) expressed the need of a HTA network organisation, through this idea, "The development and diffusion of new pharmaceuticals, diagnostics, clinical procedures, and medical equipment are advancing at an accelerating speed. The supply of fragmented scientific information about medical innovations, and increasing public awareness of that subject, puts pressure on policy makers and health planning systems, especially where restrictions on healthcare funding are in place".

Medical Technologies

Medical technologies, probably represents one of the most innovative areas of health care services and also, the most representative in terms of increased cost. This is confirmed by Herzlinger, (1997, p. 204), when she says, "medical technologies are the root cause of excessive health care costs". In the opposite way of other industries, innovation technology is not reducing relative costs, or increasing revenues more than costs, in the health care services, which contributes to a decrease in efficiency and additionally to a low level of customer satisfaction.

As referred before, we can include in the category of medical technologies: medical devices, drugs or pharmaceuticals and also the procedures used in medical and surgical operations.

According to Siebert *et al*, (2002, p. 735), the European Directive 93/42/EEC defines a medical device as:

"….any instrument, apparatus, appliance, material or other article, whether used alone or in combination, including the software necessary for its proper application intended by the manufacturer to be used for human beings for the purpose of:

- diagnosis, prevention, monitoring, treatment or alleviation of disease,

- diagnosis, monitoring, treatment or alleviation of or compensation for an injury or handicap,

- investigation, replacement or modification of the anatomy or of a physiological process,

- control of conception,

and which does not achieve its principal intended action in or on the human body by pharmacological, immunological or metabolic means, but which may be assisted in its functions by such means".

Medical devices are object of a constant incremental product innovation, which means its product life cycle, according to Siebert et al (2002, p. 736), is very short, between 18 to 24 months, which is less than the pharmaceuticals. This incremental and continuous improvements brings a serious problem to the evaluation of the efficiency of the constant innovated medical devices, because it is necessary to the people that works with the devices to have a necessary period of learning, in order to exploit all of the features. Sometimes when the technical people learned enough to exploit efficiently the new medical device, the manufacturer will launch a "new" and improved version of that device, which means the "older" device could be abandoned.

If it is difficult to the technical people to evaluate the new devices, it is also difficult to the patients to evaluate the new technologies, because these new technologies normally appears in some specific areas to treat rare diseases, which means these patients represents a small part of the entire population, and the treatments they are object are new and they have not any comparison to establish. Additionally, the manufacturer will exploit the first step usage of the new devices to make some adaptations and corrections, accordingly to the first trials, which means that the treatments even for the same patient will have not a constant "output".

The process of evaluation of the new devices is complex, because it has at least four different entities to decide about its efficiency and efficacy: the government, normally is the payer of the new technology; the technical people that works with the new technologies and they are also a part of the eventual efficiency of the new devices; the manufacturer of the new devices, which is the main risk investor of the entire process and possibly will be the main future earner of the process; and the patient, which has a double difficult position, first, as the object of the new innovation product and second, will be the ultimate payer of the new technology (as a taxpayer or as a normal client).

Even with all the difficulties of the development of the new devices in practice, Siebert *et al* (2002, p. 740), concludes that "failure to reward innovative medical technologies will inhibit the further development of new life-inhancing and lifesaving technologies that patients need". This means that, especially public authorities are always in face of a complex decision, because it will be necessary to harmonise medical effectiveness and benefits to patients, and cost benefits.

Herzlinger (1997, p.206) describes several types of new technologies that brought enormous advantages to the patient, mainly reducing pain and adding comfort. Herzlinger assumes that "the key innovation came from a most unexpected source – the plastic industry" and she explained, "Plastics revolutionized surgery with small plastic rods, that are inserted through catheters (tubes) into natural body cavities – such as the mouth, penis, vagina, and nose – or into small holes punched into the body. These rods are fiberoptic light sources that illuminate the surgical site for the miniature cameras (endoscopes) and small surgical instruments that are also inserted through catheters. When these lights and cameras reach the surgical site, the surgeon can spring into action, using small instruments to operate, while watching the image of the site on a

screen". Finally the Author concludes, "The plastic tubes that enabled these minimally invasive surgeries (MIS) were as revolutionary as the canals that ushered in the Industrial Revolution".

Coddington *et al* (2000, p. 16) are enthusiastic supporters of the use of new technologies in health care, saying "The authors of this book…. cites technology as one of the two or three most important factors influencing health care costs and quality over the past two decades". And they explained the idea through the experience of a physician, "These new technologies (computerized tomography scanning (CT), magnetic resonance image (MRI) and ultrasound) cut down on the need for explanatory surgeries and enable physicians to do a better diagnostic job", which gives the idea of a better quality of life for the patient, possibly less level of costs to the payers and finally, a high level of motivation and confidence to the physicians and other technicians.

Nevertheless, Codington *et al* (2000, p. 17) referred to pharmaceuticals as another high-level factor to impact health care, when they mentioned the case of a doctor of internal medicine, saying, "the most important development in medicine in his years of practice - thirty-five years - has been effective drugs for treating hypertension". But these Authors (2000, p. 87) also think about pharmaceuticals, the same way as medical devices, in terms of costs impact on health care, when they say, "*New drugs*. This has to be near the top of any list of factors pushing up health care expenditures, and there is no slow-down in sight".

Pharmaceuticals are one of main sources of technological innovation in health cares services and also, one of the most important slices of the health care services budget. Together with pharmaceuticals, we have seen in the last decades great innovations coming from new sciences like genetics and biotechnology, like referred by Lemonick cited by Coddington *et al* (2000, p. 176) "Gene therapy and gene-based drugs are two ways we could benefit from our growing mastery of genetic science. But there will be others as well, including new kinds of vaccines, new sources of transplant tissue, even techniques doctors may someday use to stave off the aging process".

A report by Boston Consulting Group (BCG), cited by Coddington *et al* (2000, p. 176), reveals "drug products reaching the market today often experience only 50% to 80% average efficacy, and experts estimate that as many as 20% to 50% of prescriptions written today are either ineffective or only marginally effective for the person taking the drug". This opens the door to new research that could create new drugs that will fit the patient's needs, like the Authors say "the future of health care is tailored drugs for individual", and turning to the BCG's study, "Genomics could help eliminate the estimated 20% to 50% of prescriptions that are ineffective – and save more money in overall treatment".

Coddington *et al* (2000, p. 259) have developed a study of different scenarios in what concerns future developments in health care services and put a constant focus in all of four different scenarios on two major change drivers: consumers and technologies. With or without big resources, consumers will demand more efficiency from the health providers, and technologies will be a major source of change, no matter if it is radical or incremental, in order to increase quality of life and life expectancy. Helping to see the importance of new drugs innovativeness, these Authors referred "Advances in medications would reduce the need for some types of surgery (for example, open-heart surgery)".

Another crucial area to felt high technological development in the last decades was the medical procedures and surgical operations. Laparoscopic surgery was one of the most revolutionary changes, in terms of advances in surgery, particularly because of the popular use of the procedure and immediate impact in quantitative figures, as expressed by Coddington *et al* (2000, p. 17), "by 1993 more than a half million laparoscopic gallbladder surgeries hade been performed (just in the USA)". And the laparoscopic procedure was started to be used in different parts of the human body, as mentioned by Eubanks and Schauer (1996, p. 791), "other surgical applications for laparoscopic technology include thoracic, pediatric, gynaecological, urological, orthopedic, plastic, and ear, nose and throat surgery". These new procedures made possible to increase the quality of life of patients and allowed also a different usage of infrastructures, as explained by Herzlinger (1997, p. 209), "an increasing number of these out-of-the-hospital surgeries are conducted in doctors' offices or in free-standing facilities that are not affiliated with a hospital".

Prevention and Rehabilitation

The simple idea of preventive care, in terms of eating less level of fat, no smoking and making regular footing, are part of public health education programs. These programs can have the opportunity to expand more and more, through new ways of communication, like electronic kiosks and particularly the internet. Public and private health care services are also investing more in new incentives to the use of preventive care, mainly because it is a reality that early intervention paid off, or a prevention approach means cost savings and better quality of life. Today it is possible to every people, particularly in developed countries, to have some special medical devices at home, in order to control some basic, but fundamental, information on self-care, like level of blood pressure or diabetics scores.

Another important issue on the subject of technology on preventive care, it is the possibility of using more technological systems to manage the available data on personal preventive care, in order to get more updated information and also to store bigger amounts of data. Nevertheless, the usage of information systems on primary care, and particularly on prevention, is not so big, like mentioned by Dr. John Wennberg, cited by Coddington et al (2000, p. 184), "There are no systems in place for doctors to take care of patient population. Primary care is chaotically organized and so is hospital care (situation referred to USA)".

The increased life expectancy is creating generations of elderly people all over the world. This fact is also creating new needs and new knowledge in what concerns, prevention, self-care and self-diagnosis. People knows that prevention paid off, but general medical expenses are becoming more and more expensive, which conducts patients to use knowledge, in a first step, and also some simple procedures and devices, to create a better quality of life and less crowded health care services.

The increasing power of patients / clients brings also additional variables to the health care services business. People are demanding more information on health issues, in order to get increased defenses without going to the formal structures of the health care services. This fact brought new opportunities to launch new communication media, like expressed by Coddington *et al* (2000, p. 263), in a reference to a future scenario of health media, "The number of radio, television, newspaper, magazine, and billboard advertisements for health care products will exceed those of the late 1990s".

Rehabilitation, like prevention, is part of primary care, even though is in a great part of the situations connected with secondary care. Rehabilitation is also object of a great level of technological innovation, not only in what concerns medical equipment and devices, like the ones related with orthopedics, but also in relation with some human functions as the ear and the eyes, or even the psychological side of the human being.

Like in other parts of health care services, rehabilitation is becoming more important and expensive, because people invests more in quality of life and technological innovation helps to go in that direction.

Organisational and Support Systems

"Companies operating information-based services (…) are seeing the nature and scope of their businesses totally transformed by the advent of national (or even global) electronic delivery systems, including the internet and its best-know component, the World Wide Web", Lovelock *et al* (1999, p. 12).

Information systems are vital for every health care services organisation, not only because general business requirements, but also because health care services are object of many external interventions, such as regulatory authorities, national and international, insurance companies, consumers and legal organisations, and from every type of media. This information requires two types of report:

- First, regular business information: number of patients; breakdown of patients by type of medical treatment received; breakdown of costs by type of expenses, like medical fees, drugs, medical equipment, etc.; level of patient satisfaction and dissatisfaction; etc.

- Second, requests by external entities, which could be a very wide type of information, and a part of them, will be unexpected. In this category, we can include: databases covering the history of every patient object of assistance; records of all staff, technical and non-technical, in terms of professional and public liability; usage of medical equipments, devices and drugs; practices of purchasing management; etc.

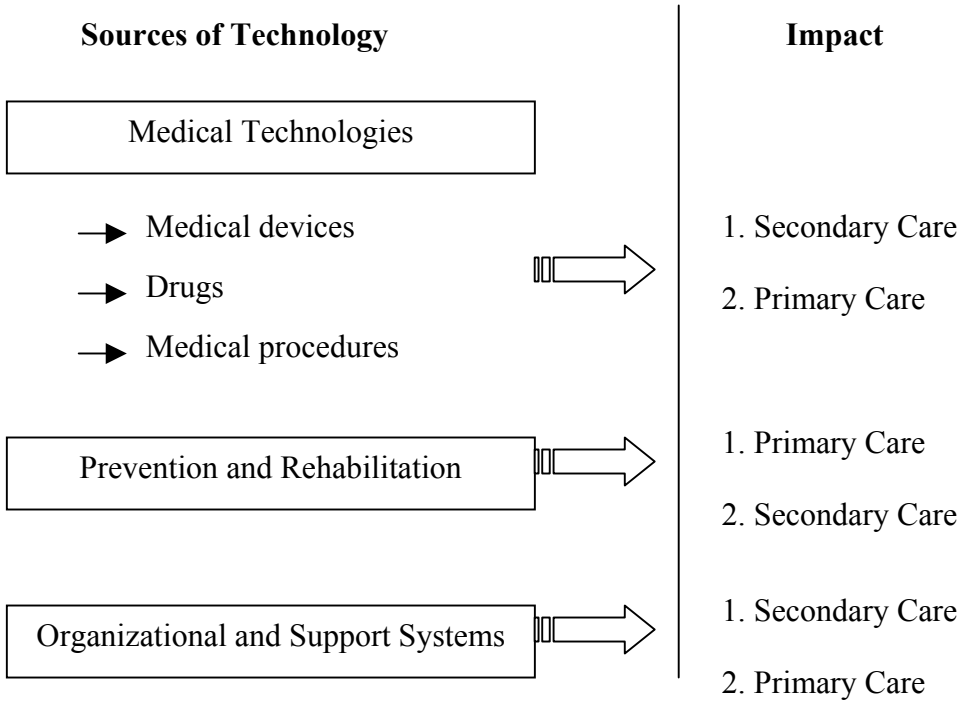
Yasin and Yavas (1994, p. 51) put the question of information systems in this way, "The integration of computerized information and statistic quality control technologies has much to offer to hospitals in operational, strategic and marketing terms. Perhaps, the greatest benefit of a comprehensive system such as this is on service quality".

There is a huge potential to exploit in the usage of information technology systems, in the health care services, in order to create additional benefits to patients, providers and even investors / owners and management of the health care organisations. A first important benefit will be brought by a system that collects database from all providers of a health care organisation, in order to select the best providers, in terms of efficiency and efficacy, for both, the patient and the organisation. A second benefit will be brought to patients and to providers, from a system that relies in "one" electronic medical record "per patient", no matter if the patient will go to a cardiology specialist or to a neurology specialist, or if the patient will be attended in London or in Paris; this procedure will bring many benefits in terms of costs to the organisation and time from providers. A

third benefit will be brought by information systems that will give to the patients a opportunity to share information with the providers, with limits defined by ethics.

A health care services sharing better and wider information systems, could means at least better service quality, increased level of efficiency of the entire system and superior value to the patients / clients and also to the investors / owners. If we imagine the possible existence of "one" electronic medical record "per patient", we can imagine also the increased satisfaction that every patient will have every time he will go to a new Doctor and he will not have to say one more time, his age, allergies, parents illness, etc.

Figure 2 – Impact of Technology in Health Care Services



Conclusion and Further Research

The importance that people around the world gives to health care services is increasing, particularly because the results are paying of the investments, in terms of increased life expectancy and increased quality of life. Nevertheless, people are demanding even more quality of life, less or no pain and unlimited capabilities from health care technicians and techniques. All of this demands, if necessary without increased costs; which appears to be very idealistic. The statistics given by international and national authorities on health care, gives us an unquestionable idea of great improvements in all data related to human being quality of life. It is also unquestionable, according to many Authors, that technological innovation is one of the major sources of efficiency and efficacy of the entire health care system.

If we analyse the impact of technological innovation in the different parts of the health care services business, it is possible to find real and great impacts everywhere. If we look to the last two or three decades, patients / clients of the entire system, find several technological innovations with smaller or bigger impact in all its different parts. Magnetic resonance imagers, laparoscopic surgery, selective painkillers, computerised axial tomography, complex information systems and the internet, represents some of the greatest recent technological innovations in the entire health care system, with real increased value to the patients, in terms of quality of life and life expectancy.

If some of the best-known technological innovations are related with inpatient care, we can find also dramatic innovations in the outpatient care. The increased importance of prevention, self-care, self-diagnosis, rehabilitation and long-term care, have been made possible because technological advances allows knowledge to be available everywhere and also common people can use some devices in a very user friendly way.

It is also possible to conclude that major research on medical technologies happens in inpatient care situations, particularly in what concerns bigger investments in new medical devices and new medical procedures. Nevertheless, some of the most innovative technologies appear at an outpatient care level, when it is possible to mass market the innovative product or process.

In a future research, it will be necessary to support findings through empirical research, in order to evaluate real impact of technological innovation in health care services, and particularly, to try to conclude if technological innovation brings or not competitiveness to the organisations belonging to the health care services business.

This future research needs to be focused, otherwise conclusions could be difficult to extract in a proper way, mainly due to the different types of ties and networks around health care organisations and to the different types of ownership existent in the sector. This means that it will be necessary to define clearly the specific part of the health care service to be object of study and also to select organisations with similar type of ownership.

Further research will be conducted in limited areas of health care services. As a first segment, it will be selected exclusively private health care organisations, with inpatient and outpatient care operations, in order to avoid incomparable comparisons like a private hospital with a state owned one. As a second segment, it will be selected technological innovations related to medical technologies. This part of health care services possibly has some complexity to evaluate, mainly due to the higher level of investment required and the high risk connected with new technologies, nevertheless medical technologies represents possibly the most challenged part of health care business, in terms of investment and also in terms of networks involved.

Finally, the empirical research that will be conducted in a near future needs to answer to the following question: private health care organisations with inpatient and outpatient care services and with a higher level of investment in medical technologies, will have a superior competitive position versus its competitors? Or not?

References

BALDRIDGE NATIONAL QUALITY PROGRAM (2002), **Health Care Criteria For Performance Excellence**, National Institute of Standards and Technology, Technology Administration, Department of Commerce, USA

BANTA, David, OORTWIJN, Wija, (2000), "Introduction: health technology assessment and the European Union", **International Journal of Technology Assessment in Health Care**, Vol. 16, nº 2, p. 299-302

BOS, Michael, (2000), **International Journal of Technology Assessment in Health Care**, "Health Technology Assessment in The Netherlands", Vol. 16, nº 2, p. 485 – 519

CLARK, Graham, (1990), **Managing Service Quality – An IFS Executive Briefing**, UK: IFS Publications

CODDINGTON, Dean, FISCHER, Elizabeth, MOORE, Keith, CLARKE, Richard, (2000), **Beyond Managed Care – How consumers and technology are changing the future of health care**, San Francisco: Jossey-Bass, a Willey Company.

EUBANKS, S., and SCHAUER, P. R., (1996) "Laparoscopic Surgery", in D. C. Sabiston Jr. ed., **Textbook of Surgery: The Biological Basis of Modern Surgical Practice**, (15th Edition), Philadelphia: Saunders

FITZSIMMONS, James A. and FITZSIMMONS, Mona J., (2000), **New Service Development**, Thousand Oaks, California, USA: Sage Publications, Inc.

FORD, David, (2002), **Understanding Business Marketing and Purchasing** – 3rd Edition, London: Thomson Learning.

HAGENFELDT, Kerstin, ASUA, José, BELLUCCI, Sergio, JENSEN, Malene Fabricius, MORLAND, Berit, OORTWIJN, Wija, STEVENS, Andrew, ten VELDEN, Gabriël H. M., (2002), "Systems for routine Information Sharing in HTA", **International Journal of Technology Assessment in Health Care**, Vol. 18, nº 2, p. 273-320

HAQUE, Irfan ul, **Trade, Technology and International Competitiveness**, EDI Development Studies, The World Bank, Washington, D. C.

HERZLINGER, Regina, (1997), **Market Driven Health Care**, New York: Perseus Books, HarperCollins Publishers.

INSTITUTE FOR THE FUTURE, (1999), **The Internet and the Future of Telehealth**, White paper sponsored by the California Healthcare Foundation, January.

JOHNSTON, Robert, CLARK, Graham, (2001), **Service Operations Management**, Harlow, England: Pearson Education Limited

JONSSON, Egon, BANTA, H. David, HENSHALL, Chris, SAMPIETRO-COLON, Laura, (2002), "Summary Report of the ECHTA / ECAHI Project", **International Journal of Technology Assessment in Health Care**, Vol. 18, nº 2, p. 218-237

LOVELOCK, Christopher, VANDERMERWE, Sandra and LEWIS, Barbara, (eds.), (1999), **Services Marketing – A European Perspective**, Harlow, Prentice Hall Europe

OECD, (1996), **Oslo Manual**, "The Measurement of Scientific and Technical Activities: Proposes Guidelines for Collecting and Interpreting Technological Innovation Data", Paris: OECD, 2nd Edition, DSTI.

PORTER, Michael, (1990), **The Competitive Advantage of Nations**, London: Macmillan Press Ltd.

RUBIN, Haya R., PRONOVOST, Peter, DIETTE, Gregory B., (2001), "From a process of care to a measure: the development and testing of a quality indicator", **International Journal for Quality in Health Care**, Vol. 13, Number 6, p. 489-496

SIEBERT, Markus, CLAUSS, Louis Christian, CARLISLE, Malcom, CASTEELS, Brigitte, de JONG, Peter, KREUZER, Michael, SANGHERA, Sukh, STOKOE, Graham, TRUEMAN, Paul, LANG, Antoinette Wenk, (2002), " Health Technology Assessment for Medical Devices in Europe – *What must be considered*", **International Journal of Technology Assessment in Health Care**, Vol. 18, nº 3, p. 733-745

TIDD, Joe, BESSANT, John and PAVITT, Keith, (2001), **Managing Innovation**, John Wiley & Sons, Chichester, 2nd Edition.

TROT, Paul (1998), **Innovation Management & New Product Development**, Harlow, England: Pearson Education Limited.

WINSTON, William J., (1994), "Reengineering Hospital Marketing", **Journal of Hospital Marketing**, Vol.9, nº 1, p. 5 – 15

WOOLF, Steven H., HENSHALL, Chris, (2000), "Health Technology Assessment in the United Kingdom", **International Journal of Technology Assessment in Health Care**, Vol. 16, nº 2, p. 591-625

YASIN, Mahmoud M., YAVAS, Ugur, (1994), **Journal of Hospital Marketing**, "Service Quality in Hospitals: An Integrated Approach", Vol.9 (1), p. 45 – 54

ZAIRI, Mohamed, (1999), **Process Innovation Management – Best Practice**, UK, Oxford: Butterworth-Heinemann