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Implementing information systems in health care organizations: myths and challenges

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Abstract

Successfully implementing patient care information systems (PCIS) in health care organizations appears to be a difficult task. After critically examining the very notions of 'success' and 'failure', and after discussing the problematic nature of lists of 'critical success- or failure factors', this paper discusses three myths that often hamper implementation processes. Alternative insights are presented, and illustrated with concrete examples. First of all, the implementation of a PCIS is a process of mutual transformation; the organization and the technology transform each other during the implementation process. When this is foreseen, PCIS implementations can be intended strategically to help transform the organization. Second, such a process can only get off the ground when properly supported by both central management and future users. A top down framework for the implementation is crucial to turn user-input into a coherent steering force, creating a solid basis for organizational transformation. Finally, the management of IS implementation processes is a careful balancing act between initiating organizational change, and drawing upon IS as a change agent, without attempting to pre-specify and control this process. Accepting, and even drawing upon, this inevitable uncertainty might be the hardest lesson to learn.

Keywords: Patient care information systems (PCIS); Success; Failure; Electronic patient record; Implementation

1. Introduction

The implementation of comprehensive information systems in health care practices has proved to be a path ridden with risks and dangers. It has become evident that there are many more failure stories to tell than there are success stories—and the more comprehensive the technology, or the wider the span of the implementation, the more difficult it appears to achieve success [1–3]. It has become equally evident that organizational issues account for many of these difficulties, and that the social sciences have an important contribution to make [4,5]. It is obvious that inadequate design of an information system (e.g. an inadequate user-interface) or its poor performance (e.g. slow response times) will reduce its chances of being implemented successfully. Yet even in cases of clear-cut technical difficulties, the question whether the

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implementation is seen as a success or a failure is ultimately not a mere technical matter. In the end, this final decision is about the attachment of the label 'success' or 'failure' (or anything in-between) to a particular situation. Some health care organizations might decide to muddle through with a given system, or to invest more resources so as to improve the problems perceived to be most problematic; other organizations might, in similar situations, decide to abort the project, and accept their losses. In the end, then, the question whether an implementation has been successful or not is *socially negotiated* [6–8].

In addition, organizational issues are key because technical difficulties can be the *result* of poorly managed development processes. When users are not sufficiently involved in the design process, the user-interface may become illogical from the users' point of view, for example, or the sequence of actions prescribed by the system may run against the users' working routines [9]. Or, likewise, some groups of users might have a political agenda embedded in the new system—insight in the working patterns of other groups, for example, or access to another group's information resources. Such agenda's might lead to open conflict with other groups, thus leading to non-use of the system [10,11]. These small examples illustrate the deep interrelation of technical and social aspects in systems development. Technical problems may have organizational roots, and result in organizational conflicts; a well-functioning system exemplifies a match between the functionalities of the system and the needs and working patterns of the organization.

It is this interrelation that is put central in the *sociotechnical* approach [4]. In this paper, the issue of successful implementation will be addressed from this perspective. Three myths will be introduced that often underlie implementation failure, but that still seem to be surprisingly alive. Concurrently, alternative and more fruitful viewpoints will be introduced, drawn from the scientific literature on organizational change and technology development, and where possible illustrated with concrete examples. The focus here is on systems that are to be used by health care professionals in the primary care process. Such systems could aim at supporting that process (such as decision support systems), and/or they could aim to ensure a more optimal fit between the primary care process and the secondary work processes that support, manage, investigate, or control it (such as management information systems, resource planning systems, electronic patient records). As a general and admittedly imperfect overall term to address such systems, I will refer to them as patient care information systems (PCIS).

2. Towards 'successful' implementation: two caveats

2.1. What is a 'successful' implementation?

When is a PCIS implementation successful? As stated, in real-life projects, whether an information system is 'successful' or not is decided on the workfloor, by the middle management, by top managers—and it is the outcome of all these interactions that in the end settles the system's fate. It is of course also possible to be less relativistic, and to set a success measure outside of an organization's own deliberations (for example, 'the percentage of professionals using the system for the majority of their patient contacts'). Only in this way, after all, can one compare different implementation processes. Also, only in this way can one build an argument whether a given organization has perhaps set its own standards too high—or too low [12].

Yet the ongoing negotiations about the degree of 'success' of any given system should at the very least open our eyes for the fundamentally multidimensional and contested nature of the concepts of 'success' and 'failure' [12]. A system can be a success economically; the implementation project may not have exceeded its budget, for example, or management may have succeeded in reducing the administrative workforce by the target set in the implementation plan. 'Success' could also mean that the system is up and running on time, for example, or it could mean that it is widely used. Alternatively, it could mean not so much the factual *use* of the system but the *appreciation* of this use by the users, or, (and this need not coincide) the appreciation of this use by those users' managers. More specifically, for an order-entry system, a specific success measure could be a reduction in errors in medication deliveries; for a reminder system attached to an electronic patient record of hypertensive patients, the measure could be a reduction in the average blood pressure of these patients [13–16].

Success, in short, has many dimensions: effectiveness, efficiency, organizational attitudes and commitment, worker satisfaction, patient satisfaction—and not all parties in and outside of the implementing organization may agree about which dimension should be the most relevant. What is more, not all parties may agree just what the proper effectiveness measure is, for example, or what costs and benefits should be incorporated in an evaluation of the system's efficiency. Should an implementation of a picture archive communication system (PACS) be judged by the reduction of administrative worktasks (by both supporting staff and nursing and medical professionals)? Or should one also include the more tacit benefit of facilitating research, and the improved availability of diagnostic information with the concurrent—but generally very hard to quantify—improved quality of the primary care process? If views on these issues differ, whose view should prevail? The question about the success of a system, then, becomes the question of success *for whom* [17]?

In addition, due to the complexity of the implementation process (see further) and to the multi-dimensional nature of the concept of 'success', what counts as 'success' at any given time may fluctuate. 'Success', in other words, is a *dynamic* concept, not a static one. After sometimes many months or even years of hard work, management and health care professionals alike might have changed their view about what a 'successful' implementation of an information system might consist of. In the case of the introduction of a physician order-entry system in a US Academic Medical Center, for example, management realized slowly that direct, substantial savings on personnel costs were not to be expected. Rather, the very restructuring of the professionals' work tasks that the system implied (creating order entry at the 'point of care') should in itself be seen as an important success [18]. 'Quality of care' and 'being a state-of-the-art Academic Medical Center' became more important criteria for success than the originally projected cost-savings that were a major factor in the decision to acquire the system.

'Success', then, is a multi-dimensional concept, which can be defined rather differently by the different involved parties, and which evolves over time. From these queries it should not be deduced that speaking about or striving for a 'successful' implementation is meaningless. Rather, it implies that managing towards a 'successful' implementation implies careful attention to what success parameters are used, whether the different parties involved in the implementation process share these goals, and how the inevitable

evolution of the criteria of 'success' will be handled [19].

2.2. How successful are success factors?

Another caveat that should be addressed is that it is not possible to list a definite set of 'success' and/or 'failure factors' that will provide a certain recipe towards implementation success (or failure). Even in those (rare) cases in which there is total agreement on the goals of an implementation, there exists no simple formula for success [20,21]. This is due, in one sentence, to the *complexity* of the behavior of the sociotechnical networks at stake [4,22]. A core feature of IS development processes within complex organizations—and I will return to this point later—is their fundamental *unpredictability*. The technology itself is already very complex. Consisting of a host of interrelated hardware components and thousands or millions lines of code, its behavior never becomes fully transparent, even to those intimately involved in its construction [21,23]. In addition, the number of parties who have a stake in and an influence on the IS implementation and use is large, and their reactions to the (in itself never fully predictable) behaviors of the technology cannot be fully foreseen. Given this unpredictability, it is not at all evident that an implementation strategy that was successful in one organization will be similarly successful in another. Even if what will count as 'success' is fixed, determining a definite list of success or failure factors is impossible because what has worked in one case might not be relevant at all in another. Even within a tightly delineated domain such as health care, and even if we limit our analysis within this domain to, say, management information systems, this still would hold. Different organizations, with different sizes, different leadership styles, different cultures, different financial situations, and different environments, may and will react very differently to a similar technological innovation, or to a similar implementation strategy.

This is not to say that we cannot outline certain insights that seem to be a sine qua non to the realization of successful systems, however, defined. Indeed, in the following paragraph, some of these insights will be discussed in the form of prevalent 'myths' that stand in the way of fruitful implementation projects. Yet any such discussion runs the risk of reducing what can only be fine-grained discussion of individual cases to bland, almost empty slogans such as 'the importance of leadership' or 'the involvement of users'. It is not that leadership is not important, but just how a specific leadership style in any given situation works out cannot be predefined. Likewise, involving users is essential, but there is no recipe for this that will work in any given case. More often than not, the proper leadership style for a specific implementation process, or the optimal way to involve users, can only be *discovered during* the process itself [24,25]. In other words, the complexity of the account can only be reduced at the expense of losing its validity. This is why speaking of 'factors' is so problematic, since that projects the notion that there is a fixed list of pregiven capacities, resources, characteristics and so forth that will do the trick. This paper rather speaks of 'insights'—issues, complexities, pitfalls to be *aware* of. This paper, in other words, is more concerned with understanding and acting upon the nature of the process as a whole than about the futile attempt to isolate individual contributors to either 'success' or 'failure'.

3. Three myths about IS implementation

3.1. Myth 1: PCIS implementation is the technical realization of a planned system in an organization

Overlooking the fact that PCIS implementation will fundamentally affect the health care organization's structures and processes is one core reason for implementation failure [20,26]. All too often, still, we can hear authors, project leaders or IS professionals speaking about 'rolling out' a system, or planning its 'diffusion' [3]. Such terminology underestimates that whether it is anticipated as such or not, the implementation of an information system in an organization involves the mutual transformation of the organization by the technology, and of the system by the organization [1,7,27]. This is a two-way process. On the one hand, the technology will affect the distribution and content of work tasks, change information flows, and affect the visibility of these work tasks and information flows. Because of this, it will also change relationships between (groups of) health care professionals and/or other staff. Electronic patient records, for example, inevitably change one's recording practices, and raise questions about who will get access to whose data, under which conditions. This may seem self-evident and innocuous, but such changes inevitably trigger subtle (and sometimes not so subtle) social and political processes about who gets to fill in what parts of the record, who 'owns' what information, and who gets to check on whose work [10,11,28]. In the perceptive analysis of the organizational changes brought by the implementation of an physician order-entry system mentioned above, Massaro describes how physicians reacted forcefully against the need to be more structured and precise in their writing of their orders. The fact that Massaro chose to describe the physicians' slow adjustment to the system in terms of Kübler-Ross' phases of mourning is an indication of the depth at which these change processes can affect existing organizational realities [29].

Such organizational processes in their turn inevitably affect the system. Pressures on the implementation staff may lead them to change authorization procedures, for example, or to throw out elaborately coded entry-screens that (in the eyes of the users) take up too much time. In a PCIS developed for a mental health care organization in the Netherlands, for example, we found that discussions about access rights to patient information had resulted in an unwieldy explosion of over 25 different authorization levels. In this case, the specification of every new level resulted in renewed discussions about the exact mutual relationships between all the involved professionals leading to more dissent, and more requests for diversification.

Because of the impact of the PCIS on the organization, then, and because of the consequent repercussions of these impacts back on the shape, use and functioning of the PCIS, it is imperative to see and manage a PCIS implementation project as an organizational change process [21,29–31]. Even better still, PCIS implementation should be conceived as organizational *development*, since that term implies that the IS is strategically *intended* to affect the organization. The mental health care organization mentioned above had in fact been very successful in doing just this. Their aim had been to transform previously independent care delivery units into one integrated care delivery system, encompassing both ambulatory and clinical care for an entire region. Through the use of IT, they could introduce case managers that would coordinate and oversee the handling of a client throughout different phases of his/her treatment, irrespective of traditional organi-

zational boundaries. The PCIS system afforded the case manager to consult patient records and care professionals agendas irrespective of their actual physical location, and in this way underwrote the process of organizational change. In fact, this possibility to draw upon IT to generate new organizational forms of delivering care—that would not be able to exist without IT—is one of the core challenges for the field of medical informatics and for the strategies of health care organizations [32–34].

3.2. Myth 2: you can leave IS implementation to the IT department

As a process of sociotechnical change, then, IS implementation should not be run as a 'mere' technical project. It should be managed as a process of organizational development, in which IT is drawn upon as a strategic asset to transform organizational structures and routines, and further the organization's goals [34,35]. When seen as such, it becomes obvious that the implementation of any medium to large scale PCIS has to be managed by a project-group that includes the IT department, but that is not limited to it. Crucially, it should include both representatives from future users, and representatives from the institution's top level management.

Adequate user-involvement, first of all, is of paramount importance to foster ownership of the system by the future users, and to allow the implementation of systems that will actually match work processes, current or future. 'User-involvement' is an easy slogan, yet its importance cannot be overstated. It is not enough to 'include' a few potential users in the project group, to have them negotiate system specifications, and to discuss implementation plans and the achievement of socio-technical 'fit' in meetings once every so often. User involvement should be taken much more extensively and literally [30,36,37]. Users are generally very bad in speaking the language of 'specifications', and in imagining what specific configuration of the technology they 'need' or what would work 'best' in actual work situations. Such judgment skills can only develop over time when users are taken on board in the development process early and systematically, and when careful attention is paid by those responsible for the implementation to the actual work processes that these users take as their starting point. Ethnographic methods, studying the detailed social organization of actual working practices through participant observation methods and in-depth interviews, can be highly useful here [38–40]. Such methods can illuminate interdependencies between worktasks, and demonstrate e.g. how tasks that seem to be executed in a highly variable way are actually fine-tuned to match a context that is highly variable (see also further). Such issues, highly relevant for choosing system configurations and planning implementation trajectories, easily disappear from view when the 'work' to be 'supported' by the PCIS remains too abstract a category. In addition, to draw upon the skills users *do* have, they should for example be allowed to try out proposed system configurations in their actual work settings. Here again, ethnographic methods can help to elucidate more practical human–computer interface designs, or more efficient ways to interrelate the demands of the actual work tasks with the demands of the chosen PCIS.

Yet in and by itself, proper and thorough user-involvement is only half of the picture. Many PCIS projects run to the ground, even when users have been thoroughly involved from the outset. In a regional Dutch hospital, for example, where a system rather similar to the order-entry system mentioned above was introduced, the concept of 'user-involvement'

was taken at heart. Health care professionals were heavily involved first in the acquisition of the system, and later in the implementation process and the tailoring of the system to the specific needs of this hospital. This implementation group that did much of the tailoring work consisted mainly of nurses and physicians who had worked in the same wards and offices that they were now fine-tuning the system's functionalities for. This work consisted mainly of designing 'screens'—electronic forms, with structured queries and preformatted fields to fill in. At the time we conducted our investigation [41], the system was implemented only partially in only a few wards. Yet at that time already, the number of individual screens was getting out of control. On the neurological ward alone, for example, nurses had access to up to 10 000 screens. The screens were linked to each other in various ways and formed several paths (to order medication, to order an investigation, to seek information, to report patient data and so forth), each consisting of up to 30 individual screens. All in all, the system consisted at that time of 27 000 different screens.

A core problem of this system, not unlike the labyrinth of authorization levels mentioned above, was that the number of screens was exploding beyond manageability. Dedicated to their previous work environments and colleagues, the implementation team dutifully translated each request and 'need' from the hospital's shop floor into a new screen. This is only one example of a common problem in projects that have users 'in the lead'; the trajectory of user-led design processes tends to loose direction and momentum due to the multitude of different voices pushing the process into different directions—or to nowhere at all. In health care settings, usually characterized by a host of different professional, paraprofessional, technical, administrative, groups and so forth, this problem is even more pronounced.

The balancing act between user-directedness and manageability, then, between the need to be 'flashy' and to be 'robust', or between the needs and desires of different usergroups can only be made when the users' presence in the project group is *itself* balanced by a proper and strong presence of upper management. Overall, the project group should lie out a vision that creates and restricts the space *within which* user-involvement can emerge and can express itself. This requires the existence of that vision at the level of the upper management, and the adequate operationalization of that vision into adequate means, mandates and maneuvering space for the project group. This vision, which should be first and foremost about the future of the *organization* (maybe inspired by IT possibilities, but not primarily centered around IT) should be both robust enough to frame and direct the IS implementation process, yet it should be open-ended enough to be adaptable to newly upcoming challenges, in part deriving from the IS implementation process itself. In the next subsection, a deeper look at the need for this flexibility and at the core insight that organizational development—including IS implementation—is more about improvisation and organizational learning than about top-down planning and 'process redesign' will be taken.

3.3. Myth 3: IS implementation can be planned, including the required organizational redesign

Although one can and should *intend* to have a PCIS development trajectory affect one's organizational structure and processes, this 'intention' should not turn into an attempt to fully plan and control this process. In much literature on IS-related organiza-

tional change, *business process redesign* or *reengineering* (BPR) is embraced as the sure route to competitive advantages and organizational survival. Originated in the private sector, BPR, in short, propagates a *process* view of organizations, in which the whole organization is organized around the customer and the product he desires, rather than the traditional *functional* view, in which the organization is organized around its core, internal functions. BPR states that managers should be willing to radically redesign business processes so as to optimize the processes' effectiveness and efficiency [42]. Translated into health care idiom, an organization's 'core business' is usually taken to be the primary care process (the work of health care professionals to manage patient's trajectories) [43]. The necessary redesign is usually taken to be the creation of PCIS-dependent integral care delivery systems, radically restructuring the traditional, 'functionally organized' health care organizations [3,34].

These ultimate aims are crucial, and it is an important insight that it is not possible to maximize IT's contribution to organizations without affecting the very nature of these organizations. Also, the current emphasis on process rather than function is a very healthy change of thinking for most current health care organizations. Yet the idea that current business processes (including current information systems) should be radically redesigned from scratch, and that this should be done top-down, is simply wrong. In strictly hierarchically oriented companies, where the processes to be redesigned are relatively predictable and standardized, such an approach might be feasible. In such instances, senior management can simply impose wholly new working routines and cooperation patterns on its employees (but see [44]). In health care, however, the 'core business process' consists of highly knowledge-intensive, professional work, typified by a complexity that defies the predictability and standardization required for simple reengineering. Moreover, the professionals ultimately responsible for this process are powerful actors in the organization, and cannot be simply told to change their work patterns by senior management.

It all adds up; the complexity of the primary care process, the complexity and unpredictability of the IS itself and the sheer number of parties involved in PCIS implementation (see Section 2) results in a process which is *fundamentally* unfit for a planning and controlling approach. The uncertainty and unpredictability of PCIS implementation processes is an *inherent* characteristic of such processes, which should be accepted and even nurtured rather than 'overcome'. Attempting to impose more controls to weed out surprises is a sure route to disaster; unexpected problems should be taken as instances to *learn from* and *adapt to* rather than as obstacles to overcome. Similarly, unforeseen spontaneous alternative uses of the system should be investigated carefully as possible unexpected ways to draw out unforeseen benefits from the system [25].

In a study of an electronic patient record developed for use in the care for hypertensive patients, for example, we found that the designers, in close cooperation with one or two leading hypertensive specialists, had opted for a very structured interface. The record consisted of several screens in which doctors could enter (coded) complaints, diagnosis, blood pressures, examination results, medication, and so forth. The IS professionals and specialists had designed this record to facilitate their research; in this way, the structured information they required for their clinical investigations could be drawn directly from the databases of the patient record [45]. For this purpose, the system functioned well—in this sense, the system was successful. In the

everyday processes of outpatient care, however, the system appeared to be less functional. Many physicians complained that the system was too 'rigid' to capture the essence of a patient's visit. The list of coded complaints, pressures, examination results and so forth was very useful to track some overall parameters—yet it could not capture that the core reason of the patient's visit was his increased anxiety about his hypertension, for example, triggered by the recent death of his father. To overcome this limitation, many physicians started to use the one small free text section that the system had ('conclusion') as a field to enter such information. This resulted in a somewhat awkward use of the system, with physicians maximally using the limited amount of text they could put in this small field, and having this lower right corner of one of the screens function as the central focus during patient visits.

From the perspective of the original aims of the system, generating 'good research data', this could be seen as a problem. The one field that generated unstructured data that were almost impossible to aggregate was heavily used—often at the expense of the more structured fields. When framed as such, an appropriate response might be to try to eliminate this unstructured usage, and to attempt to structure this field as well, or restrict its utilization. A more creative response to this unplanned use, one that would be sensitive to the multiple and changing viewpoints that characterize any implementation, would be to make this field more readily accessible and enlarge it. The structured items could be regrouped around this field so that the required back-and-forthing between the fields would be designed to facilitate the evolved usage as much as possible. In this way, a compromise between different demands would be optimized, and a *synergy* between the computer's aggregating and ordering powers and the physician's recording routines would be carefully crafted.

The transformation of success criteria, the resetting of what it is the system aims to do during the very process of implementing the system, characterizes larger-scale examples just as much—or even more—than this small scale example [46]. This is what happened in the project described by Massaro; once it was realized that cost-savings were not going to be immediate, the overall goals of the project slowly changed. One can introduce an IS to reduce administrative costs, and find that that the increase in administrative efficiency is paralleled by an increase in the amount of information required by external parties. System requirements *evolve*, Hartswood et al. argue, in and through the process of learning from unexpected workarounds and unforeseen usage of the IS [36]. Ash and her co-workers did a study of four hospitals in which physician order entry systems as described earlier by Massaro were being used [47]. She nicely describes the often expressed phenomenon that IS is a double edged sword for health care professionals; it may facilitate and support their work, but it often does so through importing novel constraints to their work, and facilitating the scrutiny of their work for outsiders [48]. The use of carepaths, for example, gave nurses both more autonomy and less. They received less orders that were difficult to decipher or interpret, and could create their own order sets, yet they regretted the loss of subtle influence that they used to have in helping doctors formulate orders [47,49]. In such situations, one often does not know how care professionals will react; Ash nicely describes how for young interns, the possession of 'individual' order sets gave an unexpected sense of 'control and even pride'. Such reactions cannot be predicted, yet are key; when carefully nurtured and acted upon, they can help further the creation of truly powerful PCIS.

Similarly, in an increasing number of hospitals in the Netherlands, clinical workstations are being placed where the physician can gain access to all the patient information present in the Hospital Information System. The systems do not support data entry, but the data retrieval is well designed, using a windows-based graphical user-interface, with many visual clues indicating what information is present and all this information just a few mouse-clicks away. One may criticize this system for its lack of data entry capacities, but that would overlook the phenomenon that it is in fact the very *presence* of this read-only system that *generates* a new 'need'. Whereas in most of these hospitals, 'computers' were low on these physicians' priority list, the coming of these workstations has sparked their interest. It is the very confrontation with its potential capacities that have *turned* the physicians into fervent supporters of a more aggressive PCIS strategy.

Radical redesign is doomed to fail, to destroy much tacit knowledge, and to produce massive organizational upheaval and chaos. A much wiser approach is to carefully learn from the embedded wisdom and already present socio-technical synergies in existing working practices, and to work from there [50]. This includes a reconsideration of what the paper-based information technologies *do* do well—their simplicity and robustness, for example, or their unsurpassed efficacy in small-group communication [51,52]. It is likely that a more radical implementation of a fully operational, electronic patient record in most hospitals' outpatient offices would have failed. Data entry by professionals is a well-known bottleneck [3,18,53], and the current implementation, one could argue, combines ease of (electronic) retrieval with ease of (paper-based) data-entry. At the very least, the current implementation has made physician resistance much less likely. As Glaser and Hsu put it, 'the use of information technology to improve care is a form of guerilla war' [34]—an ongoing set of initiatives, constantly changing tactics, constantly changing targets. 'Guerilla war' might be a rather aggressive metaphor, but it does capture the fundamental limitations to blueprints, precise planning, predictions of future needs and desires, and top down implementation strategies. Rather, it emphasizes the need to seize opportunities when they emerge, and creatively turn disadvantages into advantages—which often includes a radical reconstruction of what exactly the 'advantage' is.[1] In such instances, one does not know at the outset where one ends; one does not 'redesign' according to some plan; one rather 'drifts' with the currents, attempting to steer one's project through the ever changing environment [31,54].

4. Striving for synergy: successful implementation revisited

A proper implementation process, then, attempts to reach a situation as described in Fig. 1. The primary work processes denote all the work that is directly linked to patient care (the central work tasks of doctors, nurses, and other health care professionals). The sec-

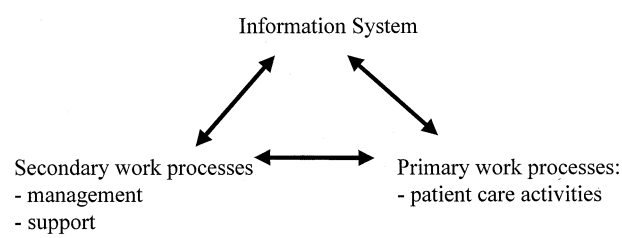

Fig. 1. Striving for synergy.

[1] Atkinson and Peel use a much more 'peaceful' metaphor when they speak of 'growing' rather than 'building' information systems [35].

ondary work tasks consist of the work processes that support, complement and steer the primary care process. This includes the whole gamut ranging from resource management, management of medical equipment, food services, billing, to overall organization management. The arrows indicate a relationship of *mutual* transformation. The IS should help transform the primary work processes (affording e.g. integral care processes, or new ways of quality control), and, likewise, should help transform the secondary work tasks (affording, e.g. new, efficient resource management, or more strategic use of primary care process information). Part and parcel of this is, of course, that the primary and secondary work processes become more aligned—a development that is already taking place throughout Western medicine, but that is requiring a re-ordering of some of the fundamental ordering principles of the classic model of the professional bureaucracy.

The figure depicts both some *ideal*, future state of an organization *and* the continuous process of striving towards that ideal—which itself will inevitably change over time. It indicates that every step taken in the gradual 'growth' of a PCIS should one way or another be a step *within* this process—towards a transformation of primary work processes, secondary work processes, and/or the interrelation of the two. How exactly the 'ideal' looks like, of course, is a highly political issue if only because of the organizational turmoil involved in any realignment between the primary and the secondary workprocesses. IS can never be a neutral player in this ongoing battle, typical for any professional bureaucracy. In addition, the complexity of the issues at stake here makes prediction impossible; every novel development (whether in- or external to the IS implementation process) will result in new challenges to meet, and new, often unexpected opportunities for new IS functionalities.

The task of achieving this synergy, then, is the task of creating the circumstances so that IS functionalities can bring primary and secondary work tasks to new levels of quality, efficiency, and/or work satisfaction—whether that means an enlarged span of control for administrative personnel, an improved grip on the patient's trajectory for the health care professional, or a novel sense of autonomy for the patient. Most of all, it is the task to create a situation in which eagerness to mutually *learn*, a desire to constantly further develop both the IS and the workprocess, has become the default. As has become clear, where and how exactly this synergy will be found, and to where it can then further develop, or where it will be thwarted by organizational politics, cannot be planned or predicted.

A sine qua non for this mutual learning to develop is ongoing, in depth, multi-level *evaluation* of the implementation process. A continuous monitoring of the 'real life' experiments that are taking place is crucial if one is to learn from their results. This may sound obvious, but more often than not, evaluation is seen as a post-hoc activity—if it is done at all. In the large scale, Dutch order entry system implementation mentioned above, it was exactly this *lack* of evaluation that created blindness to what was going on. This led to mismatch between what management and implement group *thought* was happening, and what was really happening on the workfloor level. Such evaluation activities need not be costly or highly formalized; the trick is to focus on just a few important parameters, and to observe and interview the few core processes and stakeholders that are key (this is by no means an easy achievement—for more detailed discussion about evaluation, see [8,13,55,56]).

This is the IS implementation challenge—managing the implementation so that these

synergies can be found, nurtured and developed. This implies taking the uncertainty of every single step as the rule rather than as a problem, to fully realize the political nature of the processes set in motion, and to carefully monitor and learn from spontaneous experimentation on the workfloor.

5. Conclusion: the challenge

In this paper, it is described how the implementation of a PCIS in health care organizations is a process of mutual transformation. The organization is affected by the coming of this new technology, but the technology is in its turn inevitably affected by the specific organizational dynamics of which it becomes a part. This empirical fact can become highly problematic when IS implementation is seen as a mere matter of 'diffusing' a technology, or of merely 'rolling out' a technical fix. In such instances, 'barriers' and 'obstacles' appear from the blue in the guise of 'user resistance' or suboptimal 'returns' of the PCIS. When anticipated, however, when *seen* as a process of organizational development, PCIS implementations can be intended strategically to transform the organization, and the technology can be allowed to grow along, gradually becoming part and parcel of the basic organizational work routines.

I described, likewise, how such a process can only get of the ground when properly supported by both central management and future users. A top down vision and framework for the implementation is crucial; only *with* such a framework can 'user needs' be articulated that transcend individual wish-lists. In setting the stage this way, user-input can become a coherent, steering force that in its turn transforms and specifies the overall vision—and that creates a solid basis for the organizational transformations that will then certainly ensue.

Finally, it is emphasized how the management of IS implementation processes resembles a careful balancing between initiating organizational change, and drawing upon IS as a change agent, without attempting to pre-specify and control this process. It is a balancing act between setting goals and targets for the implementation—yet stimulating the mutual learning processes that will inevitably transform these goals and targets. Accepting, and even drawing upon, this inevitable uncertainty might be the hardest lesson to learn [57]—yet time and time again, the most 'successful' implementation processes appear to be those in which an obsession for control and planning is replaced by an obsession for experimentation and mutual learning. It implies finding the difficult balance between setting the direction for change, and to let oneself drift with the current thus formed [58]. Time and time again, the most important role of the IS in the organization is only discovered *during* the implementation process. Likewise, as Ciborra powerfully phrases it, 'strategy should not be looked at as an analytical document to be handed over to the organization in order to be executed. Strategy is what emerges from the actual implementation process, which may be characterized by deviations, surprises, and conflicts' [31].

These are a few insights that are crucial to IS implementation. They do not add up to a definite list of 'critical success factors', nor to a recipe that, when followed, will certainly avoid disaster. The very attempt to formulate such lists runs against the central point just made; in the end, what a successful implementation is can only be discovered in the very process of *doing* the implementation. Certainly, there are some fundamental lessons to be learnt—I hope to have outlined the contours of some of them. Yet searching for critical success or failure factors reinstalls exactly the urge for control that we should abandon, or at least mitigate, in order for the

full potential of IS synergy to emerge. The only true success criterion, maybe, is that it is a sign of suboptimal implementation (or worse) when one's success criteria remain unchanged [24].

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