ARE INTERACTIVE CONTROL SYSTEMS REALLY DRIVEN BY STRATEGIC UNCERTAINTIES? SURVEY EVIDENCE

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Abstract
While the theory argues that strategic uncertainty drives the use of management control systems, empirical studies offer mixed or, in some cases, opposing results. This article explores and tests the control of a non-change-in-strategy setting to explain such enigmatic situation. More specifically, this paper develops and tests a model of how the strategic uncertainties affect the use of performance measurement systems when organizations have not undergone a strategic change recently.

Based on a survey of 114 hospitals, I test and find evidence that the relationships between the strategic uncertainties and the use of performance measurement system are well significant and less disappointing when the hospitals follow the same strategy for several years.

Keywords
Performance measurement system, strategic change, strategic uncertainty, interactive and diagnostic control system

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Introduction

Uncertainty is one of the raisons-d’être of management control systems\(^2\) (Galbraith, 1973) since, when the environment and/or technology of the firm become increasingly uncertain, managers call for more information to deal with these uncertainties and management control systems can offer such information (Chapman, 1997). The relationship between uncertainty and management control systems is then well-acknowledged in the accounting literature and a considerable amount of studies has investigated the relationships between the uncertainties and the design of management control systems (see Chenhall (2003) for a review). However, few researches have surprisingly been conducted on the relationships between the uncertainties and the process of management controlling (Otley & Ferreira, 2009). After the introduction of the Simons’ (1990, 1991, 1994) framework, the process of management controlling has grown to be a very influential topic in accounting over the past 20 years (see de Harlez & De Rongé (2009) for a review) and one central theory in the field of management control (Davila, Foster, & Oyon, 2009). This framework is based on the principle that control processes aim to manage the inherent tensions of the firm reflected by the organizational concern of efficiency and flexibility (Simons, 1995; Henri, 2006b). This paper aims to extend the research relating the uncertainty and the process of management controlling with the application of the Simons’ framework.

Recently, based on this framework, Widener (2007) and Davila (2000) have studied and tested the associations between different strategic uncertainties and the way of using the performance measurement system (interactively or diagnostically). In both studies, the model shows disappointing results regarding these specific associations. Additionally, the form of some relationships seems to differ across the two studies. For example, while Davila (2000) does find some significant negative relationships between technological uncertainty and interactive use of financial and non-financial information, Widener (2007) does not. In the same vein, Davila (2000) does not find evidence of significant relationships between market uncertainty and the interactive use of profitability, budget, and cost information (which reflects the financial side of the performance measurement system). However, he brings support for a negative (positive) significant relationship between competitors’ uncertainty and interactive use of time (customer) information (which represents the non-financial side of the performance measurement system).

\(^2\) Management control systems (MCS) are defined as formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities (Simons, 1995, p. 5).
Widener (2007), in turn, shows a positive relationship between competitive uncertainty and the interactive performance measurement system. Therefore, this situation remains somewhat an enigma since, while the literature argues that the strategic uncertainty is expected to drive positively the interactive use of management control systems (Simons, 1990), quantitative empirical research offers mixed or, in some cases, opposing evidence.

To explain this puzzling situation, this paper suggests that testing the relationships between strategic uncertainties and interactive management control systems necessitates ensuring that the business strategy has not changed recently because this control gives a clearer picture of the role of management control systems. This suggestion is based on the Burchell, Clubb, Hopwood, Hughes, & Nahapiet’s (1980) research, explaining that the MCS’ role depends on the level of two uncertainties: (i) the level of uncertainty of objectives for organizational action, and (ii) the level of uncertainty of cause and effect (which determine the consequences of organizational action). When the objectives for organizational action are clearly defined, management control systems allow to reduce the level of uncertainty of the consequences of organizational action by acting as an *answer machine* (in the context of low level of uncertainty of cause and effect) or a *learning machine* (in the context of high level of uncertainty of cause and effect). These machines help in the decision-making process, respectively by computing the consequences or by exploring the problems and discussing the actions and hypotheses in order to come up with a judgment. When the objectives for organizational action are ill-defined, management control systems serve instead as an *ammunition machine* (in the context of low level of uncertainty of cause and effect) or a *rationalization machine* (in the context of high level of uncertainty of cause and effect), respectively for political rationales (bargaining and compromise) or actions legitimization.

The present study suggests that, when the strategic positioning has not changed recently, one can expect a low level of uncertainty of objectives for organizational action because, after several years of unchanged strategic position, it is assumed that the objectives are more institutionalized within the organization. Then, controlling for a low level of such uncertainty leads to a circumscribed attention to the distinction between management control systems as *answer* machines and *learning* machines. This specification in the role of management control systems permits to investigate a definite function of systems as to uncertainty instead of indefinite roles and, in this paper, to show that the significance of the relationships between the
strategic uncertainties and the use of management control systems can be less disappointing.

Therefore, to extend the research of Widener (2007) and Davila (2000), the primary objective of this paper is to develop and test a model that examines the relationships between the business strategy, the strategic uncertainties, and the use of the performance measurement system (one aspect of the MCS), without limiting the investigation to organizations with a stable strategic positioning. It allows to pay an initial attention on a condense picture of the Simons’ framework and to show if the results about the relationships between the strategic uncertainties and the use of performance measurement system are consistent with prior research. The next objective is to test the same model, but limited to organizations with an unchanged strategic positioning, in order to examine and discuss the significance of the relationships between the strategic uncertainties and the use of performance measurement system. To these ends, I empirically analyze survey data from 114 hospitals with partial least squares (PLS) structural equation modeling. Similar to prior research, the first model reveals disappointing results about the relationships between the strategic uncertainties and the use of performance measurement system. However, when this model is limited to organizations that follow the same strategy for several years, the significance of the relationships is less disappointing.

The following sections introduce the research setting and review the literature on the strategic positioning, strategic uncertainty, and use of performance measurement system. Next, the hypotheses are introduced and motivated. Afterwards, the three succeeding sections describe the research methodology, show the model outputs, and discuss the results. The final section presents the contributions, practical implications, limitations and insights for future research.

1. Study setting

The hospital market presents an attractive setting to empirically test these suggestions because hospitals are entrenched in a specific environment that impact significantly accounting issues and make it an interesting field of research (Eldenburg & Krishnan, 2007).

More particularly, the increase in public health expenses due to population ageing (Jacques, Lobet-Maris, & Rousseau, 2004) coupled with a severe deterioration of most national public deficits (Attali, 2010) forces most OECD governments to adopt a new set of legislations and to reshape the financing system. These developments create massive managerial hurdles and then encourage the managers of hospitals to apply managerial principles (Nyamori, Perera, & Lawrence, 2001) that could assist them in doing more with less (Young, Charns, & Shortell,
For example, the process of scanning market requirements has turned out to be crucial for hospitals, which has led to the formulation, implementation, or adaptation of strategy (Abernethy & Brownell, 1999; Naranjo-Gil & Hartmann, 2007) and the emergence of more focused/specialized hospitals (Hyer, Wemmerlöv, & Morris, 2009; King, Clarkson, & Wallace, 2010).

Additionally, the present paper places a particular emphasis on the performance measurement system as one aspect of the management control system since it is viewed appropriate for hospitals (Li & Benton, 1996). First, due to the reporting requirement imposed by the Federal Public Service and the public financing system based on the hospital activity, hospitals’ employees encode financial and non-financial measures in the information systems and report some performance measures to the SPF. It is worth to note that these performance measures are also used for decision-making since the majority of the hospital income is determined by this kind of information. Secondly, the recent search for more cost efficiency and flexibility in the healthcare sector represents an institutional pressure to monitor more closely the financial and non-financial measures of performance. The performance measurement system is identified as a management control tool that improves the efficiency and flexibility of the hospital. All these characteristics render the performance measurement system of hospitals highly attractive and appropriate to investigate.

2. Theoretical background

2.1. Definition of constructs

2.1.1. Strategic positioning

The notion of strategy incorporates different meanings (Mintzberg, 1987a, 1987b; Ittner & Larcker, 2001). In the management control-related literature, prior research often defines the strategy as a means to locate where the organization competes in its environment, which refers to the definition of the business strategy (Langfield-Smith, 1997; Nyamori, Perera, & Lawrence, 1997). On the 10th of June 2006, the Belgian Minister of the Federal Public Service for health, food chain safety, and environment introduced a Royal Decree to promote the specialization and association of hospitals within each Belgian region. Through various declarations in national newspapers (to cite a few, LLB, 05/08/2006; LLB, 01/19/2007), he explained that the objective is to decrease the competition and to improve the complementarities between the health care institutions given that “everybody cannot do everything, everywhere, everytime” [translation of the author]. This reform has led to more financial responsibilities to the top management of hospitals that, therefore, has placed a strong emphasis on cost efficiency and flexibility issues (Jacques, Lobet-Maris, & Rousseau, 2004). Consequently, the service quality to patients and the human resources has suffered from that. Also, these cost constraints has made more salient the concerns on which medical activities the hospital should invest in and has triggered the development of business strategies.

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Based on this definition, various typologies are usually employed in the empirical research on management control such as defender vs. prospector (Miles & Snow, 1978), cost leadership vs. differentiator (Porter, 1980), conservative vs. entrepreneurial (Miller & Friesen, 1982) or still build vs. harvest (Gupta & Govindarajan, 1984). This present study uses the Miles & Snow’s (1978) typology since it offers numerous research advantages. First, this typology of strategy is suitable to investigate many management control issues because it is well documented, very similar to other archetypes, relates the control system issues to strategy and uncertainty, and has been empirically tested in numerous studies (Simons, 1987). Second, prior research investigating the relationship between the strategy and the use of management control system in particular, mostly refers to this typology (Abernethy & Brownell, 1999; Hoque, 2004; Naranjo-Gil & Hartmann, 2007) since it encompasses the role of innovation, which can be encouraged or discouraged by using control systems adequately (Miller & Friesen, 1982; Bisbe & Otley, 2004; Bisbe & Malagueño, 2009). Last but not least, the typology has been inferred from the study (among others) of the Riverside hospital, which gives confidence for further investigations on hospitals.

In this setting, change means to convert into something different in scale and/or in scope. When this conversion leads to an important modification of the firm, the concept of strategic change is regularly employed even though the meaning is confusing and creates endless controversies. However, the notion of change in strategy is clearer since it allows to catalog change in terms of the way we define strategy and to examine the consistencies within and across investigations of different types of change (Ginsberg, 1988). In this paper, a change in strategy is characterized by an organizational move along the prospector-defender continuum. By nature, this change at a conceptual level (Mintzberg & Westley, 1992) corresponds to a change in position (Nyamori, Perera, & Lawrence, 2001). Likewise, the concept of stability signifies not to convert into something significantly different in scale and/or in scope. The notion of stability in strategy is characterized by position fidelity on the prospector-defender continuum for a certain period of time.

Both ends of the continuum can be summarized by responses to three kinds of problem: entrepreneurial, engineering, and administrative (Miles & Snow, 1978). On the one hand, the

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4 Analyzer, a third category of the Miles & Snow’s (1978) typology, represents an intermediate position between prospector and defender. Reactor, the fourth category, is not a successful strategy and was not integrated into the framework accordingly, in line with prior research (Simons, 1987; Abernethy & Guthrie, 1994).
firms following a prospector strategy are innovative, flexible and entrepreneurial and prospectively change their products and services market (Abernethy & Guthrie, 1994). It means that companies changing their position towards a prospector strategy reallocate their resources in order to be more flexible, customer-oriented, to improve products and services quality, and adapt to any shift from the market demands (Naranjo-Gil & Hartmann, 2007). On the other hand, firms following a defender strategy focus on the stability and efficiency in their operations, and on preserving their market share (Abernethy & Guthrie, 1994). Any move toward this strategy entails that firms increasingly concentrate on improving efficiency by cost-control of a limited set of products and services (Naranjo-Gil & Hartmann, 2007).

2.1.2. Strategic uncertainty

The notion of uncertainty has been widely studied in the empirical management control-related literature (e.g., Gordon & Narayanan, 1984; Gerloff, Muir, & Bodensteiner, 1991; Gul & Chia, 1994; Chong & Chong, 1997; Van Gelderen, Frese, & Thurik, 2000; Mia & Chenhall, 1994; Chenhall & Langfield-Smith, 1998). One reason might be that, in accounting, the uncertainty is considered as “a core contingency factor upon which most contingency-type MAS studies rests” (Gerdin, 2005, p. 303) because it is a “driving force in the design and use of management control systems” (Davila, 2000, p. 391-392). Whereas the distinction between design and use is not always straightforward, these quotes shed light on the importance of uncertainty when the use of management control system is investigated, not exclusively the design of management control system.

Galbraith (1973) explains that uncertainty emerges when a decision-maker perceives the difference between the amount of information required to perform a task and the amount of available information in the organization. Simons (1995, p. 94) identifies the strategic uncertainties as “uncertainties and contingencies that could threaten or invalidate the current strategy of the business” regardless the origin of uncertainties such as the competitive dynamics (external environment of the organization) or from the internal competencies (the technology used by the organization) that top-level managers monitor (Widener, 2007). For instance, the events might be emerging new technologies, changing customer needs, sociopolitical threats and opportunities, and competitive threats and opportunities perceived by senior managers (Simons, 1990).

The strategic uncertainties can take three forms: known, unknown, and unknowable
(Chow & Sarin, 2002). A strategic uncertainty is known when the probability of the event occurrence is known by the top-level manager. A strategic uncertainty is unknown when the top-level manager does not know the probability but believes that some other person in the organization may know it. Eventually, when the top-level manager believes that probabilities are unknown to everyone to some extent, a strategic uncertainty is unknowable.

This paper focuses on four types of strategic uncertainty particularly relevant for hospital: human resources (e.g., hiring physicians or nurses, and conservation of physicians and nurses within the hospital), patient needs & technology (e.g., evolution of the demand in healthcare, evolution of the patients or family needs, new technology for medical treatment), strategy benchmark (e.g., change in the healthcare network of competitors, the strategic position of other hospitals), and partnership (e.g., new potential partnership with hospital). These strategic uncertainties originate from the interpretation of a factor analysis explained later in the research methodology section.

First, the human resources usually are the most important type of strategic uncertainty in hospitals because, on one hand, all important changes in hospital create some degree of resistance from employees (Young, Charns, & Shortell, 2001) and, on the other hand, the numerus clausus (Social Security Modernization Act adopted the 26th of July 1996, limiting the number of students enrolled in medical schools) has drastically reduced the number of graduated physicians. This situation has forced the hospital’s managers to principally think of the healthcare strategy in terms of the capacity to find and keep skilled physicians⁵.

Second, like in most Western countries, the healthcare sector has undergone a philosophical shift and placed a more important emphasis on the patient’s satisfaction (Abernethy & Brownell, 1999; Naranjo-Gil & Hartmann, 2007). In this respect, an examination of the patient needs and the technology accordingly are essential to successfully execute a business strategy.

Finally, the Belgian institutional and legal pressures to transform the hospitals into specialized entities also encourage the hospital to create a structure of associated hospitals or to join an existing network of hospitals. This network is composed of some entities that are at the upstream of patient health chain (short stay, rapid treatments) while others are at the downstream

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⁵ This public policy has actually started in 2004 after the adoption of Royal Decree of the 30th of May 2002. This job market tension is confirmed by the survey described in the research methodology section. The results of this questionnaire mailed to all Belgian hospitals reveal that hiring and maintaining nurses and physicians are the two most important types of uncertainty (out of eleven) that top management face today (see Table 2).
of health chain (long stay, and elongated treatment). The advantages of the network are that hospitals can receive patients from other hospitals situated in the upstream of the chain, not only from the neighborhood. Furthermore, integrating a network of hospitals and at the same time focusing the health care activities are more appropriate to optimize the funds received from the public financing system. Therefore, these two potential benefits make the uncertainty increasingly placed on the network of hospitals rather than on the hospital itself. The strategic uncertainty about network can take two forms: (1) uncertainty between networks, and (2) uncertainty within networks. First, in this setting, the members of different networks are viewed as competitors. Gathering information about those networks allows to better profile the competitors’ strategy since their strategic position become more specific and salient within their respective networks. Then, comparisons (or benchmarks) between strategic positioning and networks become more common. Furthermore, the fixed-price reimbursement system (reimbursement based on the average cost of all hospitals) renders all benchmark information even more useful. Secondly, within the network, each hospital is expected to describe its strategic position in terms of specific healthcare activities that are complementary to those of linked hospitals. The objective of such partnership is, for example, that, after an operation and post operation treatments, physicians may invite patients to visit a partner hospital that will take care of the reeducation stage since this partner is more specialized and better subsidized for such reeducation treatment. Then, the choice of partners is strongly governed by the hospital’s strategy and the specialization of the partners (Gunasekaran, 2002).

These four strategic uncertainties are assumed to drive the use of performance measurement system of hospital. Then, the following point aims to define this use of performance measurement system.

2.1.3. Use of performance measurement system

Relying on studies on strategy, on one side, and, in particular, on the distinction between deliberate strategy and emergent strategy and, on the other side, on Argyris’ (1977) study on single and double loop learning, Simons has developed an integrated theory for the control of strategy based on four levers of control: beliefs systems (e.g., core values), boundary systems (e.g., behavioral constraints), diagnostic control systems (e.g., computational monitoring) and interactive control systems (e.g., learning, assisting). Together, these systems aim to foster organizational innovation and performance accordingly (Tuomela, 2005; Henri, 2006b; Widener,
since this framework is suggested to manage the inherent tensions of the firm (Simons, 1995): (i) unlimited opportunity vs. scare attention, (ii) intended vs. emergent strategy, and (iii) self interest vs. desire to contribute.

On the one hand, the traditional design school of management control argues that, to implement an intended strategy, top managers make assumptions about the environment (Mintzberg, 1990). These assumptions underlie the intended strategy that is translated into action plans, measures and targets and then communicated down the organization (Ittner & Larcker, 2001). The implementation of this intended strategy requires the use of formal, information-based routines and procedures that focus on the achievement of critical performance variables. Theses routines and procedures encourage people to behave in such a way that they try to achieve the preset standards of performance fixed by the management. This traditional feedback system is described as a diagnostic control system or answer machine (Abernethy & Brownell, 1999; Henri, 2006a). It reflects the negative force of routines and procedures since (i) the top management attention is limited, (ii) the implementation of “a consciously intended course of action” (Mintzberg, 1987a, p. 11) is controlled by focusing on deviations and mistakes, and (iii) the adoption of a self-interest behavior is indirectly encouraged.

On the other hand, implementing an intended strategy can become irrelevant when the critical assumptions about the environment change. Then, the learning school of management argues that managers are advised to learn from their environment in a way that new strategies might emerge from people possessing relevant information on the new circumstances or are in close connection with the environment. The bottom-up emergence needs this information to be communicated, discussed and debated across all the organization and, in so doing, the top-level management may signal its values and preferences and then ratify decisions (Simons, 1990). In particular, the top-level management may implement formal, information-based routines and procedures that (1) they use intensively, (2) but also the operating managers, (3) to face-to-face challenge and debate (4) the strategic uncertainties (5) in a non-invasive, facilitating and inspirational manner (Bisbe, Batista-Foguet, & Chenhall, 2007). These routines and procedures, typically called an interactive control system, symbolize a learning machine since “it is where organizational participants would need to explore problems, ask questions, explicate presumptions, analyse the analysable and finally resort to judgement” (Burchell, Clubb, Hopwood, Hughes, & Nahapiet, 1980, p. 14-15). It represents the positive force of routines and
procedures because (i) the top management devotes a lot of attention to opportunities to learn, (ii) they facilitate the emergence of new “pattern in a stream of actions” (Mintzberg, 1987a, p. 12), and (iii) the desire to contribute is supported and enhanced.

The present paper places a particular emphasis on the performance measurement system as one aspect of the management control system. Sprinkle & Williamson (2007) explain that the dual role of the management control system is (i) to facilitate the planning and decision-making process, and (ii) to motivate individuals through an effective monitoring. Therefore, the performance measurement system presents a collection of metrics required by the management to revise their ideas about the consequences of their decisions (Davila & Foster, 2005). These metrics can be financial, non-financial, internal, external, short term, long term, ex post, or still ex ante (Ittner & Larcker, 2001). Also, the performance measurement system puts a figure on actions (Neely, Gregory, & Platts, 2005), which helps reduce the agency costs. During the contracting processes between the principal and the agent, the performance measurement system provides important information to align their objectives (Baiman, 1990).

Regarding the way of using the performance measurement system, de Haas & Kleingeld (1999) explain that this system is commonly used diagnostically since the performance measurement system is designed as a measurement tool to stay aligned with the strategy. Nevertheless, recent studies show evidence that the performance measurement system might be interactively used too6 (Marginson, 2002; Tuomela, 2005; Henri, 2006b; Widener, 2007). Meyer (1994), Henri (2006a), and Kolehmainen (2009) explain that, even with good performance measures, these measures will be of little use if top managers use them only to control people since the objective of the performance measurement system is to help them. Some flexibility is demanded given that senior managers need a means to intervene if the lower level manager meets problems or face important questions that it cannot answer by itself. Since the performance measurement system has these two distinct roles, Henri (2006b) and Widener (2007) claim that this system can be diagnostic and interactive simultaneously and the nested use enables to balance the inherent organizational tensions as mentioned earlier.

6 The interactive or diagnostic performance measurement system does not refer to a set of technical attributes but to a style of use of information (Van der Stede, 2001; Ahrens & Chapman, 2004). Then, the appropriate labels are the ‘diagnostic use of performance measurement system’ and ‘interactive use of performance measurement system’ but, in the present paper, the shortcuts ‘diagnostic performance measurement system’ or ‘interactive performance measurement system’ are used.
2.2. Hypothesis development

This section develops and motivates hypotheses regarding the relationships between business strategy, strategic uncertainty and way of using the performance measurement system. Fig. 1 shows a picture of the theoretical framework and the relationships among the strategic uncertainties (human resources, patient needs & technology, strategy benchmark, and partnership), and the way of using performance measurement system (diagnostic and interactive performance measurement system).

Insert Fig. 1 about here

The four following paragraphs motivate the significance and the sign of relationships.

2.2.1. Relationship between the hospital strategy and the use of PMS

Looking at the relationship between strategy and management control system, academic research on contingency approach claims that management control systems should be designed to support the strategy of the firm, leading to competitive advantages and performance accordingly (Otley, 1980; Dent, 1990; Fisher, 1995, 1998; Langfield-Smith, 1997; Chenhall & Chapman, 2006). While this approach has extensively examined the relationship between strategy and design of management control systems, few studies have been conducted on the effect of the strategy on the use of management control systems (Marginson, 2002).

Typical studies on the strategy-MCS relationship emphasizes that innovation-oriented strategy (like prospector, differentiation, build, or entrepreneurial) requires more intensive use of management control systems to quickly and adequately respond to the unexpected threats or opportunities. Chenhall & Morris (1986), for example, find that the prospector strategy triggers the need for more outward focused, broad-scope management control system to collect information for planning purposes. Since broad-scope aspect of the management control system motivates debates and managerial interactions (Abernethy & Brownell, 1999; Bisbe & Otley, 2004; Naranjo-Gil & Hartmann, 2007), it is assumed that the innovation-oriented strategy is positively related to interactive control systems. Concerning the strategy that prioritizes the internal efficiency and cost monitoring (like defender, cost leadership, harvest, or conservatism), the theoretical research on the use of management control systems is ambiguous (Langfield-Smith, 1997). On the one hand, Simons (1987), Guilding (1999), and Nyamori, Perera, &
Lawrence (2001) explain that management control systems are less intensively used when the firm follows a defender strategy, which suggest less diagnostic use of management control systems. On the other hand, defender firms require more sophisticated cost controls (Simons, 1990) or narrow-scope information (Abernethy & Guthrie, 1994) in order to make the internal procedures more efficient (Miles & Snow, 1978). It suggests that the defender firms rely more extensively on a diagnostic control system. Given the lack of consensus, it is hard to defend a position about the relationship between the strategy and the diagnostic management control system.

Among the studies on the strategy-MCS relationship, some focus on one facet of management control systems and examine, in particular, how the strategy affects the performance measurement system. Relying on a contingency approach, most of these studies advocate that performance measures must be aligned with the strategy and find that the fit between the strategic priorities and the measurement practices enhances the firm’s performance (Fisher, 1995). “Different businesses with different strategies require different information for […] performance measurement” (Eccles, 1991, p. 134). Govindarajan & Gupta (1985), for example, find that a greater reliance on subjective (non-formula) approach and long-term criteria (as operated through an interactive performance measurement system) enhances the effectiveness of the firm in the situation of a build strategy, which is assimilated to an innovation-oriented strategy (Simons, 1987; Langfield-Smith, 1997). The authors also do indicate that the linkage between the extent of bonus system’s reliance on short-run criteria (as motivated by a diagnostic performance measurement system) and strategic business unit effectiveness is independent of the business strategy. In line with the results of Govindarajan & Gupta (1985), Ittner, Larcker, & Rajan (1997) and Hoque (2004) also show that firms following prospector strategy place more emphasis on the use of non-financial performance measures. Since these non-financial measures provide the top-level management with a framework helpful to evaluate uncertainty in a large range of topics, the need for debates and managerial interactions increases.

H1: A prospector (defender) strategy is positively (negatively) related to the interactive PMS.

2.2.2. Relationships between the hospital strategy and the strategic uncertainties

The literature on the relationship between strategy and strategic uncertainty states that the strategy determines the objectives that are prioritized from most critical to least critical. This
classification enables top managers to emphasize the known and unknown contingencies that could threaten or invalidate the assumptions underlying the objectives. In the situation of an innovation-oriented strategy, organizations face a higher level of uncertainty than an internal efficiency and cost monitoring-oriented strategy (Porter, 1980; Miles & Snow, 1978; Miller & Friesen, 1982). This situation is justified by the fact that, on the one hand, the innovation-oriented strategy involves, nearly on an unending pace, the search for opportunities and is the creator of change while, on the other hand, the internal efficiency and cost monitoring-oriented strategy entails a need for expertise in the organization’s limited area of operations and their top-level managers are not inclined to explore outside their spheres for new opportunities (Govindarajan, 1986).

Building on the Miles & Snow’s (1978) typology, defender firms (compared to prospector) make more decisions and actions to create stability, which diminish the organization’s vulnerability to uncertainty for two reasons. First, the product-market domain is more limited for defenders than prospectors. Given that the prospectors encourage the development of new products, services or markets, the top-level managers must deal with a wider and more heterogeneous set of conditions (Abernethy & Guthrie, 1994). In addition, these conditions are filled with unknowns. Second, the defenders focus on technical efficiency in establishing only a single core technology. To contrast with prospectors and their surveillance mechanism of the market development, defenders pay more attention to the development of efficient operations. Finally, firms pursuing a prospector strategy are particularly concerned with the level of staff involvement in creativity (Hoque, 2004) than firms following a defender strategy.

Therefore, the level of strategic uncertainties about patient needs & technology and about human resources might be higher in prospector firms than defender firms. Nevertheless, the other strategic uncertainties, like strategy benchmark or partnership, are probably less sensitive to the business strategy because all hospitals (innovation or internal efficiency-oriented) are entrenched into a healthcare network. Said differently, these network-related uncertainties (strategy benchmark and partnership) are probably more independent to the strategy.

H2: A prospector (defender) strategy is positively (negatively) related to the uncertainty about (a) human resources, and (b) patient needs & technology.
2.2.3. Relationships between the strategic uncertainties and the diagnostic PMS

The diagnostic use is viewed as the traditional manner to exploit the performance measurement system (de Haas & Kleingeld, 1999). The traditional logic of the performance measurement system is to provide a set of metrics that can reflect mechanisms for enhancing strategic alignment, by enabling the translation of strategy into a set of financial and non-financial measures that may be cascaded throughout the organization (Kaplan & Norton, 1996; Kolehmainen, 2009).

However, the performance measures have to incorporate some characteristics to be diagnostically used: the objectives could be set, the outputs be measured, the deviations be calculated, and the procedures be standardized (Galbraith, 1973; Daft, Sormunen, & Parks, 1988; Simons, 2000). The properties of the measure must be stable too, with low noise and variation (Lambert & Larcker, 1987; Banker & Datar, 1989). Usually, the financial measures such as the return on investment or the net earnings have been predominant. Nevertheless, a growing body of research emphasizes the benefits of using non-financial measures (e.g., Kaplan & Norton, 1992, 1993, 1996; Ittner, Larcker, & Rajan, 1997; Ittner, Larcker, & Randall, 2003) because they are better indicators of the future success of the firm (Ittner & Larcker, 1998).

To deal with the strategic uncertainty, some performance measures might be more appropriate than others. The present paper emphasizes four strategic uncertainties and, therefore, performance measures. First, the measures related to strategy benchmark and partnership. The recent interest in these performance measures is evidenced by the proliferating literature on benchmarking and total quality measures (Hoque, 2004). However, these are not output measures but process measures (Meyer, 1994), which create difficulties for traditional performance measurement system (Kaplan & Norton, 1993) because the objective of output performance measures (like return on investment, net earnings, cash flow, and so forth) is to meet outcome targets rather than process (Hoque, 2004). Widener (2007), for example, states that measures relating to competitor tactics (sort of strategy benchmark) do not meet the conditions of a diagnostic use since the environmental disturbance caused by an unexpected changes renders these measures less accurate and thus noisier. Therefore, in the same vein, measures about the strategy benchmark and partnership do not lend themselves to a diagnostic performance measurement system.

Secondly, service industries, like healthcare for example, are characterized by the
importance of human knowledge (Ditillo, 2004), which intensify the need of an appropriate human resources management for the organizations’ survival (Vaivio, 2004). In hospitals, it is vital to find people (mostly nurses and physicians) skilled at operating the core tasks of the organization and to make sure that these key human resources are adequately managed. To ensure an appropriate workforce for hospital and the capability to restore people to health within an acceptable range of cost, top-level managers can develop and use measures related to human resources (number of terminations, recruitments, salary expenses, and so on) via the assessment of operations, the standardization of processes, and the implementation of procedures. Therefore, these measures seem to lend themselves to the diagnostic performance measurement system (Kaplan & Norton, 1992). However, since the human resources represent a significant part of the cost structure of hospital, a functional manager is usually assigned to deal with the uncertainties about human resources and is held responsible for that (Eccles, 1991). This paper suggests that, in period of low uncertainty about human resources, top managers use a diagnostic performance measurement system but, when the magnitude of this uncertainty increases, they are less interested in a diagnostic use of measures because the measures about human resources are less informative due to the noise.

Finally, since the patient needs & technology information can be routinely captured and adopted in a diagnostic management control system (Davila, 2000; Widener, 2007), these measures lend themselves to a diagnostic performance measurement system. When the level of strategic uncertainty about patient needs & technology increases, the top-level management pays more attention to the hospital activity (such as number of inpatients, outpatients, length of stays, occupancy rate, and so forth) to discern any trend in the health care needs but also to the functionality information that help also address the technology side of this uncertainty (Davila, 2000). This situation leads to an increasing use of the diagnostic performance measurement system. Additionally, these measures reflect the translation of a customer-based hospital philosophy and, as such, they become the priority of top-level managers because this philosophy is part of the most recent and important developments that top-level managers of hospital try to implement and execute (Hyer, Wemmerlöv, & Morris, 2009). Kaplan & Norton (1992), for example, and their introduction to the balanced scorecard (one type of performance measurement system), emphasize the predominant role of the customer perspective since these measures have a non-financial nature and are expected to lead the firm to future success. As such, any increase in
the uncertainty triggers a more closely results monitoring and review of key measures (Daft, Sormunen, & Parks, 1988) like the ones related to patient needs & technology.

Then, this paper predicts the following hypotheses:

H3a: The uncertainty about human resources is negatively related to the diagnostic PMS.  
H3b: The uncertainty about patient needs & technology is positively related to the diagnostic PMS.

2.2.4. Relationships between the strategic uncertainties and the interactive PMS

To contrast with the diagnostic performance measurement system and its alignment-to-objectives purpose, using the interactive performance measurement system depends on the top-level managers’ agenda such as “to explore problems, ask questions, explicate presumptions, analyse the analysable, and finally resort to judgment” (Burchell, Clubb, Hopwood, Hughes, & Nahapiet, 1980, p. 14-15). The learning process involved in these procedures filled with interactions consumes important managerial efforts (Haka & Krishnan, 2005). This involves high opportunity costs by diverting attention from other tasks. Then, a growing perception of strategic uncertainty accredits more benefits to the learning-by-interaction up to a point where these benefits outweigh the opportunity costs. In such circumstances, the role of the performance measurement system evolves from a computational machine toward a learning machine and the performance measures are viewed as catalysts for formal discussions and debates about hospitals problems and presumptions in order to agree on judgment.

As mentioned earlier, the present study puts a specific emphasis on four strategic uncertainties and, therefore, performance measures. First, through their introduction of the balanced scorecard, Kaplan & Norton (1992) place a particular focus on the customer concern due to the importance of a close monitoring of this leading indicator of success. Then, the increasing perception that unexpected shifts in patient needs & technology could occur, encourages the top-level management to adopt a proactive behavior in monitoring these needs and would promote discussions with physicians and nurses that are directly in contact with the patients and the technological needs. Nevertheless, the empirical literature shows some divergences in the significance of the relationship between technological uncertainty in particular and interactive performance measurement system. While Davila (2000) does find some

7 Cognitive and strategic reasons must be also outlined (Simons, 1995). The former reflects the limited ability of individuals to process large amount of disparate information, and the latter outlines the information overload, the analysis superficiality, a lack of perspective, and potential paralysis.
significant relationships, Widener (2007) does not. In this paper, I posit that the strategic uncertainty about patient needs & technology drives regular performance talks and the need of lateral communications.

Secondly, the core operations of hospital reside in the ability of physicians and nurses to restore people to health. The human resources represent then one of the most important elements to closely monitor. According to the strategy pointing out the types of pathology treated by the hospital, the managers have, as an objective, to ensure that the development of the hospital headcount suits to the strategic needs, to adequately invest into the workforce to promote healthcare of quality, and to maintain the workforce cost into an acceptable range. Then, this close relationship between the strategy implementation and the human resources area creates sensitivity to the human resources issues (Young, Charns, & Shortell, 2001), which reduce the cost of opportunity by rerouting attention from other tasks. Moreover, the tension in the employment market\(^8\) triggers the need of intense communications between the top-level management and the physicians and nurses in order to avoid undesirable disagreements as much as possible, which increase the benefit of an interactive use of performance measures. However, albeit the growing perception of unforeseen events about human resources is expected to encourage the interactive use of performance measures, some specific tasks related to the management of strategic issues about human resources rest, in most cases, with the responsibilities of a specific HR manager (Eccles, 1991). In this respect, a growing interactive performance measurement system is susceptible to be gradually more used by a functional manager but less used by a general manager.

Thirdly, most hospitals are increasingly integrated into a whole supply chain that begins from organizations offering punctual cures to hospitals proposing long-stay treatments. The reason is related to the healthcare institutional context that progressively encourages the top-level management to adopt a business strategy focused on some specific healthcare activities. This phenomenon implies that managers have to cope with a difficult decision-making process (for example, the choice to divest in some healthcare activities), governed by the competition but also by the potentiality of partnerships with other focused hospitals (Gunasekaran, 2002). This partnership might be translated into key performance measures such as measures about the

\(^8\) As mentioned earlier, this situation is intensified by the Social Security Modernization Act limiting the number of students enrolled in medical school, since it has drastically reduced the number of graduated physicians.
integration of partners, the alignment of different strategies, the connectivity, the time to develop partnership, the criteria for partnership formation and so on (Gunasekaran, 2002). These measures of partnership are process-oriented (to contrast with output-oriented), which call for liaison devices between different functional managers to discuss about them. It is predicted that, since the weak uncertainty about the partnership implies that the hospital is probably not involved into a partnership process, the interactive performance measurement system is weakly used. But when a partnership process is initiated, the extent of uncertainty increases and the needs of intensive debates and challenges grow likewise.

Finally, this paper places an emphasis on the strategy benchmark measures that comprise metrics about the strategic position of competitors. These measures are hardly quantifiable and integrated into a set of performance metrics since the strategic position of competitors reflects the value chain of a network that is generally large and complex. Beamon (1999) explains that certain performance measures, such as the measures relating to the value chain, can be used qualitatively for benchmarking. This externally oriented approach to measure performance can be served as a means of identifying important improvement opportunities (Eccles, 1991; Underdown & Talluri, 2002). The qualitative nature of the measures and their underlying role of improvement identification motivate debates and discussions. Nevertheless, when the strategic uncertainty about the strategy benchmark increases, it is predicted that the network of competitors are not easily identifiable any longer and the information necessary to feed the debates and discussions becomes unknowable (Chow & Sarin, 2002). This situation redirects the learning process outside of the firm (Daft, Sormunen, & Parks, 1988) and yields less interactive use of performance measures accordingly.

H4a: The uncertainty about patient needs & technology is positively related to the interactive PMS.
H4b: The uncertainty about human resources is negatively related to the interactive PMS.
H4c: The uncertainty about partnership is positively related to the interactive PMS.
H4d: The uncertainty about strategy benchmark is negatively related to the interactive PMS.

3. Research methodology

3.1. Design

A structured questionnaire was distributed and returned by mail to two members of the
top-level management team of hospitals. Mostly, respondent desired to answer by email but, in some cases, responses have been collected electronically. Given the usual disconnection between the hospital administration and the medical operations, the CEO and the COO (i.e. the medical director)\textsuperscript{9} of all Belgian hospitals were identified via the official website of the Belgian Federal Public Service of health, food chain safety and environment\textsuperscript{10}. To design the questionnaire, I relied on Dillman, Smyth, & Christian (2009). Four following steps were implemented: (1) a pre-notice letter, (2) a survey sending (one week later), (3) a follow-up letter (two weeks later), and (4) the second survey sending (two weeks later). For every step, the package was personally addressed, and included colored and hardback paper. The purpose of the first contact was to produce early interest and trust in the survey\textsuperscript{11}. In the second step, a mail package including a cover letter, the questionnaire coded with an ID, and a pre-paid reply envelope was sent. To motivate to respond, I proposed to mail back the mean scores for each question accompanied with some statistical tests. Afterwards, the first follow-up was in the form of a postcard to kindly remind the value of the questionnaire. The questionnaire complemented with a new cover letter was distributed again, as a second follow-up. The two follow-ups were sent to those who had not answered exclusively. 144 questionnaires were returned\textsuperscript{12} out of the 387 mailed initially, which yields a 37.2 \% response rate. This percentage is in line with what similar recent studies have reported (Henri, 2006b; Sandino, 2007; Kallunki & Silvola, 2008). Two respondents have been discarded from the analysis due to the significant incompleteness of the questionnaire and one extra respondent because of its insufficient experience (less than three years in the same position). I also removed four other respondents working in a less-than-50-beds hospital in order to eliminate the cases in which the informal mechanisms of control predominate. The reliability

\textsuperscript{9} The unit of analysis is organizational. At this level, I can cautiously argue that the CEO and COO have a good knowledge of their strategic positioning, strategic uncertainty, and the way their organization uses the performance measurement system since they are responsible (and have the decision-making authority) for adopting the key policies that govern the organization’s activities (Hambrick & Mason, 1984; Carpenter, Geletkanycz, & Sanders, 2004).

\textsuperscript{10} Actually, the website gives access to three lists (one per Belgian region) representing the situation at the first of January 2009. These three lists included 300 campuses of hospital (195 different hospitals) in total, 40 in the Brussels region, 159 in the Flemish region, and 101 in the Walloon region.

\textsuperscript{11} For example, the Cliniques universitaires Saint-Luc, an academic hospital, is an important faculty of the Université catholique de Louvain and is publicly known as such. Using the name and logo of the Université catholique de Louvain on the questionnaire and envelopes was likely to make the potential respondents believe that the academic hospital depending on the author’s university desires to figure out the management practice of its competitors. Then, to avoid this potential feeling of mistrust, the name and logo of the school of management was used instead of the name and logo of the University catholique de Louvain.

\textsuperscript{12} Actually, 172 responses have been received but 28 managers declined the invitation to participate. The recurring reason was that they had not three years of experience in their position.
of the measures is also evaluated. In 23 cases, the responses from two respondents (CEO and COO) per hospital have been collected\textsuperscript{13}. These 46 responses have been averaged accordingly to represent the responses from organization. Consequently, the structural model analyses are based on 114 hospitals.

This study might be threatened by two kinds of bias. First, this survey may be subject to the common-rater bias due to the single respondent for the measurement of each construct. To assess the importance of the bias, I conducted an exploratory factor analysis in which all constructs of the study have been considered all together (Harman, 1967). No single factor has materialized and no factor captures more than 25% of the total variance. Therefore, the survey is not substantially affected by the reference to common raters. Secondly, the non-response bias may also influence the results and limit the generalization of the study. The evaluation of this bias followed a two-step procedure. The respondents were initially compared with non-respondents in terms of hospital (size, diversity, region, type of hospital, ownership status) and individual (position and gender) characteristics. After that, within the set of respondents, the early and late respondents\textsuperscript{14} were contrasted with respect to each construct of the study (mean of the ratings). A t-test has been operated to test the mean difference between the scale variables and a chi-square test for categorical variables. The mean differences are not significant (at 0.05, two-tailed), which leads to the conclusion that the hypothesis of absence of a non-response bias is not rejected.

Focusing on the healthcare industry allows to concentrate on the specificities of this industry and to eliminate the influence of other industry-specific variables. Given the complexity of the variables and the expected relationships of the present paper, this focus allows to reduce the noise in the measures and to control for other non-investigated variables. At the same time, it

\textsuperscript{13} Based on these responses, I followed a two-step approach to measure the interrater reliability. First, the group of 46 respondents representing the 23 hospitals has been compared to the rest of the respondents on the basis of the size, the diversity, the status of hospital, and each construct of the model (mean of the ratings). No significant difference (at 0.05, two-tailed) has been found except for the uncertainty about patient needs & technology. The double-respondent hospitals seem to score more importantly this uncertainty. Secondly, within these 23 cases, the responses from the CEO and the COO have been contrasted with respect to the constructs of the study (mean of the ratings). The results do not show significant differences (at 0.05, two-tailed) except for ICS and DCS. It turns out that the CEO scores higher the interactive and diagnostic performance measurement system than the COO. One explanation might be that the CEO is more focused on the financial side of the hospital and its measurement of the performance while the COO is probably more concentrated on the operational side of the hospital and less on the hospital performance.

\textsuperscript{14} An early respondent is the CEO or COO that sent back the questionnaire after the first mail while a respondent is deemed as late if he/she replied after the second recall.
is reasonably recognized that the management control practices are substantially varied within hospitals (King, Clarkson, & Wallace, 2010). Furthermore, a growing body of research examines the practices within hospitals and numerous calls to improve the knowledge on accounting within not-for-profit organizations have been made (Chenhall, 2003; Auzair & Langfield-Smith, 2005). The purpose of this paper is then to build on similar studies in hospitals (Abernethy & Stoelwinder, 1991; Abernethy & Lillis, 2001; Abernethy & Brownell, 1999; Naranjo-Gil & Hartmann, 2007) and contribute in this stream of research.

3.2. Variables measurement

A two-step approach has been operated to establish the construct validity: the translation validity followed by the criterion-related validity (Trochim, 2006). First, the translation validity aims to subjectively assess the quality of indicators with regard to the construct (Runkel & McGrath, 1972). Through an extensive literature review, this quality is initially ensured in using instruments that all have been previously validated (Table 1 exhibits the questionnaire items). Due to the language sensibility in Belgium, an English-French and English-Dutch bilingual researchers in accounting translated this instrument. At face value, 2, 11, 4, and 6 items seem to respectively measure the constructs of business strategy, strategic uncertainty, diagnostic, and interactive performance measurement system rather well. Furthermore, ten top managers of hospitals have been interviewed about each construct to understand the specificity of Belgian hospitals, which allowed to contextualize each indicator. Eight academics with an experience in survey also gave their opinion on the written questionnaire for readability. Concerning the content validity, on the one hand, the relationships between the indicators and the constructs of business strategy, strategic uncertainty, and diagnostic performance measurement system are considered as reflective. On the other hand, the relationships between the indicators and the interactive performance measurement system are formative (Bisbe, Batista-Foguet, & Chenhall, 2007).

Secondly, the criterion-related validity is evaluated for each construct through the examination of the dimensionality, internal consistency, reviewed range of responses, discriminant, and convergent validity.

To measure the business strategy, I adopted the instrument of Miles & Snow (1978) since, as mentioned earlier, it has been widely used in empirical research (Simons, 1987; Doty, Glick, & Huber, 1993; Abernethy & Guthrie, 1994; Chong & Chong, 1997; Ittner, Larcker, &
Rajan, 1997; Abernethy & Brownell, 1999; Naranjo-Gil & Hartmann, 2007) and its psychometric assessment is robust (Snow and Hrebiniak, 1980; Hambrick, 1983; Shortell & Zajac, 1990). In the questionnaire, the respondent was invited to read two descriptions of hospital. The first description presented the ‘Hospital A’ following a defender strategy and the second one described the ‘Hospital B’ pursuing a prospector strategy. Based on the current situation, he/she was told to place his/her hospital on a 5-point Likert-type scale anchored at the point 1 by ‘Hospital A’-like hospital, and, at the point 5, by ‘Hospital B’-like hospital. Then, a high (low) score represents a prospector (defender) strategy. To evaluate the change in strategy, the same question was posed based on the situation three years ago. The change is then measured by the absolute value of the difference between the past and the current situation. In 45 cases, no difference between these two situations was revealed.

The strategic uncertainty as defined by Simons has not been broadly used in empirical research. Widener (2007) tests the overall Simons’ framework and, to do so, develops an instrument for the measurement of the Simons’ strategic uncertainties. Given that this instrument is initially built for a multi-sectors study, the interviews with top managers allowed to adapt this instrument to the Belgian hospital context. To evaluate the extent of strategic uncertainties, I presented the meaning of uncertainty in the questionnaire as an unforeseen event that could threaten the success of the strategy. The respondent was asked to assess the extent to which each uncertainty is important for their hospital on a 5-points Likert-type scale, three-point anchored. To capture the different strategic uncertainties, I operated an exploratory factor analysis (with varimax rotation) on eleven items of the full data set (n = 114), which extracts four factors with eigenvalue greater than one (explaining 68.6% of variance). Hiring physicians or nurses, and the conservation of physicians and nurses within the hospital load on factor 1 ($\alpha = 0.769; CR = 0.896$) which turns out to be the most relevant source of concerns in hospitals. These items are called the uncertainty about human resources. An evolution of the demand in healthcare, a new technology for medical treatment, and an evolution of the patients or family needs load on factor 2 ($\alpha = 0.770; CR = 0.866$). This factor seems to symbolize the uncertainty

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15 Scholars must clarify their position as to the debate about the source of uncertainty. While Abernethy & Brownell (1999) and Naranjo-Gil & Hartmann (2007) argue that a strategic change creates a level of uncertainty, Milliken (1987) and Gerloff, Muir, & Bodensteiner (1991) consider that change, per se, is not the source of uncertainty but rather unexpected change since decision-makers do not have accurate information about the event. It seems that Simons agrees on this last position when he wrote that “by definition, strategic uncertainties are unknowable in advance and emerge unexpectedly over time” (Simons, 2000, p. 215).

16 The values of Cronbach alpha and composite reliability originate from the PLS analysis.
about patient needs & technology. On factor 3 ($\alpha = 0.722; \ CR = 0.631$), a change in the healthcare network of competitors, and the strategic position of other hospitals load together and characterize the uncertainty about strategy benchmark. The factor 4 exclusively includes a new potential partnership with hospital. Finally, three remaining items were not comprised in any factor due to the insufficient load ($\lambda < 0.7$).

The questions measuring the diagnostic performance measurement system were constructed on the basis of the instrument of Henri (2006b), initially developed by Vandenbosch (1999). The respondent was invited to specify, on a five-point Likert-type scale, three-point anchored, the extent he/she uses the hospital scorecard for four managerial actions: to track progress towards goals, to monitor results, to compare outcomes to expectations, and to review key measures. Only one factor (with eigenvalue $> 1$) was extracted from a confirmatory factor analysis, which indicates that this construct is unidimensional. The explained variance, Cronbach’s alpha, and composite reliability are 68.7%, 0.848 and 0.897 respectively.

I selected the instrument of Naranjo-Gil & Hartmann (2007), drawn initially on Bisbe & Otley (2004) and Abernethy & Brownell (1999), to capture the interactive performance measurement system since this instrument seems to cover the different domain of interest of an Interactive Control System (Bisbe, Batista-Foguet, & Chenhall, 2007) and because Naranjo-Gil & Hartmann (2007) contextualized this instrument to the healthcare industry. The respondent was suggested to rate on a five-point Likert-type scale, three-point anchored, the extent he/she uses the hospital scorecard for each of the six types of managerial actions. Recently, methodology-oriented research argues that scholars should pay more attention to the relationship between construct and indicators for practice-defined variables, like the interactive performance measurement system for example. In most cases, empirical studies operationalize ICS in assuming implicitly that this construct is reflected by items while the methodological literature suggests that this construct might be rather formed by items (Bisbe, Batista-Foguet, & Chenhall, 2007). Presuming a formative relationship between construct and items involves that every item represents a unique constitutive part of the abstraction and cause the existence of the construct (Edwards & Bagozzi, 2000). The risk when this suggestion is neglected is to substantially bias
the estimates of the model (Jarvis, MacKenzie, & Podsakoff, 2003). Then, this paper adopts a formative relationship between the construct of interactive performance measurement system and the six indicators. I did not run a factor analysis or other classical tests because the indicators are expected to represent an independent reality (Bollen & Lennox, 1991; Bollen, 1989; Henseler, Ringle, & Sinkovics, 2009). The quality of the construct is evaluated with respect to the Diamantopoulos & Winklhofer’s (2001) recommendations: (i) content specification (see Bisbe, Batista-Foguet, & Chenhall (2007)), (ii) indicator specification, (iii) indicator collinearity, and (iv) external validity. The multicollinearity issue among the six indicators is not serious since no variance inflation factor (VIF), listed in Table 1, exceeds 2.096 (Hair, Anderson, Tatham, & Black, 1998). Regarding the external validity, Diamantopoulos & Winklhofer (2001) propose to measure the correlations between each item and another variable theoretically related. Given that all items of the interactive performance measurement system are individually and positively correlated to the construct of diagnostic performance measurement system ($p < 0.05$, two-tailed) as theoretically expected (Simons, 1995; Henri, 2006; Widener, 2007), the external validity does not seem to be endangered.

The following model controls the effects of the hospital size, measured by the number of beds (Naranjo-Gil & Hartmann, 2007; Abernethy & Lillis, 2001) to avoid potential omitted variable bias (Abernethy & Brownell, 1999; Bisbe & Otley, 2004). The hospital status, private or public, is also included in the model as a dummy variable to control its effects on the strategic uncertainties and the diagnostic and interactive performance measurement system.

4. Results

When the statistical tool must be chosen, the features of the theoretical model have to be closely examined. The model of this paper is first reflected by relationships among multiple explanatory variables ($X_i$) and response variables ($Y_j$). The model refers also to unobservable

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17 Fornell, Lorange, & Roos (1990), for example, test a structural model with formative constructs. In the paper, little attention is placed on the quality evaluation since each indicator is expected to form (not reflect) a domain of interest.

18 The six indicators forming the construct of ICS measure five facets of this construct: an intensive use by top and operating management (‘involvement in a permanent discussion with subordinates’), a pervasiveness of face-to-face challenges and debates (‘challenge new ideas and ways for doing tasks’, ‘debate data assumptions and actions plans’), a focus on strategic uncertainties (‘set and negotiate goals and targets’, ‘signal key strategic areas for improvement’), and a non-invasive, facilitating and inspirational involvement (‘use as a learning tool’).

19 Even though the item ‘use as a learning tool’ seems weakly correlated to the diagnostic PMS ($p = 0.064$, one-tailed), it is preferred to keep it in the model in order to limit the potential misspecification problems (Jarvis, MacKenzie, & Podsakoff, 2003).
latent variables (the constructs). Using a structural equation modeling (SEM) technique allows to model relationships among multiple predictor and criterion variables, to construct latent variables, but also to model errors in measurement for observed variables (the indicators), and statistically test a priori theoretical and measurement assumptions against empirical data (Chin, 1998). Therefore, I opted for the partial least square (PLS)\textsuperscript{20}, as one SEM approach (Wold, 1966, 1974, 1982, 1985). PLS is a variance-based technique that seeks to minimize the residual variance of the dependent variables, which is different than covariance-based approach (LISREL, AMOS, EQS) that estimates the extent to which an empirical covariance matrix fits to the theoretical covariance matrix. The PLS technique offers numerous benefits. It avoids small sample size issues, does not impose strict assumptions on the distribution of variables and error terms, and deal easily with reflective and formative measurement models (Henseler, Ringle, & Sinkovics, 2009).

Some descriptive statistics are displayed in Table 2. Prior to the tests of the theoretical model, the reliability of the measurement model is evaluated. For reflective measures, one item has a weight inferior to 0.7 (‘a change in the healthcare network of competitors’) and therefore, it has been dropped (Hulland, 1999). Furthermore, the average variance extracted (AVE) is calculated (Table 1) to appraise the convergent validity and, afterward, the square root of AVE is compared to the variables correlation in order to assess the discriminant validity. The smallest AVE is 0.68 which is well above the minimum threshold value of 0.5 (Fornell & Larcker, 1981) and the smallest square root of AVE is 0.826, which is greater than all correlations (Fornell & Larcker, 1981). In that case, the measurement model seems significantly reliable.

\begin{quote}
Insert Table 2 about here
\end{quote}

\section*{4.1. Preliminary results}

The Pearson correlations between the concepts in this study are displayed in the Table 3\textsuperscript{21}.

\textsuperscript{20} I used the SmartPLS software (v2.0) developed by Ringle, C.M./Wende, S./Will, S.: SmartPLS 2.0 (M3) Beta, Hamburg 2005, http://www.smartpls.de.
\textsuperscript{21} The scores of all indicators have been standardized (a zero mean and a variance of one) prior to using PLS.
First, the strategy is positively associated to the interactive performance measurement system, which means that more prospector-oriented is the hospital, more important is the interactive performance measurement system. Also, these preliminary results do not reveal significant evidence about the links between the business strategy and strategic uncertainties. Second, the associations between the strategic uncertainties (about human resources and about patient needs & technology) and the diagnostic performance measurement system are positive and significant. Thirdly, the correlations matrix shows both strong and positive associations between the strategic uncertainties (about human resources and about patient needs & technology) and the interactive performance measurement system.

Table 4 presents the correlations between the constructs in this study, computed based on the limited set of hospitals that have not changed their business strategy recently (n = 45). In this setting, the relationship between the business strategy and the interactive performance measurement system remains significant and positive. Like the previous setting (n = 114), no associations between the business strategy and the strategic uncertainties are significant. Regarding the links between the strategic uncertainties and the way of using the performance measurement system, the correlations seem to diverge from the previous setting (n = 114). More specifically, on the one hand, the strategic uncertainty about patient needs & technology stays significantly and positively related to the diagnostic and interactive performance measurement system. On the other hand, the strategic uncertainty about human resources is not associated to the diagnostic performance measurement system anymore and also becomes negatively correlated to the interactive performance measurement system.

4.2. Main findings

Table 5 reports the outcomes of the structural model and, in particular, the path coefficients and their respective t-statistics (calculated by a bootstrapping procedure of 500 samples with replacement). This table informs on the outcomes of two models. The model A
shows the results determined by the responses from all hospitals (n = 114). These results are also graphically depicted in the Fig.2. The model B and the Fig. 3 exhibit the results drawn on the responses from hospitals with a stable strategic positioning (n = 45).

Insert Table 5 about here

Insert Fig. 2 about here

Insert Fig. 3 about here

All hospitals (n = 114)

H1 predicts that, when the hospital follows a prospector strategy, the top managers use the interactive performance measurement system. The model A (Table 5, Fig. 2) shows that the business strategy is not significantly associated to the interactive performance measurement system but well to the diagnostic performance measurement system ($p = 0.042$). Then, H1 is not supported. Regarding H2, the business strategy is assumed to drive the strategic uncertainties. However, the model A does not reveal any significant relationships, which does not corroborate the hypothesis H2a and H2b.

The set of hypotheses H3 and H4 focuses on the relationships between the strategic uncertainties and the way of using the performance measurement system. Consistent to prior research, the results in the model A are relatively disappointing. Only one association is significant between the strategic uncertainties and the diagnostic performance measurement system and no more than one is significant between the strategic uncertainties and the interactive performance measurement system. On the one hand, the path coefficients of the association between the strategic uncertainty about human resources and the diagnostic performance measurement system is not statistically significant, which means that H3a is not supported. On the other hand, hospitals place more emphasis on the diagnostic performance measurement system when the strategic uncertainty about patient needs & technology is higher ($p = 0.044$), which is consistent with H3b. Furthermore, the association between the uncertainty about human
resources and the interactive performance measurement system is significant and positive. This result confirms H4a ($p = 0.009$). The other hypotheses, H4b, H4c, and H4d are not supported.

The R-square derived from the structural model amounts to 0.14 and 0.25 for the diagnostic and interactive performance measurement system respectively and is strongly significant. These figures are similar in magnitude to that reported by Widener (2007) for her test of the Simons’ framework.

*Hospitals with a stable strategy (n = 45)*

The model B (Table 5, Fig. 3) presents the results for the hospitals that have not changed their strategic positioning recently. Initially, the first hypothesis explains that the hospitals following a prospector strategy use the interactive performance measurement system. However, the results do not support this assumption. Also, in the second set of hypotheses, it is argued that the business strategy drives the importance of strategic uncertainties. In line with the model A, no significant relationships between the business strategy and the strategic uncertainties arise.

Concerning H3 and H4, the outputs show more significant results. First, as expected, the strategic uncertainty about human resources affects negatively the diagnostic performance measurement system ($p < 0.001$), which support H3a. Interestingly, this relationship is not statistically significant in the model A. Consistent with H3b and the model A, the diagnostic performance measurement system is positively driven by the strategic uncertainty about patient needs & technology ($p < 0.001$). When the model A and model B are put side by side, the path coefficients and the t-statistics seem to increase substantially in the non-strategic change setting.

Secondly, through the review of the model B, one may examine that three relationships (out of four) are significant. The output reveals a negative and significant path coefficient between the strategic uncertainty about human resources and the interactive performance measurement system ($p = 0.008$), which confirms H4a. It is worthy to observe that this path coefficient is positive in the model A. The model B reveals also that the hospitals facing higher extent of uncertainty about patient needs & technology place more emphasis on the interactive performance measurement system. H4a is then supported ($p < 0.001$). This results, however, is unconfirmed in the model A. Moreover, the output of the model B informs that the relationship between the uncertainty about strategy benchmark and the interactive performance measurement system is negative ($p = 0.085$), which is consistent with H4c. The model A, in turn, does not. Finally, in line with the model A, the association between the strategic uncertainty about
partnership and the interactive performance measurement system is not statistically significant. Thus, this output is not consistent with expectation, H4d.

The R-square of the interactive performance measurement system (0.45) seems in line with other investigations of the interactive control system such as the Naranjo-Gil & Hartmann’s (2007) study about the measures of the interactive control system in a hospital setting, the Widener (2007)’s study about the test of the Simons’ framework, or still the study of Abernethy, Bouwens, & van Lent (2010). The R-square of the model B seems substantially superior to the R-square of the model A, which means that the model B looks more appropriate than the model A. This comment is similar for the R-square of the diagnostic performance measurement system.

5. Discussions

This paper suggests that, when the business strategy exists and has not changed recently, it is more than probable that the organization drifts in a context of low level of uncertainty of objectives for action. Within this context, the role of management control systems is circumscribed to an answer or learning machine, according to the level of uncertainty of cause and effect (Burchell, Clubb, Hopwood, Hughes, & Nahapiet, 1980). This clarification in the role of management control systems enables to study a specific role of systems with respect to uncertainty instead of undistinguished roles. This paper suggests that the focus on the hospitals with unchanged strategy allows to explain that the significance of the relationships between the strategic uncertainties and the use of performance measurement systems can be less unsatisfactory. The results seem to confirm that suggestion.

First, regarding the strategic uncertainty about human resources, the diagnostic and interactive performance measurement system help monitor this uncertainty. Top managers use the performance measurement system to revise the ideas about the consequences of the decisions and to enhance the strategic alignment (Chenhall, 2005) but also “to explore problems, ask questions, explicate presumptions, analyse the analysable and finally resort to judgement” (Burchell, Clubb, Hopwood, Hughes, & Nahapiet, 1980, p. 14-15). When the level of this strategic uncertainty increases however, top managers place less emphasis on the diagnostic and interactive performance measurement system. The decreased use of the diagnostic performance measurement is consistent with a contingency approach because, when the extent of uncertainty

\[22\] Given that the style of use of management control systems is defined as the formal, information-based routines and procedures, this perspective appears to be part of the structure of the firm (delegation, hierarchy, formalization, etc).
enhances, the performance evaluation is characterized by a more subjective evaluation style (Govindarajan, 1984) and based on more nonfinancial performance measures (Ittner, Larcker, & Rajan, 1997). The decreased utilization of the interactive performance measures though might be viewed as surprising in light of the Simons’ framework since the higher level of strategic uncertainties is expected to affect positively the interactive control systems. However, the outlined argument is that increased interactive use of performance measures is operated by more functional managers and, as a consequence, the general managers participate less extensively to the debates and discussions about human resources.

To contrast with the human resources, the strategic uncertainty about patient needs & technology seems to motivate both a diagnostic and interactive use of performance measures. When this strategic uncertainty is not perceived as important, the diagnostic and interactive performance measurement system are weakly used while, when the level of strategic uncertainty goes up, more emphasis is placed on the diagnostic and interactive performance measurement system. This situation is in line with the results of Chapman (1998) who states that uncertainty intensifies the planning role of accounting and the pressure to meet financial target. It is also consistent to Merchant (1990) who argues that the uncertainty strengthens the need of interactions between managers and flexibility. As mentioned by Simons (1995) and tested by Henri (2006b), the complementary use of interactive and diagnostic performance measurement system is a powerful tool to cope with the inherent organizational tension reflected by the simultaneous need of control and flexibility.

The measures about strategy benchmark and partnership do not meet the conditions to be diagnostically used due to the noise. However, facing a growing strategic uncertainty about strategy benchmark generates debates and discussions. In particular, senior managers place strong emphasis on the interactive use of performance measures of strategy benchmark. This result is consistent with the literature related to the performance measurement of the supply chain (Beamon, 1999; Brewer & Speh, 2000; Gunasekaran, Patel, & Tirtiroglu, 2001; Gunasekaran, Patel, & McGaughey, 2003).

Finally, the results of this study imply that no control of the strategy stability is likely to lead to disappointing or even opposing results about the relationships between the strategic

Therefore, the development of the contingency theory might be considered as appropriate in the study of use and design of MCS likewise.
uncertainties and the way of using the performance measurement system. Only two relationships are statistically significant in the no-control setting while five are statistically significant in the strategic stability setting.

6. Conclusion

While the management literature abounds of adjectives to describe the nature of today business environment such as turbulent, hostile, diverse, or complex, the strategic positioning of the firm in such environment may become inappropriate after changes in customers, technologies and competition. These modifications create pressure for change in strategy (Ginsberg, 1988). On the one hand, answering to this pressure by changing the strategy could generate an increasing uncertainty about organizational objectives for action and then accounting serves as an ammunition (decision by compromise if low level of uncertainty of cause and effect) or rationalization (decision by inspiration if high level of uncertainty of cause and effect) machine. On the other hand, resisting to these pressures leads to a sense of strategy stability and a low importance of uncertainty about objectives for action. In this situation, accounting aims to facilitate the decision-making process as an answer (decision by computation if low level of uncertainty of cause and effect) or learning (decision by judgment if high level of uncertainty of cause and effect) machine.

This article provides with evidences that, in period of strategy stability, the relationships between the strategic uncertainties and the way of using the performance measurement system (diagnostic and interactive) are more significant. The reason is that ensuring strategy stability leads to a context of low uncertainty of objectives for action, which result in a clarification of the roles of performance measurement system. The diagnostic performance measurement system represents the computational machine and the interactive performance measurement system symbolizes the learning machine.

This article attempts to contribute to the literature in several respects. First, most studies consider the way of using the management control system as exogenous (Abernethy & Brownell, 1999; Bisbe & Otley, 2004; Henri, 2006b). Consequently, this research helps gain deeper understanding on the determinant side of the diagnostic and interactive control systems (Naranjo-Gil & Hartmann, 2007; Bisbe & Malagueño, 2009). In particular, this article pays particular attention to strategic uncertainty. The main reason is that the early writings of Simons point to the strategic uncertainty as the determinant of interactive control system although few prior studies
were deeply involved in such topic.

Also, Haka & Krishnan (2005) and Chenhall (2003) outline the inconsistencies in the type of questions used to measure the uncertainty and call for the use of a single valid and reliable measure of uncertainty that would help construct a consistent body of knowledge. In this study, an instrument is proposed to measure the notion of strategic uncertainty and it outlines the importance of a prior clarification (for the survey participant) of the uncertainty as an unexpected event and a contextualization of the questions to the healthcare setting.

Most empirical papers in management accounting implicitly refer to reflective epistemic relationship. This paper is an endeavor to test a model with a variable that is formed (rather than reflected) by indicators (Edwards & Bagozzi, 2000). To do so, I relied on the empirical investigation of Fornell, Lorange, & Roos (1990) and the recommendations of Diamantopoulos & Winklhofer (2001).

Finally, most OECD countries have adopted recently important reforms to restructure the healthcare system, probably due to the profound financial and non-financial issues of hospitals. However, little is known about the use of performance measures within hospitals. Thus, this paper is an attempt to contribute to this growingly important stream of research.

A practical implication for hospitals is that, in order to realize the full benefits of the performance measurement system, the interactive and the diagnostic performance measurement system should not be systematically encouraged for all measures but for a specific circumscribed set of measures.

This study suffers from limitations. First, through the use of a cross-sectional survey, no causality has been proofed. Even though the theoretical arguments describe causal relationships, it can only be argued that the results are consistent with the theory (Van der Stede, Young, & Chen, 2005). Another limitation concerns the reliability and validity of the instruments. Some cautions have been undertaken before the mailing of the questionnaire (use of validated scale, pre-test of instrument, pilot study) and verifications a posteriori have been operated (translation, construct validity, and checks of the measurement model). Yet, these steps do not fully prevent the possibilities of noise in the measures. Also, the results rely on the situation of hospitals. Then, the generalization to other kinds of organization should be done cautiously. It is worth to note too that this paper does not focus on the complete framework of Simons (1995) since the beliefs and boundaries control systems are not taken into account since it addresses specific issues revealed
in Davila (2000), Henri (2006b), and Widener (2007). Finally, although the strategy is multidimensional, this paper measures a single dimension, which is unlikely to capture the full complexity of the strategy (Ittner & Larcker, 2001). The idea was to extend the line of research illustrated by the study of Abernethy & Brownell (1999) and Naranjo-Gil & Hartmann (2007).

This investigation allows to emphasize some future valuable research questions. An important emergent area of research is the use of the performance measurement system in period of strategic change (Chenhall & Langfield-Smith, 2003). This study shows that, in comparing the two settings (all hospitals vs. hospitals with a stable strategy), the measures related to human resources (one key organizational resource for organizational learning) are used differently. Then, one could understand that the organizational learning is sensitive to the strategic context but, however, little is known about the effect of this context on the organizational learning.

Furthermore, one relatively unexplored area of research is the nature of the management control systems’ change. Traditionally, one specific system is examined whereas all managers do not use identically the same system. Bisbe & Otley (2004) and Bisbe & Malagueño (2009) are examples that illustrate this reasoning. Consequently, the investigation of the nature of the change in use of management control systems would allow to identify the evolution in the use of management control systems.
Fig. 1. Graphical depiction of the general structural model. This model is an adapted version of Simons (1995, p.102). The effects of the hospital size & status are controlled.

Fig. 2. Graphical depiction of the results of the structural model for the full set of hospitals (n = 114). It presents the path coefficients of the model A (Table 4) for the relationships between strategy, strategic uncertainties, and the way of using PMS. The solid and dotted lines represent significant and not significant results respectively. ***, **, *: Significant at p < 0.01, 0.05, 0.10 respectively (two-tailed).
Fig. 3. Graphical depiction of the results of the structural model for the set of hospitals that do not change their strategy (n = 45). It presents the path coefficients of the model B (Table 4) for the relationships between strategy, strategic uncertainties, and the way of using PMS. The solid and dotted lines represent significant and not significant results respectively. ***, **, *: Significant at $p < 0.01, 0.05, 0.10$ respectively (two-tailed).
Table 1. Questionnaire items, factor analysis, loadings, reliability and validity statistics for the constructs (n = 114)

Strategic uncertainty: Consider an uncertainty as an unexpected event that could derail the success of your hospital strategy. To what extent are the here-mentioned uncertainties important for your hospital now? (Scale: 1 = Not at all, 3 = Average, 5 = To a great extent)

<table>
<thead>
<tr>
<th>Item</th>
<th>Human resources</th>
<th>Patient needs &amp; technology</th>
<th>Strategy benchmark</th>
<th>Partnership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hiring physicians or nurses</td>
<td>0.834</td>
<td>0.137</td>
<td>-0.096</td>
<td>0.147</td>
</tr>
<tr>
<td>Conservation of physicians and nurses within the hospital</td>
<td>0.847</td>
<td>0.086</td>
<td>0.130</td>
<td>-0.019</td>
</tr>
<tr>
<td>Evolution of the demand in healthcare</td>
<td>0.168</td>
<td><strong>0.826</strong></td>
<td>0.192</td>
<td>-0.161</td>
</tr>
<tr>
<td>New technology for medical treatment</td>
<td>0.178</td>
<td><strong>0.727</strong></td>
<td>0.066</td>
<td>0.253</td>
</tr>
<tr>
<td>Evolution of the patients or family needs</td>
<td>0.154</td>
<td><strong>0.825</strong></td>
<td>0.078</td>
<td>-0.026</td>
</tr>
<tr>
<td>[A change in the healthcare network of competitors]</td>
<td>0.017</td>
<td>0.171</td>
<td>[0.859]</td>
<td>0.053</td>
</tr>
<tr>
<td>The strategic position of other hospitals (service activity)</td>
<td>0.061</td>
<td>0.076</td>
<td><strong>0.815</strong></td>
<td>0.142</td>
</tr>
<tr>
<td>A new potential partnership with hospital</td>
<td>0.190</td>
<td>0.071</td>
<td>0.290</td>
<td><strong>0.799</strong></td>
</tr>
<tr>
<td>Staff resistance if important change in hospital occurs</td>
<td>0.610</td>
<td>0.415</td>
<td>0.059</td>
<td>0.117</td>
</tr>
<tr>
<td>New hospital in the region</td>
<td>0.395</td>
<td>0.136</td>
<td>0.420</td>
<td>-0.464</td>
</tr>
<tr>
<td>A modification of the public financing system or ID system</td>
<td>0.545</td>
<td>0.423</td>
<td>0.262</td>
<td>-0.206</td>
</tr>
<tr>
<td>% of variance explained</td>
<td>81.3%</td>
<td>68.3%</td>
<td>[78.9%]</td>
<td>100%</td>
</tr>
<tr>
<td>Cronbach alpha (α)</td>
<td>0.769</td>
<td>0.770</td>
<td>[0.722]</td>
<td>1.000</td>
</tr>
<tr>
<td>Composite reliability (CR)</td>
<td>0.896</td>
<td>0.866</td>
<td>[0.631]</td>
<td>1.000</td>
</tr>
<tr>
<td>Average variance extracted (AVE)</td>
<td>0.811</td>
<td>0.683</td>
<td>[0.517]</td>
<td>1.000</td>
</tr>
<tr>
<td>Variance inflation factor (VIF)</td>
<td>1.256</td>
<td>1.275</td>
<td>1.134</td>
<td>1.085</td>
</tr>
<tr>
<td>R² (model A/B)</td>
<td>0.066/0.070</td>
<td>0.045/0.116</td>
<td>0.026/0.079</td>
<td>0.005/0.006</td>
</tr>
</tbody>
</table>

Diagnostic PMS: Currently, to what extent do you use your hospital scorecard to... (Scale: 1 = Not at all, 3 = Average, 5 = To a great extent)

<table>
<thead>
<tr>
<th>Item</th>
<th>VIF</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track progress towards goals</td>
<td>0.846</td>
<td></td>
</tr>
<tr>
<td>Monitor results</td>
<td>0.788</td>
<td></td>
</tr>
<tr>
<td>Compare outcomes to expectations</td>
<td>0.848</td>
<td></td>
</tr>
<tr>
<td>Review key measures</td>
<td>0.833</td>
<td></td>
</tr>
<tr>
<td>Cronbach alpha (α)</td>
<td>0.848</td>
<td></td>
</tr>
<tr>
<td>Composite reliability (CR)</td>
<td>0.897</td>
<td></td>
</tr>
<tr>
<td>Average variance extracted (AVE)</td>
<td>0.685</td>
<td></td>
</tr>
<tr>
<td>% of variance explained</td>
<td>68.7%</td>
<td></td>
</tr>
<tr>
<td>R² (model A/B)</td>
<td>0.143/0.312</td>
<td>**</td>
</tr>
</tbody>
</table>

Interactive PMS: Currently, to what extent do you use your hospital scorecard to... (Scale: 1 = Not at all, 3 = Average, 5 = To a great extent)

<table>
<thead>
<tr>
<th>VIF</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.071</td>
<td>-0.296</td>
</tr>
<tr>
<td>2.096</td>
<td>0.704</td>
</tr>
<tr>
<td>2.051</td>
<td>0.235</td>
</tr>
<tr>
<td>1.822</td>
<td>-0.170</td>
</tr>
<tr>
<td>1.735</td>
<td>0.378</td>
</tr>
<tr>
<td>1.223</td>
<td>-0.669</td>
</tr>
<tr>
<td>R² (model A/B)</td>
<td>0.224/0.449</td>
</tr>
</tbody>
</table>

Strategy: Currently, where would you place your hospital? (5 points scale with two anchors: Hospital A, hospital B).

This table presents the results of factor analysis by construct. A principal components analysis with varimax rotation has been run with SPSS (v.18). I extracted all factors with eigenvalue > 1 and indicated the variance explained for each factor. For ease of presentation, I outlined the loadings > 0.7 in bold that are considered in the PLS analyses. The [...] indicates that, due to the dropping of item, these results do not hold any longer. The Cronbach’s alpha, the composite reliability, the average variance extracted, and the variance inflation factor are reported for each construct. ***, **, *: Significant at p < 0.01, 0.05, 0.10 respectively (two-tailed).
<table>
<thead>
<tr>
<th>Constructs and indicators</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Median</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interactive PMS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To set and negotiate goals and targets</td>
<td>1</td>
<td>5</td>
<td>3.49</td>
<td>4.00</td>
<td>0.994</td>
</tr>
<tr>
<td>To encourage new goals and priorities</td>
<td>1</td>
<td>5</td>
<td>3.64</td>
<td>4.00</td>
<td>0.948</td>
</tr>
<tr>
<td>To signal key strategic areas for improvement</td>
<td>1</td>
<td>5</td>
<td>3.78</td>
<td>4.00</td>
<td>0.885</td>
</tr>
<tr>
<td>To challenge new ideas and ways for doing tasks</td>
<td>1</td>
<td>5</td>
<td>3.29</td>
<td>3.00</td>
<td>0.925</td>
</tr>
<tr>
<td>To involve in a permanent discussion with subordinates</td>
<td>1</td>
<td>5</td>
<td>3.10</td>
<td>3.00</td>
<td>1.018</td>
</tr>
<tr>
<td>To use as a learning tool</td>
<td>1</td>
<td>5</td>
<td>2.92</td>
<td>3.00</td>
<td>1.063</td>
</tr>
<tr>
<td><strong>Diagnostic PMS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To track progress towards goals</td>
<td>1</td>
<td>5</td>
<td>3.77</td>
<td>4.00</td>
<td>0.945</td>
</tr>
<tr>
<td>To monitor results</td>
<td>1</td>
<td>5</td>
<td>3.79</td>
<td>4.00</td>
<td>0.893</td>
</tr>
<tr>
<td>To compare outcomes to expectations</td>
<td>1</td>
<td>5</td>
<td>3.63</td>
<td>4.00</td>
<td>0.953</td>
</tr>
<tr>
<td>To review key measures</td>
<td>1</td>
<td>5</td>
<td>3.92</td>
<td>4.00</td>
<td>0.969</td>
</tr>
<tr>
<td><strong>SU1 - Human resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hiring physicians or nurses</td>
<td>2</td>
<td>5</td>
<td>4.24</td>
<td>4.00</td>
<td>0.807</td>
</tr>
<tr>
<td>Conservation of physicians and nurses within the hospital</td>
<td>2</td>
<td>5</td>
<td>4.11</td>
<td>4.00</td>
<td>0.819</td>
</tr>
<tr>
<td><strong>SU2 - Patients &amp; Technology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evolution of the demand in healthcare</td>
<td>2</td>
<td>5</td>
<td>3.61</td>
<td>4.00</td>
<td>0.936</td>
</tr>
<tr>
<td>New technology for medical treatment</td>
<td>1</td>
<td>5</td>
<td>3.02</td>
<td>3.00</td>
<td>1.090</td>
</tr>
<tr>
<td>Evolution of the patients or family needs</td>
<td>1</td>
<td>5</td>
<td>3.71</td>
<td>4.00</td>
<td>0.877</td>
</tr>
<tr>
<td><strong>SU3 - Strategy benchmark</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[A change in the healthcare network of competitors]</td>
<td>[1]</td>
<td>[5]</td>
<td>[3.51]</td>
<td>[3.50]</td>
<td>[0.907]</td>
</tr>
<tr>
<td>The strategic position of other hospitals (service activity)</td>
<td>2</td>
<td>5</td>
<td>3.83</td>
<td>4.00</td>
<td>0.832</td>
</tr>
<tr>
<td><strong>SU4 - Partnership</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A new potential partnership with hospital</td>
<td>1</td>
<td>5</td>
<td>3.94</td>
<td>4.00</td>
<td>0.935</td>
</tr>
<tr>
<td>Strategy</td>
<td>1</td>
<td>5</td>
<td>3.01</td>
<td>3.00</td>
<td>1.157</td>
</tr>
</tbody>
</table>
Table 3. Pearson correlation coefficients from PLS (n = 114)

<table>
<thead>
<tr>
<th></th>
<th>1. DCS</th>
<th>2. ICS</th>
<th>3. STRAT</th>
<th>4. SU1</th>
<th>5. SU2</th>
<th>6. SU3</th>
<th>7. SU4</th>
<th>8. SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. ICS</td>
<td>0.391 ***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. STRAT</td>
<td>0.219 **</td>
<td>0.177 *</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. SU1</td>
<td>0.164 *</td>
<td>0.405 ***</td>
<td>0.002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. SU2</td>
<td>0.233 **</td>
<td>0.286 ***</td>
<td>0.076</td>
<td>0.352 ***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. SU3</td>
<td>0.115</td>
<td>0.058</td>
<td>0.010</td>
<td>0.136</td>
<td>0.215 **</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. SU4</td>
<td>0.043</td>
<td>0.028</td>
<td>0.037</td>
<td>0.157 *</td>
<td>0.156 *</td>
<td>0.212 **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. SIZE</td>
<td>0.256 ***</td>
<td>0.212 **</td>
<td>0.353 ***</td>
<td>0.199 **</td>
<td>0.157 *</td>
<td>-0.046</td>
<td>-0.042</td>
<td></td>
</tr>
<tr>
<td>9. STATUS</td>
<td>-0.162 *</td>
<td>-0.033</td>
<td>-0.069</td>
<td>-0.195 **</td>
<td>0.096</td>
<td>-0.132</td>
<td>0.034</td>
<td>-0.266 ***</td>
</tr>
</tbody>
</table>

Table 4. Pearson correlation coefficients from PLS (n = 45)

<table>
<thead>
<tr>
<th></th>
<th>1. DCS</th>
<th>2. ICS</th>
<th>3. STRAT</th>
<th>4. SU1</th>
<th>5. SU2</th>
<th>6. SU3</th>
<th>7. SU4</th>
<th>8. SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. ICS</td>
<td>0.607 ***</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3. STRAT</td>
<td>0.244</td>
<td>0.295 **</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4. SU1</td>
<td>-0.057</td>
<td>-0.252 *</td>
<td>-0.053</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. SU2</td>
<td>0.358 **</td>
<td>0.369 **</td>
<td>0.133</td>
<td>0.250 *</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. SU3</td>
<td>0.158</td>
<td>-0.220</td>
<td>-0.051</td>
<td>0.205</td>
<td>0.169</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7. SU4</td>
<td>0.154</td>
<td>0.133</td>
<td>0.041</td>
<td>-0.012</td>
<td>0.126</td>
<td>0.242</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. SIZE</td>
<td>0.288 *</td>
<td>0.334 **</td>
<td>0.425 ***</td>
<td>0.146</td>
<td>0.069</td>
<td>-0.099</td>
<td>-0.033</td>
<td></td>
</tr>
<tr>
<td>9. STATUS</td>
<td>-0.164</td>
<td>0.079</td>
<td>-0.083</td>
<td>-0.233</td>
<td>0.273 *</td>
<td>-0.206</td>
<td>-0.020</td>
<td>-0.381 ***</td>
</tr>
</tbody>
</table>

***, **, *: Significant at p < 0.01, 0.05, 0.10 respectively (two-tailed).

Table 5. Structural model

<table>
<thead>
<tr>
<th></th>
<th>Model A - All data (n = 114)</th>
<th>Model B - No SC (n = 45)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Path coefficient</td>
<td>T-statistic</td>
</tr>
<tr>
<td>S → DCS</td>
<td>0.147</td>
<td>2.061 **</td>
</tr>
<tr>
<td>(H1) S → ICS (+)</td>
<td>0.143</td>
<td>1.100</td>
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<tr>
<td>(H2a) S → SU1 (+)</td>
<td>-0.074</td>
<td>0.960</td>
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<tr>
<td>(H2b) S → SU2 (+)</td>
<td>0.019</td>
<td>0.319</td>
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<tr>
<td>S → SU3</td>
<td>0.034</td>
<td>0.437</td>
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<tr>
<td>S → SU4</td>
<td>0.059</td>
<td>0.822</td>
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<tr>
<td>(H3a) SU1 → DCS (–)</td>
<td>0.040</td>
<td>0.486</td>
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<tr>
<td>(H3b) SU2 → DCS (+)</td>
<td>0.185</td>
<td>2.035 **</td>
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<tr>
<td>SU3 → DCS</td>
<td>0.060</td>
<td>0.762</td>
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<tr>
<td>SU4 → DCS</td>
<td>-0.001</td>
<td>0.010</td>
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<tr>
<td>(H4b) SU1 → ICS (–)</td>
<td>0.359</td>
<td>2.665 ***</td>
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<tr>
<td>(H4a) SU2 → ICS (+)</td>
<td>0.139</td>
<td>1.178</td>
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<tr>
<td>(H4d) SU3 → ICS (–)</td>
<td>0.000</td>
<td>0.000</td>
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<tr>
<td>(H4c) SU4 → ICS (+)</td>
<td>-0.054</td>
<td>0.535</td>
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</tbody>
</table>

This table reports the output of the PLS structural model. The model A represents the basic structural model with the full dataset (n = 114). The model B reflects the model in which only the data from the hospitals in a non-strategic change setting are used (n = 45). ***, **, *: Significant at p < 0.01, 0.05, 0.10 respectively (two-tailed).
References


