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Practicing Lean strategy: Hoshin Kanri and X-Matrix in a healthcare-centered simulation

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Abstract

Purpose – This paper builds on the debate regarding the application of Lean strategy principles and tools in modern organizations, specifically focusing on the healthcare (HC) sector. The purpose of this paper is threefold: first, to highlight the potential role played by Lean strategy tools for strategic planning and management, particularly in reference to the Hoshin Kanri policy deployment system and the "focus, alignment, integration, and review" (FAIR) method; second, to discuss how Lean strategy can be operationalized, specifically relying on the X-Matrix reporting tool; and third, to explore how simulation techniques, in the form of role-playing (RP), may support the aforementioned operationalization of Lean strategy while at the same time promoting policymaking and knowledge sharing.
Design/methodology/approach – This research adopts a case study approach. Specifically, the paper relies on the use of a RP Lean strategy project developed in a HC setting.
Findings – The paper highlights the potential for the Hoshin Kanri policy deployment process in HC, also emphasizing the main strengths of X-Matrix reporting and the usefulness of the RP technique to support learning acquisition and decision making.
Practical implications – The paper demonstrates how a Lean strategy simulation project may be effectively used for strategic planning/management and to train professionals in HC. To achieve these aims, a methodology to design and implement simulation-based Lean strategy projects in HC is presented and discussed.
Originality/value – A review of the academic literature indicates that Lean strategy is still an emerging research topic addressed by only a limited number of articles. The paper contributes to a deeper understanding of the fundamentals of Lean strategy (particularly Hoshin Kanri and X-Matrix) with particular reference to the HC sector.

Keywords Healthcare, Lean thinking, Hoshin Kanri, Lean strategy, Role-playing, X-Matrix
Paper type Case study

1. Introduction and research aims

Lean (Womack *et al.*, 1990) principles and tools have been applied for many years in a variety of industries and contexts. Following their original applications in the automotive industry, Lean principles were subsequently implemented in the manufacturing industry (e.g. Shah and Ward, 2003; Melton, 2005; Taj, 2008; Karim and Arif-Uz-Zaman, 2013), in companies both large (e.g. Bhasin, 2012) and small (e.g. Achanga *et al.*, 2006; Lande *et al.*, 2016), in service-based organizations (e.g. George, 2003; Liker and Morgan, 2006; Bicheno, 2008; Taylor, 2008; Suárez-Barraza *et al.*, 2012), and, more recently, in the public sector (e.g. Radnor and Bucci, 2008; Radnor and Boaden, 2008; Taylor, 2008; Radnor and Osborne, 2013).

The fundamental Lean principle seeks to increase the efficiency of a given process through the identification and elimination of wasteful activities, described with the Japanese term of *muda*. This approach helps organizations to increase value-added activities (hereafter VA) – i.e., those that in the eyes of the final customer make a product or a service more valuable – and reduce non-value-added activities (NVA), decrease operational costs, increase quality, and facilitate business process reengineering and improvement initiatives (Hines and Taylor, 2000; Pettersen, 2009; Horne, 2014).

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In the public sector context, Lean provides a powerful approach for assisting organizations in increasing the efficiency and quality of their services while simultaneously reducing wasteful activities, saving costs, and generating greater value for their customers and, more generally, all of their stakeholders (Radnor and Walley, 2008). This coincides with the current debate involving change management processes within public administrations, which have been under scrutiny across the globe for more than two decades (Radnor, 2010; Radnor and Osborne, 2013). In particular, strong rhetoric about the so-called "3 Es" (efficiency, effectiveness, and economy) first emerged within the aforementioned scenario (Barzelay, 1992; Hood, 1995; Van Dooren *et al.*, 2010) and later became part of the even stronger debate on the necessity of adopting strategic management and strategic planning tools (Bryson and Roering, 1987; Bryson, 1988, 2011; Moore, 1995; Poister and Streib, 1999) in order to manage the interdependencies between internal and external processes and services (Radnor and Johnston, 2013).

In this scenario, Lean is not to be regarded just as an operations management technique and a set of operational tools (Radnor *et al.*, 2006; Shah and Ward, 2007). Rather, Lean is a systematic approach to continuous improvement, a "philosophy" (Bhasin and Burcher, 2006) and "ideology" (Bhasin, 2011) based on a comprehensive strategic architecture for assisting organizations in developing strategies, implementing plans and actions, aligning operations with the organization's strategies, and measuring results against targets in the short, medium, and long term (Radnor *et al.*, 2012).

However, it is important to note that, whereas Lean tools are able to help organizations pursue goals of increased efficiency, efficacy, and cost savings (i.e. economy), its strategic dimension and ability to support strategy design and strategy implementation have received less attention in the literature. Interestingly, the "strategic nature" of Lean is growing in prominence (e.g. Barnabè, 2015), whereas Lean is seen beyond its operational content as a managerial philosophy that may be selected by a given organization (Bhasin, 2011; Radnor *et al.*, 2012).

To achieve their goals, Lean organizations rely on a dedicated policy deployment system and specific performance measurement tools or metrics. Regarding the former, the literature suggests adopting either the balanced scorecard system (Kaplan and Norton, 1992, 1996, 2001) or the Hoshin Kanri process (Tennant and Roberts, 2001; Jackson, 2006; Chiarini, 2016). Regarding the latter, a specific reporting system (called X-Matrix) and a set of key indicators (named Lean metrics) are usually applied to measure performance in Lean organizations.

Starting from these considerations, this paper refers to healthcare (HC) organizations as the context selected for the analysis, due to their peculiarities, and the factors affecting performance and policy deployment in HC. Cost pressure, spending review processes, and increased customer requirements are just some examples that call for the design and implementation of long-term sustainable strategies in HC. Moreover, these factors are relevant and common for HC organizations across the globe.

More specifically, this paper aims to:

(1) highlight the potential role of Lean tools for strategic planning and strategic management; in particular, this paper focuses on the Hoshin Kanri policy deployment system and the "focus, alignment, integration, and review" (FAIR) method;

(2) discuss how Lean strategy can be operationalized, specifically relying on the reporting tool called X-Matrix; and

(3) explore how simulation techniques, in the form of role-playing (RP), may support the aforementioned operationalization of Lean strategy while also promoting policymaking and knowledge sharing.

To achieve these goals, the paper presents a simulation-based Lean strategy case study (Yin, 1994) organized at an Italian University hospital in which 22 HC professionals took part

into a RP simulation. Data and the main outputs are reported and discussed. Excerpts from the debriefing phase are additionally reported to gauge the outcomes and usefulness of the project.

The paper is structured as follows: Section 2 briefly summarizes Lean principles and tools. Section 3 focuses on the concept of Lean strategy, presenting the fundamental characteristics of the Hoshin Kanri deployment system, the FAIR method, and the X-Matrix. Section 4 provides a brief literature review of Lean thinking and strategy in the HC sector. The research design, the data, and the outputs of the study are reported in Section 5. The discussion and several final remarks conclude the paper.

2. Lean thinking

Lean was originally developed and implemented by Japanese manufacturing companies (Ohno, 1988), specifically in the automotive market (Monden, 1983). Faced with a scarcity of resources and increased competition (Hines *et al.*, 2004), Japanese companies had to develop management approaches and operations tools to simultaneously increase efficiency, eliminate wasteful activities, and reduce costs. In general, Lean did not immediately acquire great relevance; the interest of western authors and manufacturers increased only after the publication of *The Machine that Changed the World* by Womack *et al.* (1990). Lean was subsequently implemented in the US auto manufacturing and in many other production systems, including the service industry and in public sector organizations.

The key Lean principle entails the pursuit of value creation through the elimination of waste.

Value creation is defined as adopting the customer point of view; therefore, only those activities that add value from the final customer's perspective (and not from the perspective of the organization and/or its functions and departments) are seen as worthy and value-adding. Other activities are either non-value-added but still necessary activities or unnecessary, non-value-added activities, i.e., waste to be eliminated.

The literature identifies the main categories of wasteful activities as the so-called "Toyota seven-wastes," or *muda* (Ohno, 1988): overproduction, waiting, transporting, over-processing, unnecessary inventory, unnecessary/excess motion, and defects. Besides the main goal of eliminating waste, the method focuses on cost reduction (Hines and Taylor, 2000; Hines *et al.*, 2004) and designing-out overburden (*muri*) and inconsistencies (*mura*) (see Hines *et al.*, 2008).

In broad terms, Lean thinking (Ohno, 1988; Womack *et al.*, 1990; Womack and Jones, 1996; Hines and Taylor, 2000) may be viewed as a five-step process, as follows:

(1) Identify value and waste: only a part of an organization's activities creates value from the customer's perspective, rather from the perspective of individual organizations or departments; therefore, it is necessary to identify who is the end customer and to separate the activities that add value from the end customer's perspective from non-value activities, i.e., waste.

(2) Map value stream: a value stream map (VSM) is used to identify and map all the activities across the organization that are involved and play a role in jointly delivering a product or service. The activities are usually classified in VA and NVA, as well as in online and offline activities; typically, organizations develop two VSMs, i.e., a current state map that portrays the as-is situation and a future state map that defines the desired future situation.

(3) Create flow: this step generates a flow of activities to be performed in sequence so to flow to the customers without waste, interruptions, reworks, or waiting times.

(4) Establish pull: the process is regulated with pull logic, i.e., the customer pulls value from upstream activities (therefore, the whole system is demand driven).

(5) Seek perfection: in the end, any system should be organized and managed to pursue perfection, having specified the customer's value, identified value stream, eliminated

waste, created flow, and introduced pull logic. As a whole, this may be seen as a continuous improvement process that takes place "by continually removing successive layers of waste as they are uncovered" (Hines and Taylor, 2000, p. 4).

To this aim, Lean relies on a variety of tools, including maps (e.g. VSMs and spaghetti charts), root cause analysis techniques (e.g. five-whys technique, Ishikawa diagrams), statistical-based tools (Lean Six Sigma), visual management devices, etc. As argued by Shah and Ward (2003, p. 129), "The core thrust of lean production is that these practices can work synergistically to create a streamlined, high quality system that produces finished products at the pace of customer demand with little or no waste." Beyond that, pursuing perfection and zero-waste is a daunting challenge for any kind of organization. As Womack *et al.* (1990, pp. 13-14) state, while Lean producers on one side "set their sights explicitly on perfection: continually declining costs, zero defects, zero inventories and endless product variety," on the other side, "no lean producer has ever reached his promised land – and perhaps none ever will."

Therefore, Lean is to be regarded beyond its practical implications and technical interventions as a systematic approach to strategy design and implementation. More specifically, in the last few years, Lean has evolved from a very practical OR technique to a comprehensive strategic management approach for complex business domains (Maskell and Baggaley, 2003; Jackson, 2006; Maskell and Kennedy, 2007; Bhasin, 2008, 2012; Kennedy and Widener, 2008; Hutchins, 2008; Fullerton *et al.*, 2013; Barnabè, 2015), as discussed in the next section presenting the concept of Lean strategy.

3. Beyond Lean thinking: Lean strategy

Concept of Lean strategy

A recent and growing body of literature clearly highlights the potential role that Lean strategy principles, techniques, and tools may play in assisting private as well as public organizations in designing and implementing their strategies (e.g. Jackson, 2006; Hutchins, 2008; Cudney, 2009; Chiarini, 2010, 2016).

Lean strategy (Barnabè, 2015) can be defined as a systemic and systematic approach to strategy design, implementation, and measurement in Lean organizations, namely, those companies organized and run according to Lean principles. To this aim, a core set of principles and tools are used for developing a fundamental and comprehensive strategic architecture.

Specifically, a "Lean strategy architecture" provides decision makers with a complete policy deployment process (known as Hoshin Kanri), a few fundamental managerial principles (the basic Lean principles), a structured reporting device (the X-Matrix), and a full set of key performance indicators (KPIs or Lean metrics) to be used to report, monitor, and analyze performance measures against targets.

Considering the aims of this study, emphasis is subsequently placed on the Hoshin Kanri process and the X-Matrix tool.

Hoshin Kanri

Hoshin Kanri is a process of policy deployment that has been applied since the late 1960s (Kondo, 1998; Roberts and Tennant, 2003). Building on the organization's mission, the methodology seeks to ensure that the strategic objectives identified by the company are able to stimulate the actions of all relevant players at all the hierarchical levels, consequently pursuing increased performance and continuous improvement (Witcher and Sum Chau, 2007). Therefore, Hoshin Kanri is meant to align corporate strategic objectives as defined and managed by senior managers (at the strategic level) with the plans and activities of middle management and teams (tactical level) and the work done by the employees (operational level), as portrayed in Figure 1.

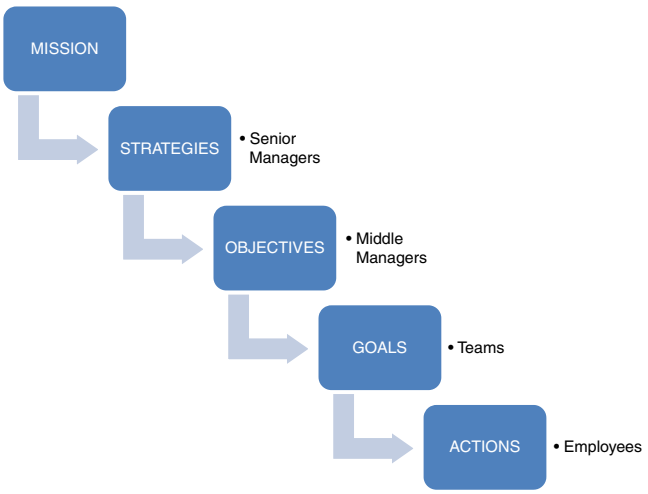

Figure 1.
Hoshin Kanri deployment process

As shown, the Hoshin system is based on the linkages between mission, strategies, objectives, and goals (Grant, 2016). Within this process of policy deployment, so-called Hoshin teams play a fundamental role. These teams usually include most (or all) of the professionalisms within the organization at all organizational and functional levels, from senior management to middle management and employees (who participate in Kaizen events) at the operational level. The ultimate goal is not only to ensure that the business strategy is known by everyone in the organization, but also to implement a method of communication and dissemination of strategic issues throughout the organization at all levels, thus focusing employees' attention on the chosen targets, subsequently informing their decisions and guiding their actions.

In other words, the methodology supports not only strategic planning but also the translation of strategies into medium-term plans and short-time operations. At the same time, Hoshin Kanri provides a coherent and structured framework to assist organizations in identifying and formalizing their priorities and providing the fundamental KPIs needed to assess the impacts and outcomes subsequently generated.

In detail, the execution of Hoshin Kanri is articulated into four distinct phases, which are summarized by the acronym FAIR:

(1) Focus: this phase stimulates management to identify and define the main strategic objectives. The idea of "focus" means that the entire organization's strategy is dismissed in favor of just a few strategic priorities.

(2) Alignment: the "align" phase aims to correlate available resources with strategic priorities and objectives (as identified in the previous step) through the development of appropriate policies (the Hoshin policies). The Hoshin policies, in particular, are agreed upon within dedicated teams in a participatory manner.

(3) Integrate: this phase provides for the "integration" of the Hoshin policies with daily operational activities. To do this, the Hoshin policies are included in an implementation plan.

(4) Review: in this step, the implementation of Hoshin policies and their results are assessed, eventually defining corrective actions. Reviews are usually carried out on a yearly basis, but they could also be scheduled more frequently. Typically, the information gained in this phase is used to redefine the next Hoshin cycle.

Implementing Hoshin Kanri involves the drafting of numerous reports, particularly X-Matrix reports.

X-Matrix

Also known as "A3-X" or "A3-X Report," the X-Matrix is at the heart of the business planning process carried out according to the Hoshin cycle. The ultimate aim of this report is to provide a structured framework for linking together long-term strategic goals, strategic objectives, tactical improvement initiatives, and KPIs.

More specifically, the X-Report displays in clockwise direction four main sections that require:

(1) identifying the strategies to be implemented;

(2) defining long-term strategic objectives, in relation to the targets to be achieved;

(3) developing tactics, or the specific improvement initiatives that will allow to achieve the targets (initiatives/tactics); and

(4) identifying a core set of short-term KPIs useful for reporting and assessing the results of the policy deployment.

A typical X-Matrix is portrayed in Figure 2. Notably, the aforementioned terms are displayed at the center of the report and linked together in clockwise direction.

Moving clockwise, the X-Matrix helps organizations not only to formalize their strategies but also to "translate" long-term plans into short-term initiatives and targets. Regarding the measures that may be included into any X-Matrix, Lean typically provides a complete set of metrics (the *Lean metrics*), including time-based indicators (e.g. lead time and time to market), financial measures (e.g. EBIT and EBITDA), measures of efficiency and effectiveness (e.g. overall or operational equipment effectiveness), customer-related indicators, etc.

Interestingly, integration and connection among items within the X-Matrix are ensured, highlighting their "correlations." Specifically, the sections in the corners highlight the correlations between the other elements displayed in adjacent areas. For example, the correlation section located on the lower left corner links strategies with strategic objectives.

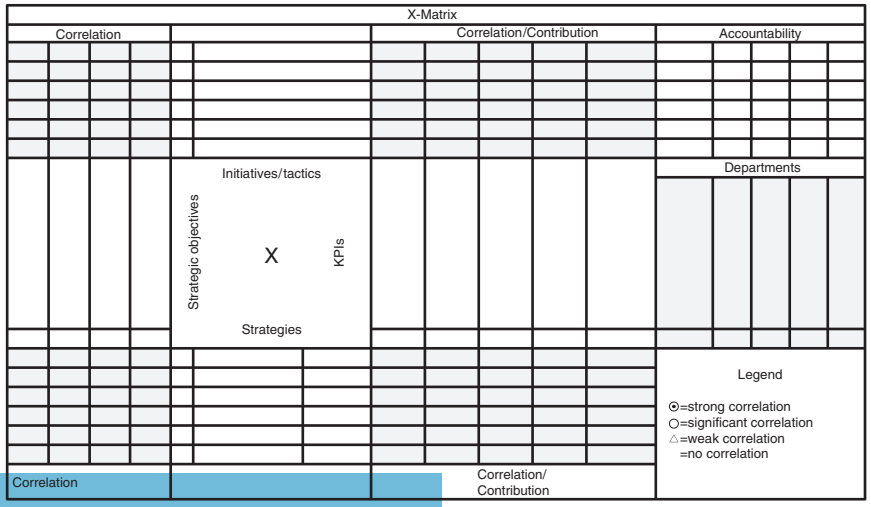

Figure 2.
Structure of a typical X-Matrix

The right part of the matrix highlights which teams or individuals are accountable for the initiatives/tactics and, therefore, for achieving the expected results.

The strength and level of correlation and accountability are typically visualized with a few icons, as exemplified below:

◉ = strong correlation, or team leader responsibility;
○ = significant correlation, or accountability for a specific core team member;
Δ = weak correlation, or accountability for a participating team member (who may change periodically according to a rotation scheme); and
empty cell = no correlation, or responsibilities not attributed to any team member.

In this regard, Lean makes a frequent and widespread use of visual elements for the purpose of direct communication, with an immediate impact for the reader and the recipient of the information.

Given these considerations, the X-Matrix may be considered to be a loose framework (Brännmark *et al.*, 2012), or even a strategic management "model," i.e., a simplified representation of the reality under analysis (Pidd, 2004), able to assist organizations to design their strategies, set strategic targets, develop initiatives, and identify KPIs.

Even more relevant, building an X-Matrix is similar to a "catchball process" (Tennant and Roberts, 2001), with a few steps chained in a continuous cycle. The underlying idea of a continuous improvement process is one of the approach's main strengths (Chiarini, 2016). In this light, the X-Matrix provides an opportunity to continuously stimulate and inform discussion, knowledge sharing, and analysis in teams, while at the same time communicating a variety of data and making clear strategic priorities throughout the organization at all levels.

This is particularly relevant in organizational contexts characterized by a strong presence of independent, highly skilled, and autonomous professionals, such as in HC.

4. Lean thinking and Lean strategy in the HC sector

Lean is a global approach applied in the HC sector for several reasons.

First, as this sector absorbs most of the financial resources of any central and local government budget, and in order to counterbalance the effects of cutbacks (Pandey, 2010) and spending review policies (Holden, 2011), Lean projects have been launched to increase the technical efficiency of the services being provided, while at the same time reducing the costs of health service provision (Spear, 2005, Kim *et al.*, 2006; Proudlove *et al.*, 2008). Second, HC institutions are being globally challenged by demographic trends and migration phenomena to deliver care to more people with improved quality and security, but with fewer human resources at its disposal (Waring and Bishop, 2010; Curatolo *et al.*, 2014). Third, with specific reference to its strategic nature, Lean (i.e. Lean strategy) projects are increasingly developed in HC to align strategic and operational goals at different levels: the central/government's goals on one side, and those of HC institutions, subunits, and professionals on the other. Furthermore, Lean is particularly well adapted for HC organizations, as its basic principles are intuitive and compelling and therefore easily understood and applied by hospital staff (Curatolo *et al.*, 2014). Its ultimate goal, namely the elimination of any kind of waste, is a recurrent issue in HC (Bush, 2007). Finally, HC professionals have traditionally been characterized by a large degree of autonomy and self-managerialism when making decisions and in dealing with daily operations (Mintzberg, 1996; Kim *et al.*, 2006; Brandao de Souza and Pidd, 2011). This sometimes led to situations characterized by a lack of coordination and poor performance. Subsequently, and quite recently, rhetoric about the necessity of developing more integrated and collaborative forms of managerialism (Maddock and Morgan, 1998), facilitating teamwork (e.g. Dent and Burtney, 1996), and sustaining the adoption of new management innovations (e.g. Hellström *et al.*, 2015) in HC has emerged and is still at the center of the debate, with Lean mentioned as a potential powerful option.

Overall, these factors make HC an intriguing and challenging sector for Lean, particularly Lean strategy projects. In this paper, we argue that Lean strategy can provide for the whole strategic management architecture, enabling Lean tools potentialities when applied in practice in HC institutions.

A wide base of literature has already attested to the potential and usefulness of Lean thinking for improving efficiency and quality and eliminating waste in HC across the world (especially in the USA, UK, and Australia – see Brandao de Souza, 2009). For example, Silvester *et al.* (2004) report that Lean tools sustain improvements in emergency care services, intensive care units, and operating units. Radnor *et al.* (2006) suggest that Lean may help reducing customer/patient waiting times. Holden (2011) highlights several benefits of Lean thinking implementation in emergency departments. Joosten *et al.* (2009) argue that Lean may improve safety, quality, and staff morale, while at the same time reducing costs. Waring and Bishop (2010) look at Lean thinking as a way to add customer value through reconfiguring organizational processes. Radnor *et al.* (2012) report productivity gains while discussing several case studies. Moreover, a number of papers presented successful case studies based on a combination of Lean and Six Sigma concepts and tools (e.g. de Koning *et al.*, 2006; Tolga Taner *et al.*, 2007; Proudlove *et al.*, 2008; Schattenkirk, 2012; Barnabè *et al.*, 2016).

However, while it is widely acknowledged that operations management approaches and Lean Thinking principles and tools may be applied in HC organizations, less research has focused on holistic integrated management systems and, particularly, on Lean strategy projects (Antony, 2013). More specifically, as part of the literature underlines (e.g. Mazzocato *et al.*, 2010; Curatolo *et al.*, 2014), research articles and case studies frequently reported data and information on very specific technical and focused issues for which Lean was chosen and implemented in HC institutions, while the strategic nature of Lean and Lean strategy interventions received less emphasis, specifically with reference to their design and implementation phases rather than to their results and benefits. Overall these factors justify the calls for more case studies and evidence-based applications of Lean strategy.

5. Case study

Research design

The paper presents a single case study (Yin, 1994), focusing on a Lean strategy RP simulation project organized at an Italian University hospital.

As Yin (1994) points out, case studies represent the preferred research strategy when "how" and "why" questions are raised. Additionally, simulation and gaming represents a well-grounded methodological choice particularly in reference to projects aimed at stimulating and supporting learning, performance enhancement, group discussion, knowledge sharing, and research validation (Wolfe and Crookall, 1998, Faria, 2001; Gredler, 2004; Kriz and Hense, 2006; Crookall, 2010). More specifically, this paper relies on RP, a peculiar typology of simulation technique (see Crookall *et al.*, 1987; Sauvé *et al.*, 2007) that facilitates the interaction of participants (i.e. the players) within an "artificially" specific business system. The key operating conditions and decision-making rules may also be reproduced in that artificial environment to make the simulation as realistic and engaging as possible.

In this paper, we refer to RP as a tool able for providing a safe environment in which participants interact (or "embrace a role" – Clements, 2007) with a simulated business domain, experience firsthand the working and managerial conditions of the business context, and directly observe the consequences of the policies and actions carried out in a "realistic" and "transparent" domain (Alessi, 2000; Adobor and Daneshfar, 2006).

In this regard, as an increasing body of literature attests (e.g. Sogunro, 2004; Pepper and Clements, 2008; Poisson-de Haro and Turgut, 2012; Sterman *et al.*, 2015; Barnabè, 2016), RP might play a fundamental role in knowledge acquisition and has the potential to facilitate

learning processes in reference to a variety of business domains and operational as well as decision-making contexts.

In detail, this RP simulation was designed to explore the potentials of Lean strategy principles and tools within HC organizations and analyze how an X-Matrix may support HC professionals in discussing long-term strategies, focusing on a few key projects, and designing feasible improvement tactics/initiatives. Additionally, the simulation aimed at testing if a combined use of the Hoshin Kanri's FAIR method and the X-Matrix report may support and influence group dynamics and policymaking toward the identification and approval of a core set of strategies, objectives, goals, actions and metrics.

In total, 22 HC professionals belonging to various HC organizations and with different skills and competences took part to the simulation project. The participants were instructed in a briefing phase lasting one hour and were subsequently grouped into four teams. A leader was appointed for each team (i.e. playing the role of a "senior manager"), thus recreating the typical structure of the Hoshin teams in charge of the deployment process. All the teams received the same initial assignments, as follows:

- Examine the three-year strategic plan of the hospital under analysis, i.e., a 51-page document reporting various information on the hospital, a complete presentation of strategies and strategic objectives, a full range of initiatives and expected targets, and a comprehensive set of short-, medium- and long-term KPIs. Notably, the hospital's strategic plan also displays the organization's mission, vision, and core values.
- Analyze the list of strategic objectives approved by the hospital. This list contains 15 strategic objectives further divided into operational improvements to be carried out over the three-year period.

After these initial and preliminary tasks were completed, the facilitators instructed the participants to complete a RP simulation, as follows:

- rely on the documents mentioned previously to inform group discussion (within each Hoshin team) about the hospital's strategy and its strategic objectives/plans;
- apply the Hoshin Kanri FAIR method to focus on a limited number of strategies (maximum: four) to be further discussed by each Hoshin team; and
- draw an X-Matrix based on the strategies selected in the previous step, correlating strategies, objectives, initiatives, and KPIs displayed in Figure 2.

A debriefing phase was scheduled to conclude the project and with the aim of discussing in a plenary session the main benefits derived from the aforementioned process as revealed during the X-Matrix development phase with all the participants.

Outcomes

Following this research design, the four Hoshin teams carried out the aforementioned tasks in order to complete their X-Matrix reports and discussed them in a plenary debriefing phase.

As mentioned, after examining the hospital's strategic plan and analyzing the list of strategic objectives approved by the hospital, all the teams applied the FAIR method in order to create an X-Matrix:

(1) The first task is related to the focus phase. Starting with the organization's mission, the strategic plan, and the list of strategic objectives, each team extensively discussed all available data and information in order to identify a limited number of strategic priorities (maximum: four). The range of strategies selected by the four teams varied from two to four and addressed everything from the operating to the administrative area.

(2) Subsequently, in the alignment phase, each team correlated available resources with strategic priorities and objectives.

(3) Then, in the "Integration" phase, each team developed Hoshin policies that correlated and integrated with tactical initiatives and daily operational activities. As previously mentioned, the Hoshin policies and the tactical initiatives were agreed upon within the Hoshin teams in a participatory manner.

(4) During the last phase of the FAIR method, review, each team identified a core set of KPIs to evaluate and monitor the implementation of the Hoshin policies and their results.

Table I summarizes the key data from the experiment.

By the end of this process, each team had built its own X-Matrix (as a handout, not as an electronic file).

Notably, each Hoshin team adopted a variety of solutions for building the X-Matrix, whose functioning is similar to a catchball process, starting with strategies and moving in a clockwise direction.

Exemplifying the outcomes obtained during the RP simulation, Figure 3 displays the X-Matrix built by the second Hoshin team (Team B) by applying the FAIR method.

Starting with the strategies section, the X-Matrix highlights the three strategies first selected by this Hoshin team from the original list of 15 strategic priorities identified by the hospital: "reduction of waiting list (surgical ward)," "centralization of laboratory activities," and "creation of a new center dedicated to blood transfusion." Like almost all of the other teams, Hoshin Team B focused on a number of strategies below the maximum number (four) allowed for the simulation. The selection of the specific strategies heavily depended on group discussion and individuals' knowledge and interests, as we will later highlight. The information included in the matrix was extensively discussed and agreed upon by the team before being approved by the senior manager in charge of the Hoshin team's activities.

For each of the strategies selected, the team identified a limited number of strategic objectives to pursue in the near future, represented in the X-Matrix moving in clockwise direction. Correlations on the lower left corner immediately highlight that the participants agreed on:

- two specific objectives, i.e., "reduction of waiting list (surgical ward) by 5%" and "increase in number of surgeries by 2%," for the strategy "reduction of waiting list (surgical ward);"
- the objective of displaying laboratory tests for the strategy "centralization of laboratory activities;" and
- the objective of centralizing the transfusion-related activities for the strategy "creation of a new blood transfusion center."

These objectives supported the policy deployment process leading to the identification of some specific initiatives whose correlation with the strategic objectives is seen in the upper left corner of the X-Matrix. For instance, the initiatives correlated to the centralization of transfusion-related activities are threefold: the creation of a new layout, the planning and management of displacement activities, and the development of information systems. On the other hand, only the initiative of developing a VSM for surgical processes is related to the objective of reducing the waiting list.

Finally, the Hoshin team in charge of this X-Matrix identified relevant potential metrics capable of monitoring and assessing the impact of the initiatives and informing future decisions according to and in conjunction with the previously chosen strategies. Moreover, in selecting the KPIs, fundamental Lean metrics-typologies were also considered, with specific emphasis on measures of efficiency and quality and time-based indicators.

Table I. Key data from the experiment

Hoshin team	Number of Strategies	Number of Tactics	Number of Initiatives	Number of KPIs	Strategies selected	Correlation icons	Typologies of KPIs	Accountability	Other information
A	2	3	3	3	Increase in percentage of patients from other geographical areas Monitoring and development of scientific research	Yes	Non-financial ratios	Yes	Use of a Gantt diagram
B	3	4	5	4	Reduction of waiting list (surgical ward) Centralization of laboratory activities Creation of a new center dedicated to blood transfusions	Yes	Time-based metrics Efficiency	Yes	None
C	4	5	7	9	Performance improvement Reorganization of processes (surgical ward) Dematerialization of administrative documents Digitalization of administrative documents	Yes	Non-financial ratios Time-based metrics Efficiency	Yes	None
D	2	2	4	5	Enhancement of human resources Career development programs	Yes	Non-financial ratios Time-based metrics	Yes	None

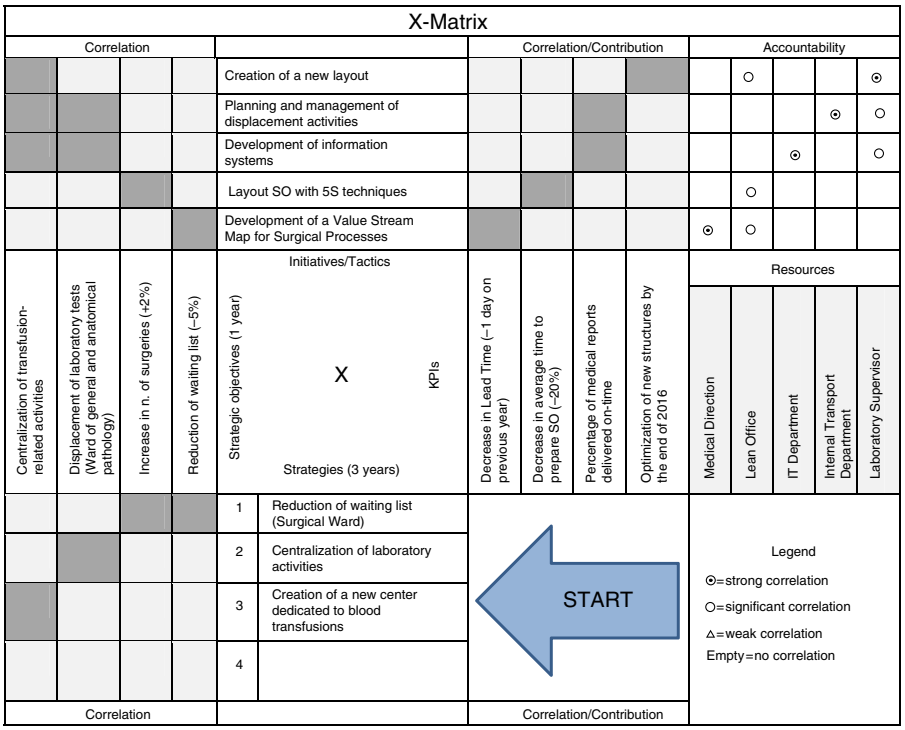

Figure 3.
One of the X-Matrix reports from the simulation

In the context of this example, team members selected the following measures:

- "decrease of lead time (–1 day on previous year)" and "reduction of time needed to prepare SO (–20%)" for the initiatives related to the development of a VSM and the layout SO with 5S techniques, respectively;
- "percentage of medical reports delivered on time" as a measure for the initiatives on both the development of information systems and the planning of displacement activities; and
- "optimization of new structures by the end of 2016" as the KPI related to the creation of a new layout.

In addition to those already mentioned, KPIs used by the participants included: number of beds/population, average set-up time/standard set-up time, number of webpage visits for the ward/hospital, average waiting time for an examination, number of projects concluded per year, number of administrative documents being digitalized/number of new administrative documents, and percentage of patients who underwent surgery in 90 days. Notably, these KPIs were not included in any of the documents that the participants received prior to the RP simulation but were subsequently identified and approved by the Hoshin teams.

Finally, to complete the X-Matrix, the teams discussed accountability correlation among the initiatives planned and the resources at disposal (i.e. medical direction, Lean Office, IT department, internal transport department, and laboratory supervisor), as represented on the right side of the Figure 3, according to the legend below.

Importantly, each Hoshin team comprehensively discussed its X-Matrix in a concluding debriefing phase that lasted more than an hour.

6. Discussion and conclusions

This paper explored the potentialities of Lean strategy principles and tools, specifically by focusing on the HC sector.

As a significant body of literature attests (e.g. Hines *et al.*, 2004, 2008; Bhasin, 2011), Lean may provide a range of benefits to an organization interested in adopting and implementing its principles and tools. The majority of these benefits are related to daily operations, particularly the elimination of wasteful activities, cost savings, and increases in technical efficiency and quality (e.g. Hines and Taylor, 2000; Pettersen, 2009; Horne, 2014). As we discussed in this paper, however, the "strategic" dimension of Lean has received less emphasis, which justifies new studies focused on the design, adoption, and implementation of Lean strategy methodologies and tools. Overall, a few final considerations may be now provided in reference to the outcomes seen in the Lean strategy simulation project, which involved 22 HC professionals in a Hoshin Kanri process.

Although Hoshin Kanri is a policy deployment process that was originally developed by Japanese firms as their main strategic management approach to decision making, its use in HC is relatively new (e.g. Kollberg *et al.*, 2006). In this regard, the first aim of this study was to highlight the potential role of Lean strategy tools for strategic planning and strategic management, particularly in the HC context. As argued by Witcher and Sum Chau (2007, pp. 533-534), Hoshin Kanri may be successfully used as "an implementation and execution system," whose primary advantage is its "insistence on only a very few Hoshins to focus attention on those cause-and-effect relationships at an operational level that require breakthrough in performance." This is consistent with what a participant in the simulation project emphasized during the debriefing session:

> The task for our team was to move from the hospital's strategy to very practical daily operations, going through strategic objectives and a few improvement initiatives. This was very challenging and required a great effort to focus only on a few interventions.

In these terms, the study outcomes confirmed the main strength of Hoshin Kanri, namely to align strategic objectives with operations through the development and implementation of a collaborative approach to decision-making, planning, and daily management among the professionals involved (Witcher and Butterworth, 2001). This is particularly relevant when considering the major shift occurring in many HC systems across the world, with professionals increasingly called to adopt the logic of "managerialism" rather than the logic of professionalism (Waring and Bishop, 2010).

Regarding the second aim of this study, related to Lean strategy operationalization, this paper presented the features and main results of a Lean strategy simulation project centered on the use of the FAIR method and an X-Matrix.

On one hand, the study reflected the usefulness of the FAIR method in operationalizing the Hoshin Kanri by translating the organization's mission and strategic goals into tactics and actions. On the other hand, the simulation tested the ability of the X-Matrix to support and assist Hoshin teams in discussing, structuring, and graphically formalizing this process while at the same time providing the fundamental KPIs needed to monitor and assess the impact and the outcomes generated by the policies. In this regard, Hoshin Kanri is basically a top-down deployment process in its strategic planning phase (with the launch of projects that will affect the business functions), while it may be viewed, as in this case, as a bottom-up process when identifying potential KPIs and measuring the results that are subsequently assessed against targets in order to inform future decision-making (Chiarini, 2010, p. 67). This not only helps to communicate and disseminate information across the organization but also to align the actions of all employees at all levels to the organization's strategies in a participative manner.

Notably, the participants progressively and increasingly built confidence in the X-Matrix functioning during the simulation. As confirmed by part of the literature (e.g. Witcher and Sum Chau, 2007), the paired use of Hoshin Kanri and X-Matrix not only provides a structured framework for strategic planning, tactical improvements, daily operations, and reporting but also does so by sustaining a cycle that is periodically revised and updated. In the end, this process greatly supports continuous improvement.

As a participant highlighted:

> The catchball process which is required while drawing the X-Matrix is helpful to understand that we are dealing with progressive and continuous improvements that should be made within the hospital.

In detail, the PDCA cycle (Deming, 1952) is coherently and fully considered and integrated in Lean strategy initiatives (Kondo, 1998) and by the FAIR method (Witcher, 2003).

Consequently, the X-Matrix, as well as Lean philosophy as a whole, represents a loose framework (Ballé and Ballé, 2005; Brännmark *et al.*, 2012) for organizations to adapt and customize Lean principles and tools coherently with the operational, organizational, and managerial factors of their specific context. Moreover, it is meaningful that this university hospital officially recognized Lean thinking not only as a set of powerful "operations management" tools and techniques, but also as a fundamental strategic architecture to facilitate and support sustainable continuous improvement at all levels of the hospital.

The third aim of this study was to explore how simulation techniques such as RP may support the aforementioned operationalization of Lean strategy while simultaneously promoting policymaking and knowledge sharing.

In this regard, the simulation project helped to challenge a number of HC professionals with different skills to develop a collaborative approach to strategic planning, confirming the usefulness of RP in supporting group discussion, participants' interactions, and policy deployment (Clements, 2007).

In particular, the RP simulation prompted the players not only to rely on Lean strategy tools to accomplish their task, but also to inform and facilitate group discussion, knowledge sharing, and team learning. This is consistent with other studies that have looked at Lean principles, tools, and models as factors supporting change initiatives, leadership, and experiential learning (e.g. Schattenkirk, 2012).

Another excerpt from the debriefing phase may be helpful to clarify this concept:

> The simulation with the X-Matrix was incredibly engaging. We had the chance to discuss together and we were obliged not only to share our ideas about feasible policies, but also to agree on very specific managerial actions and relevant KPIs. This helped us to be on the same page.

Finally, it is noteworthy that the project sought to organize the simulation according to the typical organizational structure in place within any Hoshin Kanri process. Each team therefore resembled the structure of a Hoshin team in charge of the deployment process and the X-Matrix report. This also helped to reinforce the concept and relevance of teamwork in HC organizations and with HC professionals (Tanco *et al.*, 2011).

In this particular regard, consider another excerpt from the debriefing:

> It was interesting to collaborate in teams with specific tasks to perform. We are all different professionals, with different skills and attitudes, and we are not that used to share ideas and collaborate. Working in team is therefore really helpful.

Overall, all the participants emphasized the potentials of Lean strategy not as a sum or set of tools and techniques, but as a systemic approach to knowledge sharing, group decision making, and policy deployment. Notably, the authors have already scheduled new simulations based on the same tasks, Lean strategy tools, and simulation technique with other groups of HC professionals.

In terms of practical implications for the HC sector, this study reveals the potential of the Hoshin Kanri (deployed with the FAIR method and using an RP design) to assist HC organizations as well as their professionals in developing tactics, and quality and process improvement initiatives based on the wider organization's mission, vision, and long-term strategy. This is related to the positive effects that the concrete application of a Lean strategy project, such as the one we referred to in this study, may generate on decision-making, waste elimination, and cost savings. This can eventually have a positive impact on the quality of the services provided, thus improving patients' quality of life and overall value creation in the HC sector.

In conclusion, and in order to summarize one of the main contributions of this paper, we emphasize the following statement by Shah and Ward (2007, p. 787): "Lean production is generally described from two points of view, either from a philosophical perspective related to guiding principles and overarching goals, or from the practical perspective of a set of management practices, tools, or techniques that can be observed directly." This study contributes to the debate about the potential for Lean going beyond its technical aspects and its ideology, as described by Bhasin (2011): designing an intervention of Lean strategy entails considering a full range of aspects which span from the top to the bottom of the organization, looking at the core set of Lean principles in terms of both technical efficiency and management choices, and the adoption of a collaborative approach to decision making and the full engagement of HC professionals at all levels.

Our contribution has some limitations. First, the paper focuses just on one case study and a single simulation RP project. However, we believe it is a relevant case study, given the enormous effort and the high commitment that this HC organization is devoting to Lean principles and Lean strategy tools. In this regard, we also believe that this approach has general application in the HC sector according to the common characteristics of HC organizations (such as cost pressure, spending review processes, and increased customer requirements) that are ripe for the application of Lean principles and tools (Brandao de Souza, 2009; Joosten *et al.*, 2009). At the same time, this methodology may also be effectively tested in other sectors; since it is not context dependent, it may be applied in a variety of industries worldwide. We will continue applying this methodology to additional HC organizations.

Second, due to the limitations of the time available for the RP and the overall number of participants, our study only explores how an RP-based Lean strategy simulation may affect group discussion and policymaking in a typical HC setting. We were not able to test how this would eventually translate into actual decision making affecting daily operations. Nevertheless, this also raises interesting research questions that can be addressed in future studies. As previously mentioned, several Lean strategy projects are already underway, and further research from the authors is planned to assess the main features, outputs, and outcomes of Lean principles and tools in practice.

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