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# Combining the Viable System Model and Kotter's 8 Steps for Multidepartment Integration in Hospitals

GUILLAUME LAMÉ, OUALID JOUINI, JULIE STAL-LE CARDINAL,

LABORATOIRE GENIE INDUSTRIEL, CENTRALESUPELEC, UNIVERSITE PARIS-SACLAY  
Grande Voie des Vignes, 92290 Chatenay-Malabry, France

<guillaume.lame>, <oualid.jouini> & <julie.le-cardinal> @centralesupelec.fr

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**Résumé** – L'intégration des différents services en un ensemble coordonné est un défi important pour les hôpitaux afin d'augmenter leur efficacité. A ce jour, les solutions apportées par la recherche en génie industriel pour aider les praticiens à y parvenir sont insuffisantes. Les problématiques multi-services sont insuffisamment traitées et l'implémentation des recommandations est rare. Cet article s'intéresse aux premières phases d'un programme de changement visant à renforcer l'intégration d'un sous-système hospitalier. Nous proposons une combinaison méthodologique originale : le Viable System Model, un modèle cybernétique d'organisation, est couplé à une méthode de conduite du changement, les 8 étapes de John Kotter. Cette approche, implémentée en recherche-action sur la délivrance de chimiothérapies ambulatoires dans un hôpital français, nous permet de diagnostiquer les problèmes structurels de l'organisation, de construire un programme de changement et de le lancer efficacement. Les premiers éléments d'une vision intégrés sont déjà présents dans l'hôpital.

**Abstract** – Integration between different departments is a major challenge for hospitals. It is considered as a key step towards greater efficiency. Yet research in industrial engineering does not provide satisfactory answers to this issue. Multi-departments issues are under-investigated and the implementation of recommendations is scarce. In this article, we focus on the first phases of a change program aiming at the better integration of a hospital sub-system. We propose an original methodological combination: Stafford Beer's Viable System Model, an organizational cybernetics model, is coupled with John Kotter's 8 steps for leading change, a change management method. We implement this approach in an action-research project in a French hospital's outpatient chemotherapy sub-system. The method allows us to diagnose structural issues in the system, to build a change program and to launch its implementation effectively. The first elements of an integrated vision are already present in the hospital.

**Mots clés** – Viable System Model, intégration, gestion hospitalière, conduite du changement, recherche-action.

**Keywords** – Viable System Model, integration, hospital management, change management, action-research.

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## 1 INTRODUCTION

Healthcare systems need to be more efficient to face increasing demand and constrained budgets. Hospitals are a major component of the healthcare industry, and they have long-since been considered as complex organizations. They are still often fragmented organizations, making the move towards higher efficiency a challenge. Besides, hospitals differ from more "traditional" industrial firms in many aspects, especially multi-dimensional value stakes (Young and McClean, 2009) and structural specificities in the balance of influence and power between boards and frontline (Lega and DePietro, 2005). To describe this Klein and Young label healthcare as "hypercomplex" (Klein and Young, 2015).

To meet the efficiency and efficacy targets of hospitals, integration is often proposed as a way forward (Lillrank, 2012), with support from systems approaches suggested as promising (Reid et al., 2005). Yet Drupsteen et al. (2016) explain that besides injunctions to integrate services and general success factors, there is a lack of knowledge at the operational level on the factors that impact on integration. The situation is not very different with regards to the methods and processes capable of creating integration. Many industrial

approaches from Operations Management/Operations Research (OM/OR) have been tried, but the results are mixed at best. In OM, the lack of evidence supporting Lean management impact on hospital performance is instructive (Moraros et al., 2016), Lean being a leading industrial approach. When it comes to OR, the lack of integrative, multidepartment modelling studies has been reported (Hulshof et al., 2012; Vanberkel et al., 2009), and studies fail to move to the implementation stage (Jahangirian et al., 2012).

To move forward, previous examples – e.g. Paltved et al. (2016) in a Danish surgery ward or Lehaney and Paul (1996) in a British outpatient service - have proved action research to be a valuable approach to learn about i) the adaptation of methods to this new context and ii) the dynamics of change in hospitals. In this article, we use action-research (Checkland and Holwell, 1998; Coghlan and Brannick, 2014; McNiff and Whitehead, 2011) as our overall approach to study multi-department coordination in the cancer division of a French hospital. To theoretically frame our intervention, we propose to use the Stafford Beer's Viable System Model (VSM). The VSM takes a holistic, systemic perspective on organizations heavily and it emphasizes coordination aspects. Indeed, the VSM stems from cybernetics, the discipline that provided

researchers with concepts such as feedback or variety engineering, concepts which are today fundamental in the analysis of information flows. Using the VSM, we present an action-research project in the cancer division of a French university hospital. In this context, the VSM needs to be integrated in a change process. To this end, we use a change management approach based on Kotter's 8-step model (1996). The contribution of this article is a method for structuring and initiating a change program in a hospital, when integration between departments is the objective. To do so, we show an example of the VSM encapsulated in a change process, informed by Kotter's change management theory. This is complementary to Keating's application of VSM in a hospital which focuses on the analytic power of the VSM (Keating, 2000). To summarize, we develop a new approach combining two existing methods, which we test on a real project to help solving a problem encountered by professionals. The article is structured as follows. In Section 2 we review the literature on integrated care, on the VSM and on Kotter's 8 steps. In Section 3, we introduce our project, its context and the action research process we implemented. In Section 4 the results of the project are laid out. Section 5 discusses these results in relation to the literature and specifies what learnings we draw from this action research project. The paper ends with some concluding remarks.

## 2 LITERATURE REVIEW

### 2.1 Integrated Care: Definitions

Integration is a familiar concept in OM. Lillrank provides a definition: "Integration is the combining of several specialized and differentiated resources and contributions to create an output that is a system consisting of several parts. Each part needs to contribute to the output, but also submit to the demands of the whole. Integration means giving up some of the benefits of specialization for the sake of the system." (Lillrank, 2012: 8).

In healthcare, McDonald et al. (2007) define integration as "the deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services." Kodner and Spreeuwenberg (2002: 3) go further in their definition by qualifying integration as a process resulting in integrated organizations: "Integration is a coherent set of methods and models on the funding, administrative, organisational, service delivery and clinical levels designed to create connectivity, alignment and collaboration within and between the cure and care sectors. The goal of these methods and models is to enhance quality of care and quality of life, consumer satisfaction and system efficiency for patients ... cutting across multiple services, providers and settings. [Where] the result of such multi-pronged efforts to promote integration [lead to] the benefit of patient groups [the outcome can be] called 'integrated care'".

Integration is much called for, but there is not enough research available on the ways to achieve it (Drupsteen et al., 2016). Coordination, "the arrangement of roles and tasks into an organized whole" (Lillrank, 2012: 8), is the way to achieve integration (Lillrank, 2012). The VSM addresses the challenge of coordination using cybernetic principles, with specific emphasis on the balance between autonomy/differentiation and cohesion/integration (Pérez Ríos, 2012). Consequently this model is a good candidate for the study of coordination in hospitals. We now present the theory of the VSM and its applications.

## 2.2 The Viable System Model

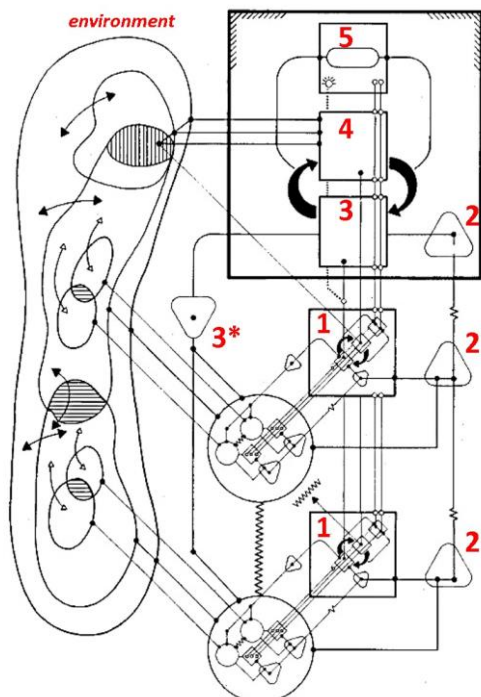
### 2.2.1 Origins and Theory

The theory for the VSM was developed by Stafford Beer in two books in the 1970's, *Brain of the firm* (1972) and *The heart of enterprise* (1979). He later presented the model in a guidebook for practitioners, *Diagnosing the system for organizations* (1985). A shorter paper to introduce the model was also published in 1984 in the Journal of the Operational Research Society (Beer, 1984). Research on the subject was then pursued by Jackson (1988), Leonard (2009), Pérez Ríos (2012), Schwaninger (2006; Schwaninger and Scheef, 2016) or by Espejo with his colleagues Reyes (2011) and Harnden (1989).

The theoretical roots of the VSM are cybernetics, developed for managerial issues into organizational cybernetics (Jackson, 2003). Organizational cybernetics should not be confounded with management cybernetics (Jackson, 1991). The latter take a mechanistic perspective on organizations, and do not consider the observer as part of the investigation. This is in contrast with Beer building his VSM from fundamental cybernetic principles, thus bypassing any metaphoric reasoning with machines or living organisms. Furthermore, Beer's approach encapsulates the observing system in the study and thus belongs to second-order cybernetics (Jackson, 1991: 104). The VSM describes viable systems as made of five interconnected systems, numbered from 1 to 5:

- System 1 is made of the units that implement the function of the system, each with its own management and environment. System 1 is the production function of the system.
- System 2 is a coordination function between the units of System 1. It ensures that they work along in a coherent way, for instance for production planning between different units to avoid bullwhip effects and similar issues.
- System 3 is the control function of the system. It focuses on the inside-and-now of the system, monitoring the performance of System 1. It ensures resource allocation to System 1 based on the information from System 2 and from System 3\*.
- System 3\* performs sporadic audit of System 1 and reports to System 3.
- System 4 is the development function of the system. It is connected with the environment of the system (which does not coincide with the sum of all System 1 units' environments). It is in charge of analyzing the environment of the system and putting in perspective the information on the operations of the system transmitted by System 3.
- System 5 is the policy function. This is where strategic decisions are made. System 5 must also represent the system-in-focus to other systems.

As shown in Figure 1, all systems are richly connected by information channels, which must follow the laws of requisite variety ("only variety can destroy variety", i.e. the system's variety must match with the incoming variety from its environment). A final important concept is that the model is recursive: each System 1 unit can be analyzed with the VSM, and the system-in-focus is also embedded in a larger system which can be analyzed with the VSM. For further details on the VSM, the reader is referred to Beer's original writings (1972, 1979, 1984, 1985), Jackson's textbooks (1991, 2003) or the more recent books of Espejo and Reyes (2011) and Pérez Ríos (2012).



**Figure 1 - Viable System Model, modified from (Beer, 1985)**

### 2.2.2 Applications and Validation

The empirical validation of the VSM is mainly based on numerous successful case-studies, e.g. (Schwaninger, 2006). To complement this approach, Schwaninger and Scheef carried quantitative research on the relationship between firms' compliance with the VSM's principles and their success. Their questionnaire study indicated a relation between VSM concepts and effective organizational performance and viability.

Concerning the field of healthcare, applications of the VSM are scarce. A quick search on the Web of Science (Thomson Reuters, 2016) on October 6th, 2016, with the following combination of keywords: [ ("viable system model" OR "cybernetic\*") OR "vsm") AND (("hospital\*" OR "healthcare") OR "health care") ], lists 46 journal articles, none of which is relevant to our study. We know of only one study addressing hospital management with the VSM, by Keating (2000). In this study, Keating proposes a method based on the VSM for structural analysis of organizations and then applies it to an American 600-bed hospital. The focus is more on the proposed systems-based methodology than on the specific healthcare context. The methodology is judged to be satisfying because it allowed for the identification of multiple "structural pathologies". It is not mentioned whether this diagnosis was followed by action: the study stops after the diagnosis of the hospital's structure has been established by the author. We wish to go further and to study whether VSM diagnosis can lead to action being taken in a hospital. To achieve this, we need to include the VSM in a change process. We now present one such process, Kotter's 8 steps for leading change.

### 2.3 Kotter's 8 Steps for Leading Change

In 1995, John Kotter described in a Harvard Business Review paper what he felt were the 8 most important factors in the failure of change efforts (Kotter, 1995). He then proposed an 8-step normative model for change management, designed to avoid the traps previously identified. This was the argument of his 1996 book, *Leading change* (Kotter, 1996). The 8 steps are:

- Establishing a Sense of Urgency

- Creating the Guiding Coalition
- Developing a Vision and Strategy
- Communicating the Change Vision
- Empowering Employees for Broad-Based Action
- Generating Short-Term Wins
- Consolidating Gains and Producing More Change
- Anchoring New Approaches in the Culture

The model has been very influential since its first publication (Appelbaum et al., 2012). The 1995 HBR article and the 1996 book were in January 2014 the most cited publications on organizational change (Hughes, 2016a). This situation is paradoxical, as neither publication comply with academic standards, first of all because Kotter never specifies the contexts of the organizations he describes and does not build on previous academic references (Appelbaum et al., 2012; Hughes, 2016a). The validation of the model is also problematic. After reviewing the literature on the model's validity, Appelbaum et al. (2012: 776) conclude that most of the validation was made by Kotter himself in subsequent books. In addition to the model not being grounded in academic research and sufficiently backed by scientific evidence, criticisms also address the content of the model. In a recent polemic paper, Hughes argues that Leading change is a landmark book in change leadership studies, but that it is "stuck in the past" and that today it "paradoxically discourages change", in part due to its neglect for the ethics of organizational change (Hughes, 2016a: 463–465).

However, Pollack and Pollack (2015) identify a few action-research studies (they directly cite five) that successfully applied the model in real-life conditions and contribute themselves to this research effort. They conclude that Kotter's process is an "effective way of managing change" (2015: 63), although it requires some adaptations. They question the linearity of the process, and to the unicity of the change process. In their case, multipole change projects with each its guiding coalition and its timeframe concurred in the organization. In each of these concurrent projects, they experienced the 8 stages mixing rather than neatly succeeding each other. In another study, Ansari and Bell (2009) underline the fact that Kotter's process needs to be complemented with other frameworks to suit their needs, in particular the first step "establishing a sense of urgency" needed more work in their project than what's mentioned by Kotter.

Examples of applications of the 8-step model in the healthcare sector include the implementation of a new care algorithm for palliative care in a neonatal intensive care unit (Conway-Orgel and Edlund, 2015), a nurse-led mobility program in a trauma center (Mount and Anderson, 2015) and the replacement of CVCs with long-term accesses for hemodialysis patients (Mbamalu and Whiteman, 2014). These articles are quite uncritical with regards to Kotter's process and they resemble more practitioners' case studies on hospital change management than academic studies on the process itself.

Having introduced the concepts and the two components of our theoretical framework, the VSM and the 8 steps, we now develop their integration in an action-research study.

## 3 MATERIALS AND METHODS

### 3.1 Context and Research Approach

Our study takes place in a French public university hospital, and more specifically in the cancer care division. The cancer division we study contains surgery departments (urology, plastic, digestive), medical departments (hepato-

gastroenterology, medical oncology, hematology, nephrology, dermatology) and a radiotherapy department. Its three main specialties are digestive and urology cancers and blood malignancies. In our study, we focus on chemotherapy delivery in cancer care, with the oncology, hematology and dermatology departments. The empirical work was mostly done in the oncology department and the pharmacy department. This is because the processes are assumed to be structurally close in the other clinical departments, and also because the head of the oncology department was most eager to get our input. Therefore limiting the study to the oncology-pharmacy system was relevant because the findings could then be transposed to the dermatology and hematology departments. During the project, the field researcher (GL) spent 18 months as a researcher-in-residence (Marshall et al., 2014) in the hospital, from June 2015 onwards. His overall project was carried in an action-research perspective, in order to improve the efficiency of this cancer division. This paper explains the first cycle of AR where a diagnosis of the organization was undertaken, using the VSM as our framework. The objective of this first phase was to trigger improvement projects and structure a course of action for following phases. This objective in fact concurs with Lewin's first phase of change, unfreezing the present level to introduce changes (1947: 35).

We use action research (AR) as our research design. Although less used than descriptive quantitative approaches or case study, AR is a recognized, valid approach for management research (Susman and Evered, 1978). It is regularly used in the context of healthcare and in the specific case of hospitals for various purposes. For a recent review of AR contributions in hospitals, the reader is referred to the recent literature review by Montgomery et al. (2015).

To describe our approach, we use Checkland and Holwell's FMA model (1998: 13). Our area of interest A is that of hospital internal coordination between separate departments. Our theoretical framework F is a structuralist-functionalist approach to change and integration in organizations, informed by organizational cybernetics, change management and the literature on hospital integration. This framework is embodied in our methodology M which is the combination of Stafford Beer's VSM and John Kotter's 8 steps. In our case, the mode of AR was "pragmatic AR" as defined by Coghlan and Brannick (2014): we intend to study the system in action, but there is only limited intention at self-study in action from the researcher. Coghlan and Brannick label this approach "internal consulting" or "action learning".

Despite our weak concern with self-study, transparency on motives is an important aspect of AR, which is why we now discuss the values underlying this project for the researcher.

### *3.2 Motives and Values Underlying this Project*

McNiff and Whitehead (2011) insist on making explicit the values of the action researcher. What led the researcher to undertake this project? This project is part of a PhD in Operations Management (OM). There is therefore a need to contribute to scientific knowledge. However, it is the researcher's belief that OM research should strive to make an impact in its very process as well as with its results: the way knowledge is produced is paramount. On this point, the researcher builds on the Design Science stream in OM (Holmström et al., 2009) and on a leaning for Mode 2 research (Dick, 2014). As a result, the researcher chose the researcher-in-residence (Marshall et al., 2014) type of engagement for his PhD research. This choice was made in the context of a

laboratory very supportive of such approaches, where most PhDs are carried in partnership with industrials.

The researcher arrived in the oncology department in a context where discontent was high with current operating procedures: patients waited long before getting their treatments, nurses were under stress due to this situation, the oncology department was reaching saturation despite much lower utilization rates than other similar departments, and the pharmacy was drowned under constant calls for last-minute cancellations or prescriptions. The feeling that more integration was needed seemed shared, which agrees with the unitary vision of both the VSM and the 8 steps and gave the researcher the feeling that a structuralist-functionalist paradigm was appropriate during the stages of diagnosis and change program start-up. We now detail the connections between these two models in our methodology.

### *3.3 The VSM and the 8 Steps in this Project*

#### *3.3.1 "Mode 2" Use of the VSM*

Despite the fact that action-research is highly participative, the VSM was used solely by the researcher in this project. This is similar to the "Mode 2" of SSM (Checkland and Scholes, 1990) where the researcher uses a Problem Structuring Method (PSM) to guide his own action without explicitly discussing this specific method with his collaborators. This is for instance what Kotiadis does in a project where she uses Soft Systems Methodology in intermediate care (Kotiadis and Mingers, 2006). Kotiadis and Mingers explain that "the very valuable time that they [the healthcare professionals] offered was better spent extracting as much understanding and information about the system rather than explaining the merits of SSM" (2006: 865). In our case too, time was scarce for healthcare professionals, therefore discussions were more operational than modeling-oriented. This is one of the challenges of what has been labelled "Mode 2 research" (Dick, 2014): transdisciplinary means that a common ground must be found between disciplines, which excludes bringing everyone to the same level of knowledge and expertise on every aspect of the project. In our case we feel that mutual trust, shared data and openness on our objectives and vision of the system (that of OM/OR and management engineering) were enough to alleviate the need for a complete training on the VSM. This is why the VSM remained as a mental management model in this study. This point will be analyzed in retrospect in the discussion (Section 5).

Notwithstanding this choice, the results of the analysis were widely shared, and intermediate results (time studies, synthetic reports) were regularly fed back to the professionals. Therefore we are confident that the study can still be labelled as participatory. The VSM diagnosis ultimately led to an action plan which is under implementation at the time this paper is being written. To transform the VSM diagnosis into an action plan, we used Kotter's 8 steps as a guideline.

#### *3.3.2 Coupling the VSM and Kotter's 8 Steps*

It is often said that the VSM is good for the diagnosis and design of organizations. Unlike in product design, organizational design is often all about evolution and not creating from scratch, and like in medicine, it is desirable that cure follows diagnosis. On this point, Beer's writings on the VSM do not offer much to take action: the VSM is a model, not a methodology (Jackson, 2003: 88). Said differently, there is a lot to learn about change content but less about change process in the VSM. To prioritize our actions and handle the organizational change dimension, we build on Kotter's 8 steps.

The VSM and the 8 steps can be expected to go along well as they both follow the same structuralist-functionalist paradigm (Hughes, 2016b: 106; Jackson, 2003: 108). The VSM deals with efficiency and efficacy, but it does not tackle the question of effectiveness, i.e. if the goals we pursue really correspond to what we want to achieve. Kotter is all about “needed change”, but it does not say much about who defines what is needed. Both are adequate for problems where participants are considered as unitary, i.e. sharing the same values, beliefs and interests (Jackson, 2003: 19). This seems to match the situation (dissatisfaction and desired integration) and our goal (to get a start program going). It is anticipated that this program will later consist of a set of projects which may use different approaches, including more interpretive ones.

Figure 1 shows the research framework where the VSM and the 8 steps are integrated. The research followed a sequence of data gathering - data analysis informed by the VSM – feeding back data and taking action in an intervention framed by Kotter’s 8 steps. In Figure 2 the researcher is depicted as distinct from the hospital, however obviously relations exist and the Researcher-in-residence is more an intermediate status. In the present case there are no financial ties between the researcher and the hospital, but tied interests, mutual respect and consideration and power games create a bound.

The combination between the VSM and Kotter’s 8 steps works in two ways. The VSM is used to detect inadequacies in the system-at-study, which can be addressed in the change process proposed by Kotter. This change process then also contributes to a better knowledge of the system-at-study, which feeds the VSM analysis. The VSM is an analytic tool, while the 8 steps help turning the insights of the VSM into concrete action and decisions. The changes suggested by the VSM (i.e. the differences between the system-at-study and the ideal vision of the VSM) are proposed and negotiated. They lead to the definition of more specific change projects. A metaphor could be that of concurrent engineering: the use of the VSM by the analyst would be the “product design” process, while the negotiation of change with the 8 steps would be the “production system design” process. In the former, the change program is conceptualized, in the latter it is turned into concrete action, in this case precise change projects. Both processes happen in parallel and feed each other.

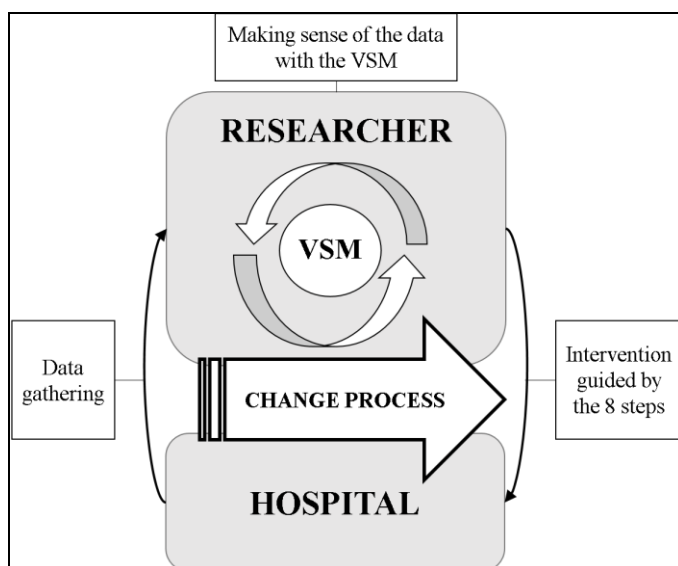


Figure 2 - Research framework integrating the VSM and the 8 steps

Now that the theory underlying our approach and the methodology have been introduced, we present the results of the study.

#### 4 RESULTS

The results are presented in three stages. First, we define the system-in-focus. Second, we analyze it with the VSM. Third, we promote a change process, informed by Kotter’s 8 steps.

##### 4.1 Defining the System

Like in any systems approach, the first step is to define the perimeter of the study. In our case, the original assigned perimeter is the outpatient oncology unit in the cancer division. It soon appears too restrictive: we need to include at least one department which is not part of the cancer division, the chemotherapy preparation unit (part of the pharmacy division). A first challenge appears already: the first person that manages both units in the hierarchy is the hospital director. We could decide to set this unit out of our perimeter, and consider it in the environment rather than as part of the system. However, the connections between chemotherapy preparation and chemotherapy delivery processes in hospitals with centralized chemotherapy preparation are so tight (Lamé, Jouini and Stal-Le Cardinal, 2016) that it made more sense to include this pharmaceutical unit. By including the pharmacy, it made sense to also consider two additional departments: the hematology and the dermatology departments, both in the cancer division, because they also deliver chemotherapies to both inpatients and outpatients. We choose not to include imagery and biological departments as the needs for synchronization happen at a longer time-scale. Also, chemotherapy preparation and chemotherapy delivery could hardly survive in the French context as viable systems, whereas imagery and biology could. Therefore following Beer’s advice (Beer, 1985) we set them aside.

In the end, we have a four-components System 1:

- The outpatient unit of the Medical Oncology department
- The outpatient unit of the Hematology department, and
- The outpatient unit of the Dermatology department, all three in the cancer division, and
- The Chemotherapy Preparation Unit in the pharmacy division.

Figure 3 shows these four components, split between two different hospital divisions. We place our study at the unit level.

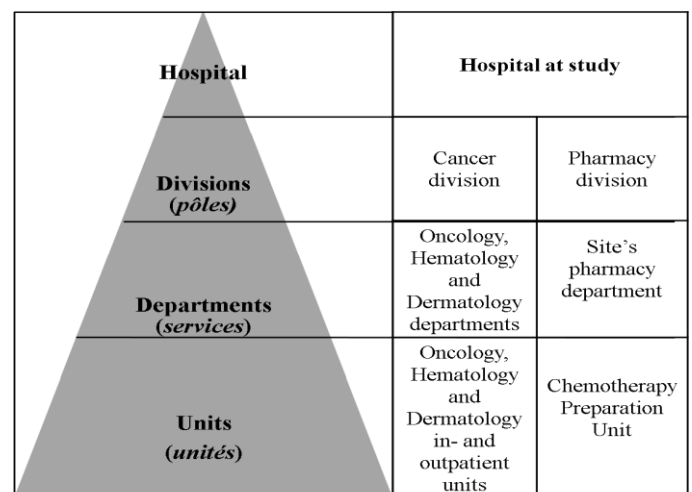


Figure 3 - The divisions, departments and units considered in this study. In italic is the French wording.

In principle, our system-in-focus is typically a high-volume, low-variety service: almost all patients follow the same process, with very few variations besides the type of chemotherapy product. However, in reality, it is experienced by its operators as a typical “organizational mess”. This process looks like a good candidate for integration because of the repeatability of the processes (one of the oncologists told us: “outpatient chemotherapy is always more or less the same”) and the high volume of patients.

#### 4.2 Diagnosing the System

Now that our system-in-focus is defined, we proceed to the diagnosis using the VSM as a reference model. We analyze all constituting systems of the system-in-focus.

##### 4.2.1 System 1

System one of a viable system consists of “those elements that produce it” (Beer, 1984: 14). All four units in System 1 have different environments. They represent different scientific disciplines, each with its scientific societies and body of knowledge. There is also a strong difference between the chemotherapy preparation unit, which is part of the pharmacy and relies on pharmacy decisions for resource allocation, and the three medical departments which are part of the cancer division. This is a clear case where the authority system, “which fits the structure of the organisation” and the responsibility system, “which fits the experience of the patient”, do not correspond (Lehaney and Paul, 1996: 868).

All departments keep a watch on scientific and clinical updates in their respective environment. They appear to be aware of organizational innovations in their respective fields, e.g. patient reported information for medical departments or robot-assisted preparation in the pharmacy. Medical departments are in contact with upstream services (surgical services in particular) through Multi-Disciplinary Team meetings, where all cancer cases are discussed.

##### 4.2.2 System 2

System 2 is a coordination function, it works to smooth the activity between all Systems 1. In our case, this system is deficient. According to Beer (1984) this is a typical issue. Coordination is limited to sharing incomplete information. What happens is that all departments send their prescriptions to the pharmacy, which is the only unit with a view on its production planning. Yet its customers’ performance depend on the ability of the pharmacy to provide them with what they need. The way things are managed during the workday is through a lot of phone calls and faxes to the pharmacy. There is in fact no information shared between the departments that deliver chemotherapies. Processes are defined between the pharmacy and each department and are not connected to one another. As a result the pharmacy workload is highly variable (as much as 50% variation between two days of the same week) and patients sometimes wait hours to get their chemotherapy drugs.

##### 4.2.3 System 3 and System 3\*

System 3 is a function of the “Senior Management” in charge of the inside-and-now of the system-in-focus. It is a control function, which allocates resources to System 1 to carry out the instructions of System 4. It translates system-level policies into directives for System 1. It then monitors the performance of System 1 through System 2 and System 3\*.

There is no unique entity in the system that performs this function. A small portion of this function is carried by Multi-Disciplinary Team meetings, where patient cases are discussed and collective decisions are made, but these discussions remain

clinical and do not cover operational aspects. As far as resource allocation goes, it is performed at two levels: the head of the hospital, where all divisions negotiate for their budgets, and at the division level between departments. However the budget allocation does not consider this system as one, even though the Chemotherapy Preparation Unit as much more connections with its customer departments than with other pharmaceutical units. System 3 should make decisions based on performance measurement. In this case, performance measurement is limited to the evaluation of costs and revenue, and various notions of productivity, and to counting undesired incidents/accidents. There is no fine analysis of the typology of patients being treated and the evolution of this typology. As System 3\* goes, audit is mainly on clinical compliance with established guidelines or finances (e.g. activity encoding for refunding) but it is performed by external auditors, mandated by higher hierarchical levels or external organizations. Each department follows up on its activity (number of patients, number of drugs produced), but there is no overall, integrated perspective. There is no routine collection of operational data. Pharmacy follows up on the cost of spoiled drugs, but there is no routine discussion of these figures with physicians. In the oncology department, a first audit was performed on waiting times coming for outpatient chemotherapy. There is no institutionalized systematic problem-solving capacity for the system-in-focus.

##### 4.2.4 System 4

The role of System 4 is double. It links the lower levels (the 1-to-3 homeostat) to policy-making System 5, and it captures and analyzes information on the environment of the system-in-focus. It is the place where the internal and external information is integrated. Contrary to the here-and-now orientation of System 3, System 4 is described as focused on the outside-and-then of the system-in-focus. Jackson refers to System 4 as the “operations room” and the “development function” of the organization (Jackson, 1991: 110–111).

In our case, as mentioned before knowledge is spread around on the organization of outpatient chemotherapy and its best practices, but common discussion is rare. An important missing element is the knowledge of the upstream processes that send patients to the system-in-focus. Where do these patients come from? What is the typology of these patients and why is it so? In oncology there is no report on the number of patients recruited from internal departments (surgery especially) and those coming from external practices.

During the course of the project, the oncology department shifted from a three-year long continuous increase in attendance to a 6% decrease over six months. This was almost impossible to foresee or to explain with the available information. The prospective function is mainly clinical and split on each service, but very limited at the level of the system-in-focus.

##### 4.2.5 System 5

System 5 is where policy is defined, based on the information transmitted by System 4. System 5 is also responsible for representing the system-in-focus to wider systems to which it belongs (in our case, the hospital at large, and then the hospital group). At the time of the diagnosis, we cannot say that there is much policy based on a global view of the system-in-focus. A project emerged a few years back in the cancer division to create a common outpatient clinic for chemotherapy. However this project was based on simple assumptions (a business-as-usual projection), it did not include the pharmacy, and it was never put to work. There is thinking on care pathways for

cancer care, but this is across medical and surgical departments – not our system-in-focus.

The representation of the system-in-focus to wider systems is weak. Indeed, there is no integrated consideration when the cancer and pharmacy divisions negotiate their budgets, despite the fact that the units we study in both division depend on each other to develop their activity. If a System 5 is to be defined, then it would be part of the policy-making at the hospital level. Algedonic signals (alerts from the operations in System 1 that go directly to System 5) consist mostly of incidents reported in the dedicated risk management system, and financial alerts (loss of activity in a department).

With this diagnosis established, the objective is to introduce enough changes so as to remove the structural pathologies of the system. To do so, a change process is started.

#### 4.3 Taking Action

The first step in order to take action is to get the change process going and establish a working environment. To do so, we first established a sense of urgency (Kotter's step 1) through time studies and data analysis – thus playing the role of System 3\*. To analyze the results and start a collaborative effort, we created a guiding coalition (Kotter's step 2) with the head of the oncology department, the head of the pharmacy unit, and the head of the cancer division. The vision for the future (Kotter's step 3) is of an integrated outpatient system, with zero waiting time, negligible spoiled drugs and superior efficiency achieved through improved coordination between the units. To communicate the change vision (step 4), we held multiple meetings and presentations: with the heads of the hospital group's pharmacy division and the hospital's pharmacy department, with the director of the hospital, with nurses and nurse assistants in the oncology department, with heads of department from oncology, pharmacy and hematology. The project was also discussed at a strategic seminar for heads of divisions and departments.

To empower employees (step 5) and generate short-term wins (step 6) we launched two first improvement projects aimed at solving the problems identified during the diagnosis.

The first project aims at a short-term win and is situated at the operational level. A simulation project was undertaken to analyze potential solutions for the coordination between the oncology department and the pharmacy, at the System 2-System 3 level. The results promoted the creation of a coordination function in the oncology department. Details are provided in (Lamé, Jouini, Stal-Le Cardinal, et al., 2016; Lamé, Stal-Le Cardinal, et al., 2016). We then put together a small task force meeting every two to three weeks to work on the implementation of this concept. We reviewed the operational use of information systems, modified the use of some software, changed procedures to take into account constraints of various stakeholders. In this project, the main methods are Soft Systems Methodology (Checkland, 1981), Discrete Event Simulation (Jun et al., 1999) and Service Blueprinting (Bitner et al., 2008). Interestingly, this project also contributed to the action plan of a risk assessment in the pharmacu (a project which was started in total independence), where it appeared clearly that analyzing the chemotherapy unit in isolation was not enough to address all identified risks.

The second project takes a more long-term perspective. It addresses the current limitations of prospective thinking in and on the system-in-focus. This is the role of System 4. The end-point is to decide whether a physical integration of the system-in-focus, as a focused factory (Bredenhoff et al., 2010), is adequate. By-products of this project will include a set of

future scenarios to guide the decision, and a finer understanding of patient referral patterns. Who refers them? What is their typology today? How could this situation evolve? These are the questions in this project. To answer them, an approach combining scenario thinking (Amer et al., 2013) and medical process data analysis is being implemented. The use of system dynamics is also considered for this long range analysis.

## 5 DISCUSSION

We have described the project. It is still ongoing, but lessons can already be drawn. The first thing that must be done is to evaluate this first stage of the change program. This is an essential step in AR. Then, we discuss the learning drawn from this project. Four areas of learning are developed: the application of the VSM in a hospital, Kotter's 8 steps, and the Researcher-in-Residence model.

### 5.1 Evaluating the Project

The last stage in the AR cycle is to evaluate the action taken. Did we change something in the organization? Did we achieve what we wanted to achieve? Are there side-effects? In this case, the initial objective is for the researcher to structure an action plan for a change program, and to start this change program with support from hospital professionals. The objective set to this change program is better integration in chemotherapy delivery.

At the end of the period described in this article, an action plan is proposed and accepted by sponsors. As we write this article, actions have been implemented already, procedures have started to be modified. Meetings have been held with the hospital's direction where the pharmacy and the cancer division have negotiated together for the outpatient chemotherapy system, rather than for each's own interest. The project managed to create a collaboration between the pharmacy and the oncology department, embodied in a series of work meetings. Although before that both departments where cooperative and willing to progress, it was the first time such a collaboration became so concrete. We can therefore say that although operational effects (i.e. measurable impacts, on patient satisfaction or productivity for instance) will only be visible in months to years, when more actions have been implemented, the project has been convincing enough to generate integrated thinking.

A big challenge is the acceptance of the results by a wider audience, in particular at higher hierarchical levels, by the hospital's administrative direction. At the present time encouraging discussions have taken place. The concern is that it may have been more effective to take administrators onboard earlier. However, this may also have created tensions and prevented fruitful discussions with physicians and paramedical staff, which is why it was avoided. Hospital politics are complex, and this is why the project remained at the level of the division to start with.

We now discuss what is learned from this project regarding its methodology and its theoretical framework.

### 5.2 Specifying Learning

#### 5.2.1 On the VSM and Hospitals

In this project the VSM proved to be a powerful lens to analyze a very complex system. It provides a rich thinking environment and a point of comparison for analyzing an organization and constitutes an effective and efficient mental management model to address coordination issues. Literature reviews have noted that multidepartment OR projects are



seldom reported in the academic literature (Hulshof et al., 2012; Vanberkel et al., 2009). Based on the experience of this project, the VSM can be a valuable tool to move forward on this dimension. Our conclusion meet with Keating's (2000: 197): analyzing hospital organizations with the VSM "offers valuable insight and understanding of structural adequacy. It is an important first step in effective restructuring or establishing initial operational structure." However, we reiterate that the VSM alone is not enough to guide action. To do so, one can then rely on her own experience, values, skills and instinct, or she can complement them with a change management approach, like Kotter's 8 steps.

### 5.2.2 On Kotter's change leadership model

This project does not show the full 8 steps. Step 6 is in process, with some short-term wins generated, steps 7 and 8 are still to come. This is not uncommon in applications of Kotter's model (Pollack and Pollack, 2015), and steps 7 and 8, "consolidate gains and produce more change" and "anchor new approaches in the culture", are hard to evaluate (Appelbaum et al., 2012). However, on a small scale, we did consolidate gains on some aspects and anchor them in the operational procedures. An example is a change of posology for chemotherapy premedication, which has been discussed by pharmacists and oncologists, and implemented. This leads us to discuss the linearity and unicity of the 8 steps. On linearity, things in reality are much messier than the neat, sequential 8-step model. There appear to be cycles where a sense of urgency and the vision must be instilled again periodically because day-to-day operations and firefighting take over. Moreover, there are in fact multiple change processes and guiding coalitions at different levels, which Pollack and Pollack (2015) had already mentioned. In our case, a general coalition at the division level, and then a smaller work group at the department level, which elaborated the premedication modification discussed above.

One important critic to Kotter's work is mentioned by (Hughes, 2016a): the depiction of employees as natural resistors to change. We did not come across this type of resistance in our work in the oncology and pharmacy departments. The fact of being integrative, working at a very operational level with frontline workers surely helped. We probably also built on the additional credibility awarded to outsiders, with their "fresh look on the situation", here informed by a curriculum in OM/OR – a discipline no one in the system had notions of. This is congruent with research on "change champions" in healthcare, which are regarded as effective in the first phases of change (Hendy and Barlow, 2012). The fact that the project came with backing from an influent division head, a physician, rather than from administrators certainly helped as well by providing us a status in the organization.

A final remark on the change process is the importance of making connections with other existing projects. In our case, a risk assessment in the pharmacy happened to have similar objectives and we managed to create synergies, and an extension project in the hospital opened perspectives of layout modifications. Kotter does not mention this aspect, but it proved essential in our project.

Despite these adaptations, we felt that Kotter remained a good guide to start our change effort. It is not a comprehensive cookbook and much still relies on the experience and instinct of the practitioner, but it provides a useful model to get a change program starting. In our case, the first four steps seemed to help "unfreeze" the situation and steps 5 and 6 gave momentum to the initiative.

### 5.2.3 On the Operations Management Researcher-in-Residence Mode

On a more personal level, this project can be analyzed from the perspective of the Researcher-in-Residence approach it implemented. The Researcher-in-Residence mode practiced in a "problem solving", "design science" way is very demanding since it requires quick reactions to build a methodology "on the go". Holmström et al. write: "design scientists cannot ex ante predict where their research will take them and what the artificial phenomenon or artifact turns out to be. It is the uncompromising commitment to solving the problem—that drives the design scientist. If solving the problem requires changing disciplines in midresearch, the design scientist has no options." (2009: 74). This commitment to solving problems requires a good knowledge of the organization, its context and its culture. As a consequence the Researcher-in-Residence mode in a hospital is very demanding for a young OM PhD student with no past experience in the healthcare sector. It requires her to adapt very fast to an environment completely different from other industries. Power games and hierarchical structures are different and arguably more complex. In the present case, the researcher is also confronted with professionals who have very limited knowledge on the sciences of management and organization. In the manufacturing industry, the researcher and her interlocutors share a common background and culture. In hospitals, clinicians have a completely different approach, often centered on individual patients, diseases and treatments. They have considerable expertise on these fields, but the patient flow, information systems and coordination perspectives are much less developed. A patient pathway view is emerging but remains very constrained by departmental boundaries. Accustomed to matrix organizations and process orientation, the OM/OR researcher must develop a pedagogical approach and defend her trans-departmental approach, in addition to learning about the specific clinical context and the overall healthcare culture. The Researcher-in-Residence must also create his own function and build his legitimacy by his usefulness to the organization. This is sometimes a stressful experience.

On the other hand, this mode is also very rewarding. The researcher's knowledge is put to practical use, and if the researcher meets eagerness for improvement, she can work through original approaches and hope to contribute to the implementation of her domain's findings in healthcare. In the context of hospitals, where the techno-structure is very weak, this is a powerful way of concurrently defining a problem, engineering a solution and working through its implementation.

The question that remains is that of the sharing of knowledge between both parties – the researcher and the professionals she works with. In our case, we chose not to train professionals to the VSM. This position is disputable. Openness and transparency are important values in interventional research. So what needs to be specified, what can remain undeclared? Our approach was pragmatic, to raise awareness of coordination issues and the potentialities of an integrated view. At this very early stage in OM thinking entering the system, this was more needed than a detailed introduction to the VSM. It is also difficult for the Researcher-in-Residence to ask for training time in the first stages of his project, and would add significantly more pressure on his shoulders. However, we do not feel that we have been treacherous or dishonest in this project. All raw information was shared. The researcher making sense of this is with his distinct expertise is what is

asked from him. The other way around, we felt that we learnt a lot about cancer care, but we in fact learnt just enough to perform our project. No one asked pharmacists or oncologists to unveil the underlying theories when they argued for or against certain propositions. The management of this intermediate knowledge, co-produced during the project, is for us one of the biggest challenges, and definitely a subject for further investigation.

## 6 CONCLUSION

### 6.1 Contributions

In this paper, we presented an action-research project based on Stafford Beer's Viable System Model and John Kotter's 8-Step change leadership process in the context of hospital internal coordination. We justified this combined approach by the fact that the VSM focuses on coordination in complex systems, and that it shares with the 8 steps the same structuralist-functional paradigm. We showed that Beer's VSM is a useful tool to tackle such issues on the analytical side, and that Kotter's 8 steps provides an effective guide to start a change program. We underlined certain adaptations to Kotter's model. We also summarize experiential learning on the intervention mode we used, the Researcher-in-Residence mode. This approach is felt as powerful and rewarding, but demanding and needing further clarification on the management of shared knowledge.

### 6.2 Limits and Further Works

This project bears the intrinsic limits of AR, in particular the theory generated is of limited external validity. Everything we discussed about the hospital we saw may be a mere particularism. To bring more robustness, this project will need to be re-assessed regularly to provide for a longitudinal analysis. It would also be interesting to try analyzing the archetypal hospital organization from the perspective of the VSM. Hospitals share common organizational traits, and a typology of hospitals could be built (public/private, teaching/not teaching, general/focused, large/small, for instance) that could be confronted with the ideal organization offered by the VSM. Moreover, future research should evaluate the approach in other settings, for instance surgery or intensive care.

An additional point that we have already underlined the need for more research on knowledge sharing, production and management in the Researcher-in-Residence approach. This includes ethical aspects. Critical theory, and Habermas' ideal speech situation concept are one possibility to investigate this aspect.

Finally, it was beyond the scope of this paper to compare the proposed approach to the many other methods for performance improvement that have been used in healthcare, e.g. Lean management, DMAIC, Soft Systems Methodology or Kaizen. However in the future it will be necessary to compare these approaches, in order to assess in which cases each one works best and provide a robust toolbox to practitioners (Keys, 2007)

## 7 REFERENCES

Amer M, Daim TU and Jetter A (2013) A review of scenario planning. *Futures* 46.  
Ansari S and Bell J (2009) Five easy pieces: a case study of cost management as organizational change. *Journal of Accounting & Organizational Change* 5(2): 139–167.  
Appelbaum SH, Habashy S, Malo J, et al. (2012) Back to the future: revisiting Kotter's 1996 change model. *Journal of*

*Management Development* 31(8): 764–782.  
Beer S (1972) *Brain of the firm*. London: Allen Lane.  
Beer S (1979) *The heart of enterprise*. Chichester: John Wiley & Sons Ltd.  
Beer S (1984) The Viable System Model: Its Provenance, Development, Methodology and Pathology. *The Journal of the Operational Research Society* 35(1): 7.  
Beer S (1985) *Diagnosing the system for organizations. The Managerial cybernetics of organization*, Chichester: John Wiley & Sons Ltd.  
Bitner MJ, Ostrom AL and Morgan FN (2008) Service blueprinting: a practical technique for service innovation. *California management review* 50(3): 66–94.  
Bredenhoff E, van Lent WA and van Harten WH (2010) Exploring types of focused factories in hospital care: a multiple case study. *BMC Health Services Research* 10(1).  
Checkland P (1981) *Systems thinking, systems practice*. Chichester: Wiley.  
Checkland P and Holwell S (1998) Action Research: Its Nature and Validity. *Systemic Practice and Action Research* 11(1): 9–21.  
Checkland P and Scholes J (1990) *Soft systems methodology in action*. Chichester: Wiley.  
Coghlan D and Brannick T (2014) *Doing action research in your own organization*. 4th edition. Thousand Oaks, CA: SAGE Publications.  
Conway-Orgel M and Edlund BJ (2015) Challenges in Change: The Perils and Pitfalls of Implementing a Palliative Care Program in the Neonatal Intensive Care Unit. *Journal of Hospice & Palliative Nursing* 17(3): 206–212.  
Dick B (2014) Validity. Coghlan D and Brydon-Miller M (eds), *The SAGE Encyclopedia of Action Research*, London, UK: SAGE Publications, Ltd.  
Drupsteen J, Van der Vaart T and Van Donk DP (2016) Operational antecedents of integrated patient planning in hospitals. *International Journal of Operations & Production Management*.  
Espejo R and Harnden R (eds) (1989) *The Viable system model: interpretations and applications of Stafford Beer's vsm*. Chichester: John Wiley & Sons Ltd.  
Espejo R and Reyes A (2011) *Organizational systems - Managing complexity with the viable system model*. Berlin: Springer.  
Green N (2007) *Vsm Self made image*. Available from: <https://commons.wikimedia.org/wiki/File:Vsm.gif> (accessed 4 November 2016).  
Hendy J and Barlow J (2012) The role of the organizational champion in achieving health system change. *Social Science & Medicine* 74(3): 348–355.  
Holmström J, Ketokivi M and Hameri A-P (2009) Bridging Practice and Theory: A Design Science Approach. *Decision Sciences* 40(1): 65–87.  
Hughes M (2016a) Leading changes: Why transformation explanations fail. *Leadership* 12(4): 449–469.  
Hughes M (2016b) *The leadership of organizational change*. Routledge Studies in Organizational Change & Development, New York ; Abingdon: Routledge.  
Hulshof PJH, Kortbeek N, Boucherie RJ, et al. (2012) Taxonomic classification of planning decisions in health care: a structured review of the state of the art in OR/MS. *Health Systems* 1(2): 129–175.  
Jackson MC (1988) An Appreciation of Stafford Beer's 'Viable System' Viewpoint on Managerial Practice. *Journal of management studies* 25(6): 557.

- Jackson MC (1991) Systems methodology for the management sciences. Contemporary systems thinking, New York: Plenum Press.
- Jackson MC (2003) Systems thinking: creative holism for managers. Chichester ; Hoboken, NJ: John Wiley & Sons.
- Jahangirian M, Naseer A, Stergioulas L, et al. (2012) Simulation in health-care: lessons from other sectors. *Operational Research* 12(1): 45–55.
- Jun JB, Jacobson SH and Swisher JR (1999) Application of Discrete-Event Simulation in Health Care Clinics: A Survey. *Journal of the Operational Research Society* 50(2): 109–123.
- Keating CB (2000) A systems-based methodology for structural analysis of health care operations. *Journal of Management in Medicine* 14(3/4): 179–198.
- Keys P (2007) Developing a Design Science for the Use of Problem Structuring Methods. *Systemic Practice and Action Research* 20(4): 333–349.
- Klein JH and Young T (2015) Health care: a case of hypercomplexity? *Health Systems* 4(2): 104–110.
- Kodner DL and Spreeuwenberg C (2002) Integrated care: meaning, logic, applications, and implications – a discussion paper. *International Journal of Integrated Care* 2(4).
- Kotiadis K and Mingers J (2006) Combining PSMs with hard OR methods: the philosophical and practical challenges. *Journal of the Operational Research Society* 57(7): 856–867.
- Kotter JP (1995) Leading change: Why transformation efforts fail. *Harvard Business Review*: 59–67.
- Kotter JP (1996) Leading change. Boston, MA: Harvard Business School Press.
- Lamé G, Stal-Le Cardinal J and Jouini O (2016) Organizational redesign: insights from ethnography before simulation. In: *Proceedings of DESIGN 2016*, Cavtat, Dubrovnik, Croatia: Design Society.
- Lamé G, Jouini O and Stal-Le Cardinal J (2016) Outpatient chemotherapy planning: A literature review with insights from a case study. *IIE Transactions on Healthcare Systems Engineering* 6(3): 127–139.
- Lamé G, Jouini O, Stal-Le Cardinal J, et al. (2016) Patient-Hospital Communication: a Platform to Improve Outpatient Chemotherapy. In: Roeder TM, Frazier PI, Szechtman R, et al. (eds), *Proceedings of the 2016 Winter Simulation Conference*, Washington, DC, USA.
- Lega F and DePietro C (2005) Converging patterns in hospital organization: beyond the professional bureaucracy. *Health Policy* 74(3): 261–281.
- Lehaney B and Paul RJ (1996) The Use of Soft Systems Methodology in the Development of a Simulation of Out-Patient Services at Watford General Hospital. *Journal of the Operational Research Society* 47(7): 864–869.
- Leonard A (2009) The Viable System Model and Its Application to Complex Organizations. *Systemic Practice and Action Research* 22(4): 223–233.
- Lewin K (1947) *Frontiers in Group Dynamics: Concept, Method and Reality in Social Science; Social Equilibria and Social Change*. *Human Relations* 1(1): 5–41.
- Lillrank P (2012) Integration and coordination in healthcare: an operations management view. *Journal of Integrated Care* 20(1): 6–12.
- Marshall M, Pagel C, French C, et al. (2014) Moving improvement research closer to practice: the Researcher-in-Residence model. *BMJ Quality & Safety* 23(10).
- Mbamalu G and Whiteman K (2014) Vascular access team collaboration to decrease catheter rates in patients on hemodialysis: utilization of Kotter’s change process. *Nephrology Nursing Journal: Journal of the American Nephrology Nurses’ Association* 41(3): 283–287; quiz 288.
- McDonald KM, Sundaram V, Bravata DM, et al. (2007) Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies (Vol. 7: Care Coordination). AHRQ Technical Reviews, Rockville, MD: Agency for Healthcare Research and Quality (US).
- McNiff J and Whitehead J (2011) All you need to know about action research. 2nd ed. Los Angeles: SAGE.
- Montgomery A, Doulougeri K and Panagopoulou E (2015) Implementing action research in hospital settings: a systematic review. *Journal of Health Organization and Management* 29(6): 729–749.
- Moraros J, Lemstra M and Nwankwo C (2016) Lean interventions in healthcare: do they actually work? A systematic literature review. *International Journal for Quality in Health Care* 28(2): 150–165.
- Mount A and Anderson I (2015) Driving Change—Not Just a Walk in the Park: The Role of the Nurse Champion in Sustained Change. *Nurse Leader* 13(4): 36–38.
- Paltved C, Morcke AM and Musaeus P (2016) Insider action research and the microsystem of a Danish surgical ward. *Action Research* 14(2): 184–200.
- Pérez Ríos JM (2012) Design and Diagnosis for Sustainable Organizations: The Viable System Method. Berlin Heidelberg: Springer Verlag.
- Pollack J and Pollack R (2015) Using Kotter’s Eight Stage Process to Manage an Organisational Change Program: Presentation and Practice. *Systemic Practice and Action Research* 28(1): 51–66.
- Reid PP, Compton WD and Grossman JH (2005) Building a Better Delivery System: a New Engineering/Health Care Partnership. Washington: National Academies Press. Available from: <http://public.eblib.com/choice/publicfullrecord.aspx?p=3378176> (accessed 4 February 2016).
- Schwaninger M (2006) Design for viable organizations: The diagnostic power of the viable system model. *Kybernetes* 35(7/8): 955–966.
- Schwaninger M and Scheef C (2016) A Test of the Viable System Model: Theoretical Claim vs. Empirical Evidence. *Cybernetics and Systems* 47(7): 544–569.
- Susman GI and Evered RD (1978) An Assessment of the Scientific Merits of Action Research. *Administrative Science Quarterly* 23(4): 582.
- Thomson Reuters (2016) Web of Science. Web of Science. Available from: [www.webofknowledge.com](http://www.webofknowledge.com).
- Vanberkel PT, Boucherie RJ, Hans EW, et al. (2009) A survey of health care models that encompass multiple departments. Enschede: University of Twente, Department of Applied Mathematics. Available from: <http://doc.utwente.nl/67545/> (accessed 26 August 2015).
- Young T and McClean S (2009) Some challenges facing Lean Thinking in healthcare. *International Journal for Quality in Health Care* 21(5): 309–310.