

# Uncovering Key Factors for a Hospital IT Change Strategy

Noel Carroll<sup>1</sup>, Ita Richardson<sup>1,2</sup> and Marie Travers<sup>2</sup>

<sup>1</sup>ARCH – Centre for Applied Research in Connected Health, University of Limerick, Limerick, Ireland

<sup>2</sup>Lero – the Irish Software Engineering Research Centre, University of Limerick, Limerick, Ireland

**Keywords** Change Management, Healthcare, Hospital, Kotter's Model, Quality.

**Abstract** Changing an Information Technology (IT) system within any organisation is a difficult and complex process. However, within the hospital setting, additional complexities make such change more difficult. These complexities include the protection of patient safety and privacy, improving the quality of the patient experience, protecting information and supporting the clinician in their medical requirements. Our research indicates that uncovering the process of hospital IT change management is not documented – making it difficult to build on evidence-based research and instill a 'lessons learned' approach in publicly funded hospitals. We address this gap in this paper. Using qualitative research methods we present the results of observations carried out in healthcare settings as well as twelve structured interviews with hospital staff. We employ the Kotter Change Model as a lens to understand this change process. While benefiting from the structure that Kotter's model provides, we argue for the need to extend this model in an effort to capture the various influences of healthcare IT-enabled innovation which will, in turn, enable much needed change within hospitals. Building on our findings, we introduce a Healthcare IT Change Management Model (HIT-CMM).

## 1 INTRODUCTION

In recent years, much has been documented about the crisis which healthcare systems currently face due to growing demand and expectations from traditional healthcare models. Healthcare organizations now realize that innovation is increasingly required to sustain a quality healthcare service system (Cazzaniga and Fischer 2015). To be successful, innovations through the implementation and upgrading of Information Technology (IT) systems should align with practice and support the evolution of healthcare processes change.

Arguably, the healthcare system suffers from similar issues experienced by other sectors when implementing change through IT. For example, while healthcare service providers commit to improving a service and invest heavily in technological infrastructures to reach improved service levels, managing the change process of IT innovation is a complex task. Healthcare IT must protect patient safety and privacy, and in addition, there are clinical, technical and software regulations that need to be considered.

Thus, uncovering the process of IT change management draws on examining a wide range of perspectives to understand how change can be successfully managed. There are numerous models throughout the literature which guide the change process. Kotter's change model is one such change management model. The authors build on a recent study by Travers and Richardson (2015) which uses Kotter's change model (Kotter 2005) to examine change processes within a private sector medical device healthcare innovation context. Their study documented a single case study in a medical device company. They discovered that process improvement should be managed through the use of this model to ensure that change is implemented systematically throughout the whole organisation. In this paper, we use the same model as a basis to understand how IT change has been managed in public hospital departments. Our results contextualise the change process within the hospital domain and allows us to introduce a Healthcare IT Change Management Model (HIT-CMM).

The next section is divided in two, namely introducing IT systems in hospital settings and Kotter's model.

## 2 LITERATURE REVIEW – IT CHANGE IN HOSPITALS

Change management requires a specific approach to transition an organisation to a desired future state (Benjamin and Levinson 1993). Within a hospital context, the various steps required to achieve a desired future state is of particular importance to ensure that patient safety is a priority and quality is not jeopardized (Cazzaniga and Fischer 2015). The objective of change management is typically to provide an approach to implementing change in a controlled manner while adhering to specific requirements such as functionality, budget and time through various deliverables or milestones. Change management is well documented throughout literature. For example, Lewin's Three Step Change Theory (Lewin 1947) and ADKAR Model (Hiatt 2006) are all applied to various dimensions of the change process.

### 2.1 Kotter's Change Model

Introducing change must be a formalised planned process (Forte 1997). Even though it is sometimes considered that having a process can be an overhead, change management techniques have shown that when change is planned it is more likely to be successful (Forte 1997). Therefore, most planning models assume that changes in organisations are planned changes (Hayes and Richardson 2008). The models stipulate that, for successful change, certain sequential steps need be executed. Kotter's change model is one such change management model (Kotter 2005).

We examine Kotter's change model (illustrated in Figure 1) within a publicly funded hospital setting. We refer to a publicly funded hospital as one where most of its funding comes from state funds. In our case study, state funding comes via the HSE. Using Kotter's eight steps, we conducted a case study to answer the following research question:

*How do clinical departments within a publicly funded hospital setting successfully implement an IT system?*

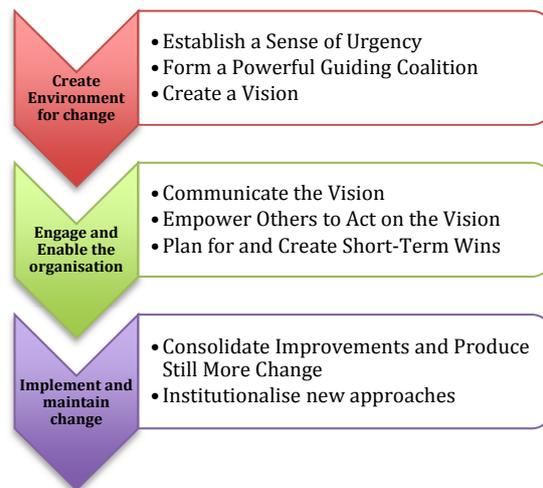


Figure 1: Kotter's Change Model (illustrated by authors).

## 3 METHODOLOGY

Qualitative research methods enjoy numerous approaches to capture raw and rich data. For example, adopting the case study method provided us with the structure to devise specific procedures to design a research strategy, collect data, analyse data, and present and report the results. We opted to undertake observational methods within a single case study considering the unique opportunity to capture an empirically rich account of specific phenomena (Yin 2013) within a healthcare context.

The authors carried out one-to-one interviews. The departments focused on were Radiology, Dermatology, Quality, Physiotherapy and IT. The interviews were held with twelve key staff members who were all involved in IT change to various degrees. Since the interviewees were healthcare experts within public hospitals, some were difficult to access. To overcome this, the authors employed a snowballing sampling strategy (Grbich 1999). This was used to identify other experts in this field within the sample population. This proved to be useful since each expert was able to recommend the next relevant expert. Through a structured interview technique, we were able to provide a more balanced insight to uncover the change process. The structured interviews supported our research methodology by ensuring consistency, i.e. each interviewee was presented with exactly the same questions in the same order. The questions had to be short since the health experts had limited time available to partake in the case study. The questions were as follows:

1. What are the current IT systems in place within your department?
2. Give examples of how new IT systems or processes were implemented? Specifically how was the change process managed? Give examples.
3. Kotter's (2005) is a change management model, which recommends 8 steps to follow to manage change. Kotter's Step 7 "Consolidate Improvements and Produce More Change" recommends that management or change advocates should become more involved in the process thus ensuring continuation of changes. Kotter's Step 8 "Institutionalise New Approaches" recommends that for success change has to be implemented so that it is now part of the organisations culture. Is this true in your experience in regards to moving or changing to new IT systems/processes? Give examples.
4. Were there any unexpected problems or issues that affected such project changes? Give examples.
5. What is your opinion of the new IT system/process implemented?
6. What could or should have been done differently? Give examples.

The interviewees' answers were reliably aggregated and comparisons were made between the different interviewees. We identified a number of emerging themes using open coding to categorise the text – allowing us to build a story around specific events, facts, and interpretations.

The interviewees' work experience spanned from 4 to 30 years. Participant's interview data (Table 1) was analysed to understand the change process within the case study. We reviewed the data within the structure of Kotter's change model steps 1 to 8, which allowed us to understand how change had been made within the hospital setting. This facilitated our gaining a rich insight of the working environment.

Analysing the findings from the hospital study we identified key themes. We contextualized these findings and their implications on Kotter's change model. Our results indicate that some aspects of Kotter's change model is useful to successfully manage change but would need to be modified for a healthcare context. This case study facilitates analysis from a hospital perspective and the findings informed and enhanced a proposed model, which we call the HIT-CMM (see Table 3).

Table 1: Summary of Interviewee Profiles.

Interviewee	Department	Yrs Exp.	Specialty
1	Quality	23	Nurse and Risk Manager with focus on use of IT systems
2	Radiology	29	Administration with focus on quality
3	Physiotherapy	17	General Administration
4	HR	28	Project Manager
5	Dermatology	4	Clinician
6	Radiology	25	Clinician/Project Manager
7	IT	30	Manager with focus on hardware and software deployment
8	Quality	19	Manager with focus on risk management
9	Laboratory	28	Manager with focus on deployment
10	Radiology	28	Clinician/Project Manager
11	IT	20	Project Manager
12	Quality	10	System user

## 4 FINDINGS

Within the hospitals, we found that there were silos of IT innovation in which a clinician or manager championed IT change. Silos proved problematic when patients had to move between departments. The need for national or central rollout of projects was identified as a solution. National or central rollouts do take time so some departments would go ahead and implement new systems thus creating IT silos.

The interview findings identified various conduits of information on the real-world IT change management process, and enabled us to explain how change management may be viewed as a product of change leadership. Based on our analysis of the observations and the interviews, we identified a number of key themes, which we present as follows:

- a) Requirement for Change
- b) Attitudes towards new IT systems and processes
- c) Lessons Learned

We provide a discussion to contextualize these findings and their implications on Kotter's change model.

## 4.1 Requirement for Change

The need for change was clearly highlighted from the interviews. For example, Interviewee 3 explained that “change is overdue as every evening each patient and the interventions delivered to them have to be input. This is very time consuming. Also a big change that is needed is with the problem of patients not having a unique identifier”. As a solution to many of these issues, a number of projects were rolled out to improve services in Ireland and allow files to be viewed in more than one hospital. Interviewee 6 confirms that the project “was rolled out nationally with input locally”. However, they caution that some form of “follow-up should have happened as staff are not using all the features of the system” (Interviewee 6). Targeted training and proper scoping of projects was identified as potential solutions by a number of interviewees. The findings indicate within various departments in the hospital, change is a forward planning process, which is well documented and audited through various stages. Change required a cultural commitment from the organisation as a whole to accommodate a new set of procedures, one of which is the use of auditing.

Stemming from a discussion on change, Interviewee 1 explained that change processes should be linked back to the concept of ‘the Iron Triangle’. They explained that the Iron Triangle describes the relationship between cost, quality, and access within the hospital’s department. The basic premise here is that a change (positive or negative) in one aspect of the triangle has a direct impact on the remaining two areas (Kissick 1994). Thus, while competing with each other, finding a balance and identifying what specific areas the department can trade-off becomes a key factor for change management teams. In addition, the reverse is also true – while improving one aspect of the Iron Triangle, change can also have a positive impact on the remaining two areas.

For the purpose of this research, we focus on the quality aspects associated with implementing change. The specific quality, safety and risk management software used has different sections for various quality documents on best practice. Interviewee 1 suggests that the documents should also link to audits to guide the change process. In addition, risk assessments are also conducted to provide a proactive management approach to assess issues, which may provide future challenges. All of these efforts support the hospitals quality

improvement plan to identify what implementations are required and record incidences.

## 4.2 Attitudes towards New IT Systems and Processes

The interviewees reported mixed views with the introduction of new IT systems and processes. While some seemed relatively pleased with the new systems, others report disappointment with the overall change and the manner in which the change process occurred. Specifically, we revisit the Iron Triangle to highlight how Access can improve Quality, which is highlighted by Interviewee 4: “overall it is an improvement as images can be view from multiple locations”.

Interviewee 4 explains that “involvement of staff is crucial for buy-in” which suggests that change management is a much wider collaborative effort within a department. Interviewee 5 highlights this and explains that the implementation of some new IT systems represents “silo thinking as lack of understanding of standards, networking, eco-system and health informatics”. In addition, to accommodate a smooth change transition, training on a new system is vital. Interviewee 7 also shares similar concerns and highlights that “buy-in crucial to generate enthusiasm” about a change in service systems. In addition, they suggest “training should be relevant and timely” which may hamper user acceptance of IT-enabled innovation. Interviewee 10 also concurs “getting buy-in from stakeholders was crucial and management had to communicate well to do this. Without buy-in there is no engagement. Open meetings are useful”.

We learn that with some projects there were “too long a time delay from training to using the system” (Interviewee 4) which can hamper the initial success of an IT change management programme. Interviewee 6 shares similar concerns regarding training and suggests, “more frequent staff sessions needed. Overall staff felt that training was not sufficient and more difficult for older people. Staged training sessions would have helped such as introduction, advanced, super user training”. While some projects provide standard operating procedures (SOP) the inclusion of other software companies for supporting services may cause concerns for some users, for example, subcontracting support services (Interviewee 6).

Our findings also suggest that communication regarding the objective of implementing change is critical. For example, Interviewee 7 raises the question: “What are the objectives?” and goes on to

explain, “there is no point in implementing centrally and then letting people do what they want locally. You might as well have two systems”. Interviewee 10 states “communication was good with staff and team but could have been a lot better with the general public”. Interviewee 8 also highlights the importance of communication “very importantly for bringing in change that communication and team work essential”. This suggests that implementing change requires improved planning and communication strategies. This led us to consider whether change management requires a specific approach or whether it is a product of change leadership, which we examine further in the next section.

### 4.3 Lessons Learned

Interviewees were provided with the opportunity to explain what they might do differently if they were to undertake a similar change management task. Interviewee 1 explained that they would like to have more control of the chosen software vendors and suggest that not all users were happy with the software. Interviewee 2 raised more concerns with the overall change process. For example, interviewee 2 had concerns around the need to rebuild a service network, the need to fill out medical records (time-consuming) and the threat of personnel moving department or institution and in so doing, bring much needed competence out of the department. Therefore, more engagement of all parties and external expertise is a critical element of success in change management. Interviewee 5 explains that they could have “engaged with research centre...to get more visibility”. Building on this comment, the interviewee suggests that it should be a national competence approach to similar projects and explains, “we need a centre such as a medical software institute with wide stakeholder representation to oversee projects”.

Interviewee 2 highlights the usefulness of using a change model such as Kotter’s and indicates that the eight steps is “what should be done...but plans can change due to unexpected problems”. This suggests that there may be a need to offer greater flexibility or agility to change management models such as Kotter’s. Interviewee 5 also suggests that models such as Kotter offer a good basis to manage change. For example, interviewee 5 further explains, “for our system we were mobile and patient centric. We understood the people and their motivations. That is a platform for engagement and multi-disciplinary teams”. Adopting an improved structured approach

was discussed by Interviewee 6 discusses this and suggest that a “well-structured maintenance service agreements especially out of hours service for example the previous system came from [Global Tech Company] and they had a person onsite to deal with issues”. Interviewee 7 suggests that the success in implementing change may be in the ability to understand user’s requirements and foster a relationship to ensure buy-in at the beginning of the project: “to implement change you have to talk to the end user and get buy-in. Start with what you want and work back. Successful projects always had buy-in”.

However, to facilitate an improved structured process, Interviewee 2 indicated the need to “encourage more trust” and avail of additional onsite support for the technology providers. One of the issues associated with the lack of support was the different time zones (i.e. Ireland and the USA) requiring out of office phone calls for long durations. The level of support provided was often unsatisfactory, for example, “they sometimes say the problem is our network when the network is working” (Interviewee 2). Interviewee 4 also shared these concerns and explained that if they underwent a similar project they would have “someone on hand instead of having to ring California with issues”. This would make a big difference.” The need for improved planning and greater stakeholder involvement was discussed. For example, Interviewee 9 discusses a failed project and suggests “it was not scoped well and users were not involved enough”. Interviewee 11 also acknowledges planning and suggests, “with any project there should be time given to planning the project timelines”. In addition, considering that one of the core objectives was to streamline healthcare processes, Interviewee 4 highlights their disappointment in that the project in question, “it is supposed to be paperless but it is not. Actually we are using more paper and ink now.” Interviewee 6 explains that going live presented some unexpected issues: “the initial go live took longer and also the bedding in period took longer than expected and more patient lists should have been cancelled beforehand. So what happened were lots of people waiting two weeks so it was not patient load effective at the beginning”. Interviewee 6 goes on to explain that planning and vision are often problematic: “we plan things and it takes so long that by the time it’s implemented the projects are too old.” Interviewee 6 also highlights some general issues associated with change management in the public sector such as:

- Not enough long-term strategic planning;
- Many projects are abandoned;
- Need be more proactive rather than reactive;
- Need to avail of informed expert opinion on change management.

Interviewee 7 shares similar concerns and suggests, “better long-term and short-term planning is needed”. Thus, there is a clear indication that implementing change requires a structured approach, which communicates both the need and benefits of supporting change.

## 5 DISCUSSION

This study demonstrates that the need to manage such change is widely recognized. The interviewees confirm that management need to lead change. Reviewing Kotter’s change model and eight phases of change, we learn that not all eight phases were necessary to successfully implement change in the hospital system. We highlight these as Strong Evidence, Some Evidence and No Evidence as detailed in Table 2. It also outlines the level of evidence of Kotter’s change model using the eight phases, which we identified within our case study. Kotter’s Step 4 ‘Communicate the Vision’ stipulates that communication of the vision should come from senior management.

Therefore, staff were aware of relevant tasks to be completed in the project and of their roles within the project. This was not identified by any of the interviewees as a necessity, yet the hospital happened to successfully implement change and raises many questions as to how it could be improved and what key factors were in play from an organisational change perspective.

Table 2: Evidence of Kotter’s 8 Phases.

Kotter’s Eight Phases	Evidence
1. Establish a Sense of Urgency	Strong Evidence (Green)
2. Form a Powerful Guiding Coalition	Some Evidence (Yellow)
3. Create a Vision	No Evidence (White)
4. Communicate the Vision	No Evidence (White)
5. Empower Others to Act on the Vision	Some Evidence (Yellow)
6. Plan for and Create Short-Term Wins	Strong Evidence (Green)
7. Consolidate Improvements and Produce Still More Change	Some Evidence (Yellow)
8. Institutionalise new approaches	Strong Evidence (Green)

The following steps were strongly identified by interviewees as being necessary during the implementation process:

- **Step 1: Urgency.** Hayes and Richardson (2008) state that, the need for such a change must be communicated to everyone in the organisation at the outset. This was confirmed by the interviewees, as there was an inherent imperative requirement for change to the current system in place.
- **Step 6: Plan.** Change should have clear goals and objectives and take place in small steps. The interviewees stated that there were clearly defined goals and that the objectives were all agreed on to be rolled out nationally.
- **Step 8: Institutionalise.** The interviewees remarked that the new approach is now part of normal way of working and is “bedded in well”.

The following steps were identified by interviewees as being necessary during the implementation process but would require a greater presence throughout the change process:

- **Step 2: Coalition.** Kotter (2005) recommends progressively involving different members of the organisation in the change to form a project team. This was seen to be the case in one such project within the hospital, which was ultimately successful. Coalition was necessary as it involved numerous team members in various locations.

**Step 3: Vision.** Kotter (2005) recommends that a clear vision and plan for implementing change is required.

While **Step 5: Empower Others to Act on the Vision** was not obvious from our interviews, Kotter (2005) recommends that obstacles, such as organisational structure should be removed. The interviewees confirmed this as a requirement. For example, while the interviewees mentioned the various obstacles they would like to remove they were not empowered to instigate change to act on the vision.

Overall our findings suggest that there is a clear need to introduce a new model to support the implementation of change in a healthcare context. While Kotter’s Steps 2, 3 and 7 were only partially implemented in successful projects the aims of these steps were achieved while carrying out other steps.

Table 3: HIT-CMM: Quality and Access.

Health IT Change Factors	System Structure		Process of Care		Healthcare Outcome	
	Quality	Access	Quality	Access	Quality	Access
Establish a Sense of Urgency	Why does the quality of the current IT healthcare system prompt the need for change?	Will a sense of urgency of the structure create improved access to the IT healthcare system?	How will a sense of urgency improve the quality in the provision of care via the IT healthcare system?	How does the sense of urgency highlight the need for improved access to care via the IT healthcare system?	Can the sense of urgency lead to improved quality in healthcare outcomes using the IT healthcare system?	Will a sense of urgency in changing the IT healthcare system support the need for improved access to healthcare outcomes?
Form a Powerful Guiding Coalition	Can a coalition improve the quality by altering the structure of an IT healthcare system?	How does a coalition structure improve the accessibility of services the IT healthcare system?	How can a coalition improve the quality of care using the IT healthcare system?	How does a coalition improve access to the IT healthcare system improve the provision of care?	How does a coalition contribute towards the quality of healthcare outcomes through the IT system?	Can a coalition for an IT healthcare system lead to improved access to improved healthcare outcomes?
Create a Vision	How can a vision of an IT healthcare system address quality concerns within a service structure?	How does the IT healthcare system vision include greater access to the system structure?	How is the quality of the IT healthcare system captured in the vision?	Does the vision of the IT healthcare system propose greater access to healthcare service?	How does the vision for the IT healthcare system propose to improve the quality of healthcare outcomes?	Are there any specific factors described in the of IT healthcare system vision which proposes to provide greater access to improved healthcare outcomes?
Communicate the Vision	What processes are in place to communicate the quality factors of the IT healthcare system vision?	How does the vision inform stakeholders for improved access to the IT healthcare system?	How is the quality of care suggested to improve through the IT healthcare system?	Is access to the IT healthcare system a key part of the vision statement?	How does the IT healthcare system vision propose to improve the quality of healthcare outcomes?	Does the IT healthcare system vision propose to improve access to improved healthcare outcomes?
Empower Others to Act on the Vision	What roles are assigned to stakeholders to act on the IT healthcare system vision to improve the service quality?	How are stakeholders empowered to have greater access to the IT healthcare system?	What processes are described in the IT healthcare system vision to empower stakeholders to improve the quality of care?	How does the vision empower stakeholders to have greater access to provide care using the IT healthcare system?	What roles are assigned to stakeholders to improve healthcare quality outcomes through the IT healthcare system vision?	How are stakeholders empowered to have greater access to the IT healthcare system in order to improve healthcare outcomes?
Plan for and Create Short-Term Wins	What short-term quality gains are defined for the change in the IT healthcare system structure?	What short-term access gains are planned for the change in the IT healthcare system structure?	What short-term quality gains are planned to be achieved using the IT healthcare system?	What short-term gains are planned for the provision of care via the IT healthcare system?	What short-term healthcare outcome quality gains are planned for using the IT healthcare system structure?	What short-term access gains can achieve improved healthcare outcomes using the IT healthcare system structure?
Consolidate Improvements and Produce Still More Change	What benefits to quality could be achieved through consolidated improvements in the IT healthcare system structure?	What improved levels of access could be achieved through consolidated improvements in the IT healthcare system structure?	What benefits to the provision of care could be achieved through consolidated improvements in the IT healthcare system?	How could improved access improve the provision of care using consolidated improvements in the IT healthcare system?	What healthcare quality outcomes could be achieved through consolidated improvements in the IT healthcare system?	What improved levels of access to healthcare outcomes could be achieved through consolidated improvements in the IT healthcare system?
Institutionalise new approaches	Are specific IT healthcare system quality metrics defined in the healthcare organisational strategy?	How is improved access to the IT healthcare system embedded into the organisational and IT strategy?	How does the organisation propose to improve the quality associated with the provision of care using the IT healthcare system?	How does the organisation propose to improve the access to care using the IT healthcare system?	Has the organisation established specific healthcare quality outcomes for the IT healthcare system?	How is it proposed that improved access to the IT healthcare system would improve the organisations overall healthcare outcomes?

### 5.1 HIT-CMM

To develop a change model we identified an approach by O’Leary et al (2015) and Carroll et al (2016) which examines primary stakeholders to address their assessment needs from a multi-perspective viewpoint. We adopted a similar methodology to influence the development of HIT-CMM: Quality and Access (Table 3). Cost will be included in the next iteration of the model. The HIT-CMM acknowledges that change is multidimensional and occurs through a series of key management stages, combining Kotter’s eight steps, which require assessment as per the Iron Triangle at various stages of the change management lifecycle. The questions presented throughout Table 3 are influenced case study data and constructed to support the hospital IT change strategy at various stages of the change process. We also found that some aspects of Kotter’s change model is useful to

successfully manage change but there are some shortcomings within a healthcare context. For example Kotter’s step 5 Empower Others to Act on the Vision was seen as unnecessary within the medical device company while in the hospital it was not obvious from our interviews. Within each of the phases we assign the relevant Kotter steps to support change management along with steps identified in this case study such as Senior Management as supporters and staff buy-in. Communication of the vision was already identified as lacking in this case study, if the HIT-CMM were then used the assessment of this step should be in terms of cost, quality, accesses, structure, process and outcome.

### 6 FUTURE RESEARCH

It is planned to further develop the HIT-CMM and use it to guide change. This model would build on

the specific needs identified such as longer term strategic planning and more flexibility to manage unexpected issues. In particular, we will include Cost as the third element of the Iron Triangle.

The HIT-CMM will be incorporated into a more detailed strategy model, which also examines the process of innovation in healthcare. Specifically the HIT-CMM has already supported us to uncover key factors for a Healthcare Innovation Strategy and how we could begin to explore innovation opportunities. Given the small sample size a more complete picture will be facilitated by interviewing a larger number of participants.

## 7 CONCLUSIONS

This study demonstrated that the need to manage change is widely recognized. Different perspectives, methods and approaches (and the underlying theories that drive them) that are aligned cannot guarantee to deliver the required change in the time and on the scale necessary. Reviewing Kotter's change model and eight phases of change, we learn that not all eight phases are necessary to successfully implement change. Therefore a more tailored yet detailed framework was required. We present a more suitable model to manage healthcare IT change through the introduction of our HIT-CMM.

## ACKNOWLEDGEMENTS

We would like to thank all the participating interviewees for their time and efforts.

This research is partially supported by Science Foundation Ireland (SFI) grant no 10/CE/I1855 to Lero (<http://www.lero.ie>), by Enterprise Ireland and the IDA through ARCH – Applied Research in Connected Health Technology Centre ([www.arch.ie](http://www.arch.ie)), BioInnovate and by Science Foundation Ireland (SFI) Industry Fellowship Grant Number 14/IF/2530.

## REFERENCES

- Benjamin, R. I., Levinson, E., 1993. A framework for managing IT-enabled change. In *Sloan Management Review*, 34(4), 23-33.
- Carroll, N., Travers, M. and Richardson, I., 2016. Evaluating Multiple Perspectives of a Connected Health Ecosystem. In *9th International Conference on Health Informatics (HEALTHINF)*, Rome, Italy, February.
- Cazzaniga, S., Fischer, S., 2015. How ICH Uses Organizational Innovations to Meet Challenges in Healthcare Management: A Hospital Case Study. In *Challenges and Opportunities in Health Care Management*, Springer International Publishing, 355-361.
- Forte, G., 1997. Managing Change for Rapid Development, In *IEEE Software* 14(6), 114–123.
- Grbich, C., 1999. *Qualitative Research in Health: An Introduction*, Sage Publications. California.
- Hayes, S., Richardson, I., 2008. Scrum Implementation using Kotter's Change Model, 9th International Conference on Agile Processes and eXtreme Programming in Software Engineering, Limerick, Ireland, Lecture Notes in Business Information Processing 2008, vol 9, Part 6, 10th-14th June, 161-171.
- Hiatt, J. M., 2006. ADKAR: a model for change in business, government and our community, Prosci Learning Center. Loveland.
- Kissick, W., 1994. *Medicine's Dilemmas: Infinite Needs versus Finite Resources*, Yale University Press. New Haven.
- Kotter, J., 2005. *Leading Change: Why Transformation Efforts Fail*, Harvard Business School Press. Boston.
- Lewin, K., 1947. *Frontiers in Group Dynamics: Concept, Method and Reality in Social Science*; In *Social Equilibria and Social Change. Human Relations*, June, 1(36).
- O'Leary, P., Carroll, N., Clarke, P. and Richardson, I., 2015. Untangling the Complexity of Connected Health Evaluations. In *International Conference on Healthcare Informatics (ICHI)*, October, 272-281. IEEE.
- Travers, M., Richardson, I., 2015. Medical Device Software Process Improvement – A Perspective from a Medical Device company, in *8th International Conference on Health Informatics, (Healthinf)*, Lisbon, Portugal, January.
- Yin, R. K., 2013. *Case study research: Design and methods*, Sage publications.