Innovation Adoption in Robotic Surgery - A Surgical Innovation Framework using Royal Bournemouth Hospital

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Abstract:

Robotic Surgery is studied as an innovative surgical procedure and we examine the way Robotic Surgery is adopted by healthcare professionals in Royal Bournemouth Hospital. This research aims to develop a Surgical Innovation Framework (SIF) that incorporates the broader adoption of surgical innovation for the National Health Service (NHS) in the United Kingdom. The aim of the framework is to assist the NHS in its determination and adoption of surgical innovation. The framework is developed taking into consideration the recent reports by the Department of Health and Social Care, NHS, NICE and existing body of knowledge. The proposed model considers unique characteristics of Robotic Surgery, NHS as the host organization, healthcare professionals as adopters and other elements such as communication channels. An end-to-end communication pathway is developed for the robotic surgery team to identify stakeholders involved in this process.

Introduction

The purpose of this research is to apply innovation theory models to examine RBH's adoption of robotics surgery to help surgical innovation spreads through cultures and is communicated through certain channels (Rogers, 2003). Also, we aim to develop an understanding of the challenges medical experts (i.e. Surgeons, Nurses, Theatre Practitioners) face in the process of adopting Robotic surgery and how it can be facilitated and encouraged. The study will focus on Gastrointestinal Robotic Surgery (GRS) at Royal Bournemouth Hospital.

New technologies are being adopted in surgery, such as "endoscopic transnasal trans-sphenoidal approach for the resection of many pituitary adenomas. In orthopaedic surgery, treatment of femoral shaft fractures has evolved from traction and casting to locked intramedullary nailing. Cardiothoracic surgeons are rapidly adopting the recently approved technology of transcatheter aortic valve replacement for use when open replacement is deemed high risk" (Alexander et al 2017). Robotic surgery is being adopted like many other new technologies in Medical and Surgical fields. However, the main Surgical Robotic system is DaVinci that has dominated the market and Royal Bournemouth Hospital uses this provider. In 2000, before the development of robotic prostatectomy, Intuitive Surgical, the manufacturer of the DaVinci system, was struggling with 18 systems worldwide, largely unused. By 2016 there were more than 3,700 systems worldwide and more than 3,000,000 operations performed (Intuitive Surgical Annual Report 2016), hence indicating the increasing rate of Robotic Surgery adoption.

There are many theories and models that have looked into innovation adoption extensively (i.e. Rogers 2003), many have considered medical and health related innovation as products (i.e. Greenhalgh et al 2004; Mendel et al 2008). In order to address the increasing growth of surgical innovation, such as robotic surgery, it is crucial to not only look into individual adoption frameworks, but also to consider organizational

models. Moreover, the unique nature of surgical innovation needs to be addressed. At this point of time, based on the authors' knowledge, there is no surgical innovation framework.

Objectives of this project are as below:

- To identify the communication pathway involved in the process of GRS adoption and the information required by different stakeholders.

- To understand the adoption/dissemination process of Gastrointestinal Robotic Surgery (GRS) in RBH

- To explore the adoption challenges and difficulties medical experts and professionals face during the adoption process

- To brainstorm solutions and recommendation to improve and facilitate the adoption/dissemination process by medical experts and professionals, for example:
  - How medical experts can learn about the process better
  - How the information can be presented in a more effective manner

- To modify the innovation adoption model along the way and propose an adapted diffusion model. Hence, developing a Surgical Innovation framework (SIF)

Literature Review

<u>Communication Pathway</u>

Understanding an end-to-end communication pathway for Gastrointestinal Robotic Surgery (GRS) results into identification of channels and stakeholders interacting with either GRS or patients undergoing GRS. This will be the baseline for the Surgical Innovation framework (SIF). Examining the communication pathway within academic literature is done taking into consideration two factors. First, communication in NHS UK, second, communication of innovation in medical field. This section examines the first factor.

Communication is key for any service provider, particularly health and medical service providers. NHS has introduced NICE (National Institute for Health and Care Excellence) guidance in order to improve health and social care (Nice.org.uk). The guidance contains information, policies, procedures and publications. Nice provides guidance, advice, quality standards and information services for health and social care. Nice pathway is an interactive guide that includes all the elements in the guideline explained in NHS service pathway.

NICE pathway (Figure 1[1]) explains the Patient Experience in Adult NHS Service. This study only looks into adult as patients. In developing a communication pathway in any NHS related centre (i.e. Royal Bournemouth Hospital), the elements highlighted within NICE pathway should be carefully considered.

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[1] https://pathways.nice.org.uk/pathways/patient-experience-in-adult-nhs-services

Figure 1. Patient Experience in Adult NHS Service
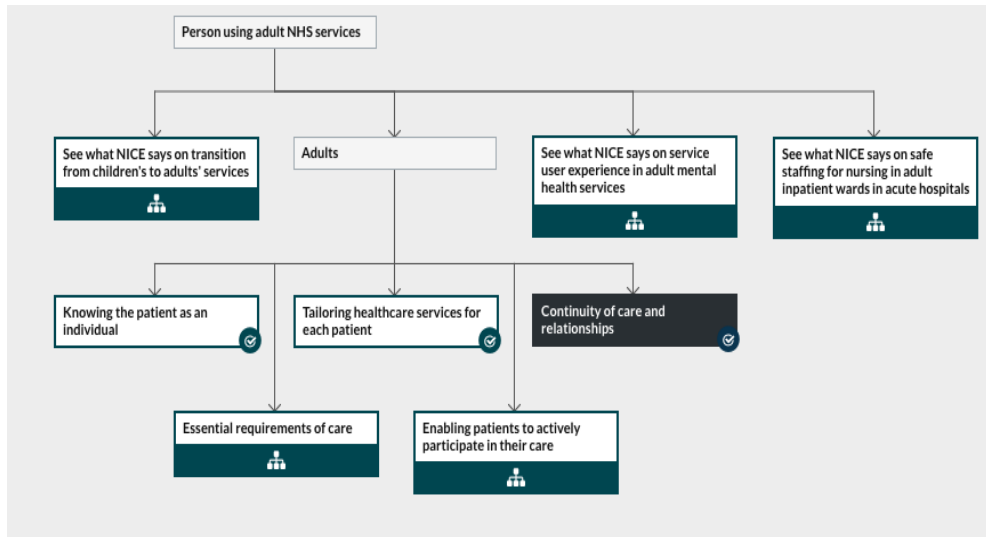
In adult experience, there are three important elements:
1. Knowing the patient as an individual;
2. Tailoring healthcare service for each patient;
3. Continuity of care and relationships.

The factor influencing the communication pathway development is the continuity of care and relationships which links to the service elements as well as communication channels. Looking into Continuity of care and relationships, it is clearly stated that it is important for patients to have Continuity and consistency of care. Establishing trusting, empathetic and reliable relationships with competent and insightful healthcare professionals is key to patients receiving effective, appropriate care (NICE). Further a timely exchange of patient's information between healthcare professionals, especially at the point of transitions in care, needs to be ensured. Having a clearly identified communication pathways certainly helps healthcare professionals to transfer information easier and more effectively. NICE recommends that all healthcare professionals involve in patient journey needs to be informative about patients' treatment and responsible clinical carer. Additionally, according to NICE, all healthcare professionals within the

pathway should "Give the patient (and their family members and/or carers if appropriate) information about what to do and who to contact in different situations" (NICE). This indicates that all stakeholders identified within patient journey (i.e. communication pathways) need to have knowledge of the treatment. In this study we apply this concept to the case of Robotic Surgery.

According to the academic literature, communication and providing information are two significant characteristics of trust relations in a modernised NHS (Rowe and Calnan 2006). Positioning SIF into the communication pathway can enhanced trust amongst patients and medical experts within NHS.

NHS and Innovation

Innovation is a significant part of NHS, which claims to be a major investor in the UK and in science, technology and engineering. It is clearly stated by NHS England[1] that innovation is a critical element to increase the scale of change. NHS England has recognised how innovation is crucial for patient outcome and experience.

> "The innovations will help to prevent diseases, speed up diagnosis, improve safety and efficiency of services and increase patient participation in decision making, self-management and research. This will lead to better health outcomes and a more sustainable NHS." (NHS England).

NICE has provided Technology appraisals. Recommendations are based on new and existing medicine and treatments within the NHS such as diagnostic techniques, surgical procedures and health promotion activities. NICE's recommendations are based on clinical and economical evidence. Furthermore, NHS provides platforms for innovators "to realise their ideas, embed them into clinical practice and exploit new opportunities in international markets". This platform encourages innovators to submit application for funding to NHS England and offer research support and provide international opportunities to innovators.

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[1] https://www.england.nhs.uk/ourwork/innovation/

It is clear that NHS has invested on innovation development hugely over the last decades; however it is still struggling to adopt new technological ideas (Castle-Clarke et al. 2017). A report by the Association of British Healthcare Industries, looked into the barriers in NHS innovation adoption. The report included MedTech innovations which include disposables, capital equipment and surgical procedure innovations. This reports concerns with Surgical innovation and why they is there still a struggle in adoption. Innovation in surgery is defined as "a new or modified surgical procedure that differs from currently accepted local practice, the outcomes of which have not been described, and which may entail risk to the patient (Biffi et al. 2008). The quest for improved patient outcomes has been a driving force for adoption of novel surgical innovations across surgical subspecialties (Abdulrahman et al. 2014). Within surgical field, innovation mostly happens due to a clinical problem at operation (Barkun et al. 2009). Sometimes though it is a more gradual and planes process, such as development of a new operation or technology which can then be introduced to the team. Barkun et al. (2009) explains the most common process for surgical innovation is "related to the intrinsically iterative nature of surgical practice itself. Indeed, surgeons will routinely experiment with an established operation in such a way that it might ultimately change unrecognisably" (Barkun et al. 2009 p1090, McKneally and Dear 2003).

One of the main issues affecting innovation adoption in the NHS is that potential problem areas are not always clearly identified by medical experts and there may be ambiguity in identifying who is responsible for innovation adoption and the extent to which individuals need to adopt innovation. It is argued that culture change needs the senior management to effectively articulate the values and beliefs for the change (Lorsch 1986). Others present steps towards better 'systems readiness' as the steps needed 'to assess and anticipate the impact of innovation' Greenhalgh et al (2004).

Castle-Clarke et al (2017) explains how innovation is seen as a luxury "to be attempted when everything else is going well rather than as a core part of improving quality and efficiency", furthermore it in unclear "who is responsible for innovation, and until that is clear and actively built into job descriptions, it is unlikely to become business as usual" (Castle-Clarke et al. 2017 p6). A further factor is the need for an adaptive

leadership style to be able to transform care pathways. Looking into these two factors, it is evident that SIF will help NHS to not only identify who needs to adopt or disseminate a surgical innovation and to what extent, but also to communicate the relevant information in a way to facilitate an efficient leadership style to manage change. Greenhalgh et al (2004) present steps towards better 'systems readiness' for innovation. They define systems readiness as the steps needed 'to assess and anticipate the impact of innovation'.

NHS as an organization needs to be evaluated. As explained leadership plays a crucial role in adoption however if managers do not believe in the innovation consequently the change that it results into and the promoting of innovation can be challenging (Gerland et al. 2010). One way to evaluate leadership's approach to innovation would be to evaluate their level of innovativeness of individuals. However, individual manager's decision is often complicated by organizational elements such as culture and value (Aarons et al. 2011). Hence, looking into organizations as low, medium or high adopters, may help understanding the reasoning behind rate of adoption (Wisdom et al. 2015; Rogers 2003). Therefore, introducing strategies to transform organizations from a low adopter to a high adopter can help NHS centres to speed up the process of innovation adoption ((Greenhalgh et al. 2004; Oldenburg and Glanz 2008; Widsom et al. 2014). Similarly, Organizational Innovativeness (OI) was introduced by Ayalla et al. (2014) as a tool to evaluate organizations level of innovativeness that has been operationalized as the number of innovations organizations adopt. This construct will be used to evaluate NHS centres in this study.

Innovation Adoption Frameworks

In order to start building SIF, main models and frameworks relevant to the context of this study are examined and the definition of adoption is studied. According to Barkun (2009) "adoption of an innovation into practice can be defined by the increase in the number of overall surgeons doing the procedure over time, which will occur until it is either accepted by surgeons or discarded. " (p1092). However, adoption is mostly defined as a decision making process (e.g. Wisdom et al. 2014; Greenhalgh et al. 2004; Mendel et al. 2008). Wisdom et al. (2014) explain "adoption is the decision to proceed with a full or

partial implementation of an evidence-based practice" (p.480). Adoption starts with a need, a problem and then there is a search for a solution. Next stage is the decision to adopt a solution and last is the final decision to implement the solution. (Damanpour and Schneider 2006; Gallivan 2001; Mendel et al. 2008). Greenhalgh et al. (2004) explained the adoption process as; pre-adoption (e.g. awareness of innovation), peri-adoption (continuous access to innovation information), established adoption (adopters commitment to the adoption decision). Frambach and Schillewaert (2002) mention a two stage process of; organizational decision to follow the adoption and staff acceptance of the innovation. In this model, adoption either results into implementation or de-adoption. Looking back at the innovation adoption literature, it is evident in a majority of the academic work, particularly the ones considering adoption as a decision process, implementation or de-adoption is the endpoint (e.g. Wisdom et al. 2014; Frambach and Schillewaert 2002; Mendel et al. 2008; Panzano and Roth 2006). Although it is recognized that focusing on implementation might result into overlooking the complex process of adoption (Wisdom et al. 2014). In addition the study takes into consideration the characteristics of surgical innovation and the proposed SIF adopts Wisdom et al's (2014) definition and examines this definition from organizational and surgical perspective.

There are many frameworks and models investigating the process of technology and innovation adoption. In order to have a broad overview of the suitable frameworks, a comprehensive literature review was conducted. The authors looked into frameworks, models and theories relevant to the field of preferably surgical/and medical innovation adoption. Furthermore, two systematic reviews of the innovation adoption literature were carefully studied. First, a study by Greenhalgh et al. (2004), which looked extensively into literature relevant to the spread and sustaining of innovation in health service organizations. They produced a systematic review from 166 papers, 6000 titles/abstracts including books. They categorized the models and theories into research traditions and academic disciplines. They looked into both content and process of adoption and as a result of this review, developed an evidence-based model of innovation diffusion based on their findings. In addition, a study by Wisdom et al (2014); a review on innovation adoption theories and constructs. They have looked into elements across adoption

frameworks that can be modifiable to improve the process of evidence-based innovation adoption. 20 theoretical frameworks were identified in this study, they were equally grouped into theories with a mere focus on the adoption process and theories which "address adoption within the context of implementation, diffusion, dissemination and/or sustainability" (Wisdom et al. 2014 p.480).

Wisdom et al. (2014) highlighted the fact that diffusion literature Is heavily focused on the implementation phase of the process with less focus on exploration/adoption (pre-implementation) or maintenance/sustainability post-implementation) phases. Wisdom et al. (2014) further argues that literature suggest a need for understanding adoption as an interactive, multi-level entity rather than standalone. In this research, it is argues that the literature is also heavily focusing on adoption as decision on either implement or di-adoption of an innovation. There is a significant gap in literature examining the adoption process, after the decision is made by the organization, such as the case for NHS. Body of knowledge is unable to explain how an adopted medical innovation will spread through the different layers of stakeholders and organizational stakeholders. Implementation is not the end of innovation adoption in organizations' such as NHS, where implementation is just the beginning of another wave of adoption for other individuals involved. Wisdom et al. (2014) have developed a middle-range theory by integrating existing adoption theories and exploring various adoption mechanisms. Their goal was to improve "transferability, generalizability and external validity of the adoption theories" (p.482).

Furthermore, within Health context, Full Contingency Model of Innovation adoption (Berta et al. 2005), TRA and TBP (Godin et al. 2008), UTAUT (BenMessaoud et al. 2011), Reach, effectiveness, adoption, implementation and maintenance (RE-AIM) (Glasgow 2003; Glasgow et al. 2003), in Health Behaviour; Precaution Adoption Process Model (PAPM) (Weinstein et al. 2008), Diffusion of Innovation Model (Rogers 2003), Evidence-Based Model for Diffusion of Innovations in Health Service Organizations (Greenhalgh et al. 2004), Framework of dissemination in healthcare intervention research (Mendel et al. 2008), Practical, robust implementation and sustainability model (PRISM) (Feldstein and Glasgow 2008) are the most talked about models and frameworks. Berta et al (2005) contingency model of innovation adoption was implemented in the area of Clinical Practice Guidelines (CPG) for Long Term Care (LTC). The framework proposed

is suitable in policy making and organizational behaviour/decision making. TRA and TBP are suitable when we are solely interested in the behavioural elements. RE-AIM is suitable when evaluating health interventions. Weinstein Precaution Adoption Process Model (PAPM) is looking into health-related behaviour.

Evidence-Based Model for Diffusion of Innovations in Health Service Organizations (Greenhalgh et al. 2004), Framework of dissemination in healthcare intervention research (Mendel et al. 2008), Practical, robust implementation and sustainability model (PRISM) (Feldstein and Glasgow 2008) have been examined, although Wisdom et al. (2014) uncovered these models on their study. Based on the previous models and frameworks, taking into account the characteristics of surgical innovation, communication and organizational elements, first draft SIF is introduced as below:

Figure 2. Surgical Innovation Framework
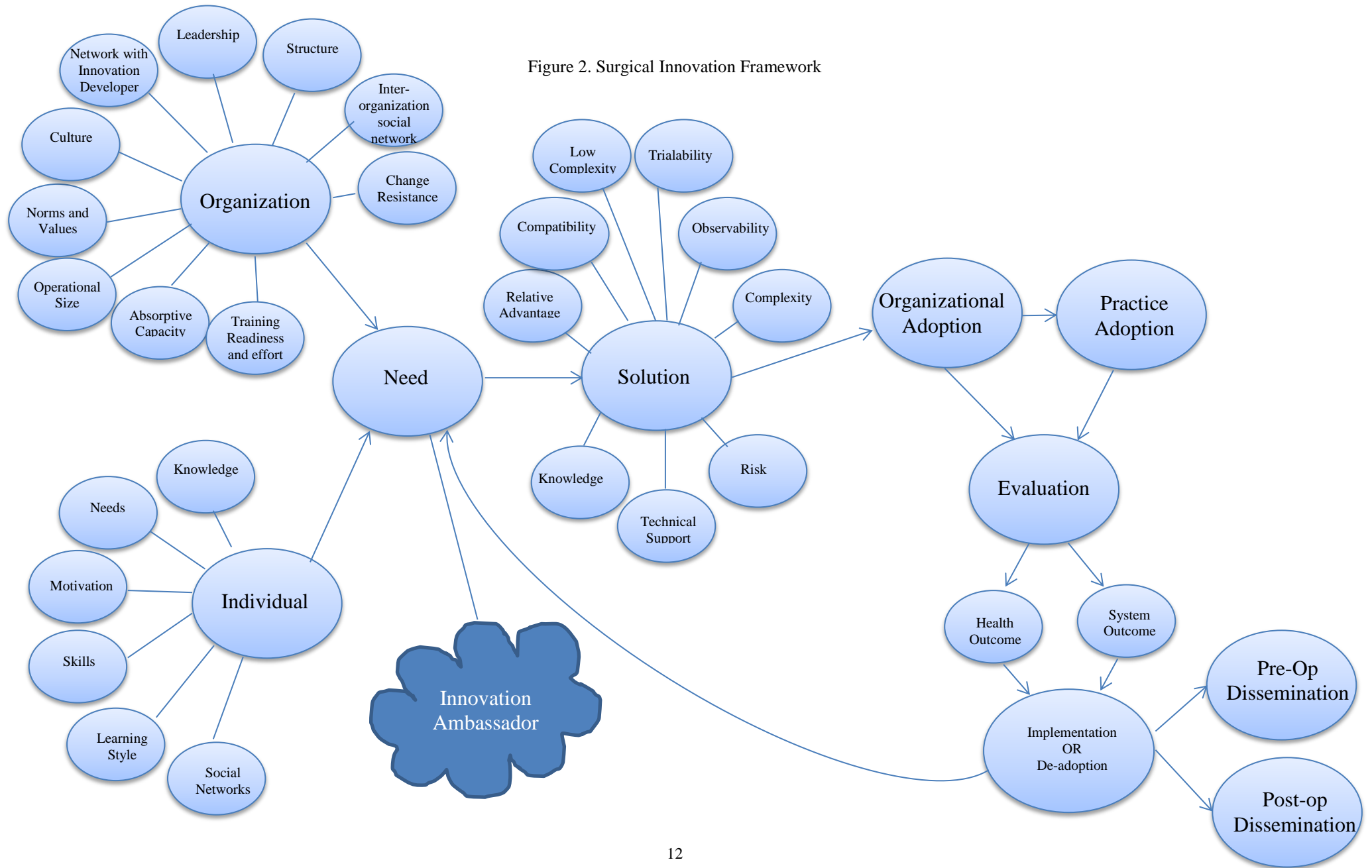
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