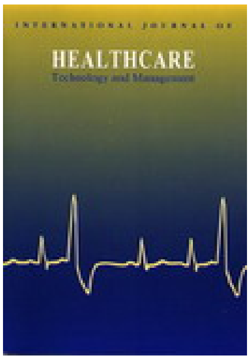

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Improving healthcare operations with IT deployment: a critical assessment of literature and a framework for future research

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Improving healthcare operations with IT deployment: a critical assessment of literature and a framework for future research

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Abstract: In this paper, we critically assess the contribution of the operations management literature in creating pragmatic knowledge regarding how IT deployment can improve healthcare performance. A systematic literature review is conducted, and the following issues limiting knowledge generation have been identified: 1) IT deployment and healthcare performance are often conceptualised as black boxes; 2) existing theories are used inadequately, and emerging theories are lacking, which restricts the identification of the underlying mechanisms in the IT–performance relation; and 3) contextual factors are often overlooked. We develop a framework, arguing that to overcome these limitations, future studies require the following: 1) conceptualise IT in terms of its functionalities; 2) explain the reason(s) for selecting the performance attribute(s); 3) identify the mechanisms of the relationship of IT-performance by investigating and theorising the consequences of IT deployment on service operations; and 4) consider the contextual factors while explaining the IT–performance relation.

Keywords: IT; healthcare; performance; mechanism; operations management; systematic literature review; theory building; research framework; PRISMA method.

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1 Introduction

In healthcare, information technology (IT) investment is escalating across the world in an unprecedented way, here with the expectation that it can resolve the current challenges caused by diminishing resources per capita, the growing elderly population, chronic diseases and multi-morbidities (Agarwal et al., 2010; Ding et al., 2019). However, the question of how to predict and control the influence of IT deployment in improving healthcare performance remains largely unanswered, even during a period when the number of IT-related studies on healthcare is increasing at a rapid pace (Angst et al., 2011; Dobrzykowski et al., 2014; Silander et al., 2019). The literature on the relation between IT deployment and healthcare performance ranges from optimistic and enthusiastic to pessimistic and cautionary (Gardner et al., 2015). Explanations of how and why IT deployment results in improved (or not improved) performance are scant (Gastaldi et al., 2018). The research community has failed to generate systematic knowledge that could guide IT deployment in healthcare. In practice, IT investments remain driven by beliefs about – rather than evidence of – the potential of IT deployment (Rigby and Ammenwerth, 2016), which often leads to the nonadaptation and abandonment of large-scale IT investments (Greenhalgh et al., 2017). The European Union (EU) cautions that the lack of evidence of the efficacy and cost-effectiveness of IT deployment in healthcare impedes large-scale implementations (EU, 2012). Additionally, the World Health Organization (WHO) emphasises that a limited understanding of how to manage IT deployed in healthcare results in many short-lived and discrete IT interventions that overwhelm the healthcare system (WHO, 2019). Both organisations call for normative guidelines and best practices that could help professionals deploy and manage IT in ways that benefit healthcare.

The aims of the current paper are to assess how literature on the deployment and management of technology in healthcare has explored the influence of IT on healthcare performance and to propose how the generation of pragmatic knowledge on improving healthcare performance with the support of IT can be enhanced. In the current paper, IT deployment implies "the application of information processing technology involving both computer hardware and software that deals with the storage, retrieval, sharing and use of healthcare information, data and knowledge for communication and decision making" (Thompson and Brailer, 2004, p.38). Because technology management in healthcare is a vast and multidisciplinary field, we focus on the literature within operations management (OM). As an applied discipline, OM is responsible for generating knowledge that not only advances the research field, but that also informs and supports practice (Fynes et al., 2015). Hence, we focus on pragmatic knowledge that links actions to outcomes to solve problematic conditions in the real world (Denyer et al., 2008).

A systematic literature review was conducted to create a rich and thorough account of the relevant studies (Table 1). Next, we evaluated these studies using the context–intervention–mechanism–outcome (CIMO) logic of design science research (DSR) because this logic aims to generate knowledge relevant for both theory and practice (Denyer et al., 2008). There are several issues, as will be elaborated upon later, that limit the generation of pragmatic knowledge. To remedy these issues, we propose a framework for future research, arguing that analysis of the service operations affected by IT deployment is key in generating pragmatic knowledge, which, in turn, can enhance the relevance and applicability of future studies conducted within the healthcare technology management field.

Table 1 The selected papers, year of publication and corresponding journal (the number in parentheses indicates the number of papers appearing in the journal)

Name of journal	*Papers and year of publication*	*Methodology*	
		Type of study	*Method*
International Journal of Production Economics (8)	Lillrank et al. (2002)	Empirical case study	Single case study
	Botta-Genoulaz and Millet (2006) and Tzeng et al. (2008)		Multiple case study
	Chowdhury et al. (2014)	Empirical statistical research	Data envelop analysis
	Chong et al. (2015)		ANN predictive analytic approach
	Yang et al. (2019)		Regression
	Liu et al. (2020)		
	Kochan et al. (2018)	Analytical mathematical research	Mathematical development of causal loop diagram

Table 1 The selected papers, year of publication and corresponding journal (the number in parentheses indicates the number of papers appearing in the journal) (continued)

Name of journal	Papers and year of publication	Methodology	
		Type of study	*Method*
Journal of Operations Management (8)	Li and Benton (2006), Queenan et al. (2011), Devaraj et al. (2013), Chen et al. (2013), Dobrzykowski and Tarafdar (2015), Gardner et al. (2015) and Sharma et al. (2016)	Empirical statistical research	Regression
	Bavafa and Terwiesch (2019)		Mathematical model development
Decision Science (7)	Umanath and Kim (1992), Chau et al. (2001), Edmondson et al. (2003), Yi et al. (2006), Ilie et al. (2009), Smit et al. (2013), Dobrzykowski et al. (2015); Dobrzykwoski and Tarafdar (2017)	Empirical statistical research	Regression
BMC Medical Informatics and Decision Making (5)	Sambasivan et al. (2012), Restuccia et al. (2012), Kim et al. (2016), Idoga et al. (2019); Zhou et al. (2019)	Empirical statistical research	Regression
Health Informatics Journal (5)	Escober-Perez et al. (2016); Fox et al. (2020)	Empirical case study	Single case study
	Hornyak et al. (2016)		Multiple case study
	Li et al. (2020)	Empirical statistical research	Stochastic frontier analysis
	Sittig et al. (2020)	Analytical conceptual research	Concept development
Management Science (5)	Devaraj and Kohli (2003), Bhargava and Mishra (2014), Atasoy et al. (2018); Hydari et al. (2019)	Empirical statistical research	Panel data analysis
	Greenwood et al. (2017)		Linear probability model

Table 1 The selected papers, year of publication and corresponding journal (the number in parentheses indicates the number of papers appearing in the journal) (continued)

Name of journal	*Papers and year of publication*	*Methodology*	
		Type of study	*Method*
International Journal of Operations and Production Management (5)	Procter and Brown (1997), Waring et al. (2002), Bakker et al. (2008); Drupsteen et al. (2016)	Empirical case study	Single case study
	Rubbio et al. (2019)		Multiple case study
Journal of Medical Systems (4)	Wu and Kuo (2012) and van Poelgeest et al. (2015)	Empirical statistical research	Regression
	Randeree (2007)	Empirical case study	Multiple case study
	Or et al. (2018)		Single case study
Production and Operations Management (4)	Amini et al. (2007)	Empirical statistical research	Simulation model
	Angst et al. (2011)		Dynamic program ClusterlG computer program
	Bradley et al. (2018)		General method of moment
	Laker et al. (2018)	Empirical experimental research	Controlled laboratory experiment
International Journal of Medical Informatics (3)	Green et al. (2006)	Empirical case study	Single case study
	Landis-Lewis et al. (2015)		Multiple case study
	Plantier et al. (2017)	Empirical statistical research	Regression
Journal of Healthcare Management (3)	Wurster et al. (2009) and Song et al. (2011)	Empirical case study	Single case study
	Menachemi et al. (2007)	Empirical statistical research	Regression
Business Process Management Journal (2)	Laurenza et al. (2018)	Empirical case study	Single case study
	Gastaldi et al. (2018)		Multiple case study
Decision Support Systems (2)	Menon and Lee (2000)	Empirical statistical research	Descriptive statistics analysis
	Thrasher et al. (2010)		Regression

Table 1 The selected papers, year of publication and corresponding journal (the number in parentheses indicates the number of papers appearing in the journal) (continued)

Name of journal	*Papers and year of publication*	*Methodology*	
		Type of study	*Method*
Health Information Management Journal (2)	Escobar-Rodriguez et al. (2012)	Empirical case study	Single case study
	Sharifian et al. (2014)	Empirical statistical research	Regression
International Journal of Pharmaceutical and Healthcare Marketing (2)	Bonacci and Tamburis (2011)	Empirical statistical research	Descriptive statistics analysis and interview
	Alam et al. (2019)		Regression
Supply Chain Management: International Journal (2)	Bhakoo and Chan (2011) and Xie et al. (2016)	Empirical case study	Single case study
American Journal of Managed Care	Fung et al. (2004)	Empirical statistical research	Regression
Health and Technology	Enaizan et al. (2020)		
Health Communication	Wei et al. (2020)		
Health Policy and Technology	Sezgin et al. (2017)		
IEEE Transactions on Professional Communication	Alaiad and Zhou (2017)		
Industrial Management and Data Systems	Xing et al. (2020)		
Informatics for Health and Social Care	Tavares et al. (2018)		
International Journal of Electronic Healthcare	Alsyouf et al. (2018)		
International Journal of Health Care Quality Assurance	Ford et al. (2016)		
International Journal of Information Management	Wu et al. (2016)		
International Journal of Integrated Care	Diaz-Chao et al. (2014)		
International Journal of Production Research	Mandal and Jha (2018)		
International Journal of Services Technology and Management	Tang et al. (2019)		

Table 1 The selected papers, year of publication and corresponding journal (the number in parentheses indicates the number of papers appearing in the journal) (continued)

Name of journal	*Papers and year of publication*	*Methodology*	
		Type of study	*Method*
Journal of American Medical Informatics	Ancker et al. (2015)		
Journal of Business and Industrial Marketing	Mandal (2018)		
Journal of Healthcare Engineering	van de Wetering (2018)		
Medical Care Research and Review	Kazley and Ozcan (2008)		
Organisation Science	Gardner et al. (2017)		
Plos One	Benedictis et al. (2020)		
Total Quality Management	Wu and Hsieh (2011)		
Healthcare Management Science	Williams et al. (2016)		Data envelop analysis
Telemedicine and E-Health	Galimany-Masclans et al. (2011)		Descriptive statistics analysis and t-test
International Journal of Logistics Management	Feibert and Jacobsen (2019)	Empirical case study	Multiple case study
Journal of Decision Systems	Alohali et al. (2020)		Single case study
Journal of Health Organization and Management	Wu et al. (2016)		
Journal for Healthcare Quality	Russell et al. (2010)		
Production Planning and Control	Wamba and Ngai (2015)		Single case study (Delphi technique)
BMJ Quality and Safety	Singh et al. (2016)	Analytical conceptual research	Concept development
Journal of Service Management	Mithas et al. (2020)		
JMIR Medical Informatics	Williams et al. (2019)		

The rest of the present paper is organised as follows: First, we develop the research framework and questions, which will guide the rest of the study. Second, the methodology of the systematic review is described, along with the evaluation and synthesis of the papers. Next, the findings are presented, which is followed by a framework for future research. The final section explains the implications and limitations of the study.

2 Research approach and research questions

The current context of healthcare IT management indicates that we need a systematic development of pragmatic knowledge to manage and regulate IT deployment in healthcare. Therefore, the current paper has two aims:

1 to assess the literature and identify how studies are contributing to the development of knowledge

2 to propose how the contributions of future studies can be improved.

A framework that could assess all of the relevant aspects of the current studies was developed by applying CIMO logic from DSR (Denyer et al., 2008). DSR aims to develop generic design propositions that enhance the pragmatic validity of a study and develop a general understanding of the underlying mechanism that produces a certain outcome. The purpose of the DSR approach is in line with our purpose of reviewing the literature: to identify how the OM literature has contributed to generating pragmatic knowledge while studying the outcome of IT deployment in healthcare. Thus, the CIMO logic has provided us with a scientifically reasoned schema for assessing the literature and has been applied to assess the status of the OM literature, specifically IT deployment in healthcare.

The CIMO logic seeks the generative mechanism (M) through which an intervention (I) results in an outcome (O) in a given context (C). According to DSR, the context refers to external and internal environmental factors, including human actors; intervention refers to the set of actions that managers/organisations have at their disposal to influence behaviour; mechanism refers to the basic explanation of why certain outcomes emerge in a given context; and outcome refers to the consequences of the intervention in its various aspects. Because the CIMO logic enables research studies to generate pragmatic knowledge, which aligns with the aim of the present paper, we use the dimensions of CIMO to frame our research questions. Following the first aim of the current study, we pose the first research question (RQ): How has IT deployment been studied in relation to the performance of the healthcare system? Next, we divide this overarching RQ into four specific RQs, reflecting the four dimensions of CIMO, that is, context, intervention, mechanism and outcome. Thus, we assess how the context of IT deployment has been taken into consideration, how IT interventions are conceptualised, what the performance attributes, here measured as the outcome of the IT deployment, are, and how the mechanisms of improving performance through IT deployment have been identified in the literature. Thus, the first RQ focuses on assessing the current literature, whereas the second RQ focuses on how future studies can better contribute pragmatic knowledge on healthcare IT deployment. Below is a list of the RQs. and Figure 1 represents the research framework reflecting the RQs and their connection with the literature review.

1 How has IT deployment been studied in relation to the performance of the healthcare system?

1.1 How is the context taken into consideration in these studies?

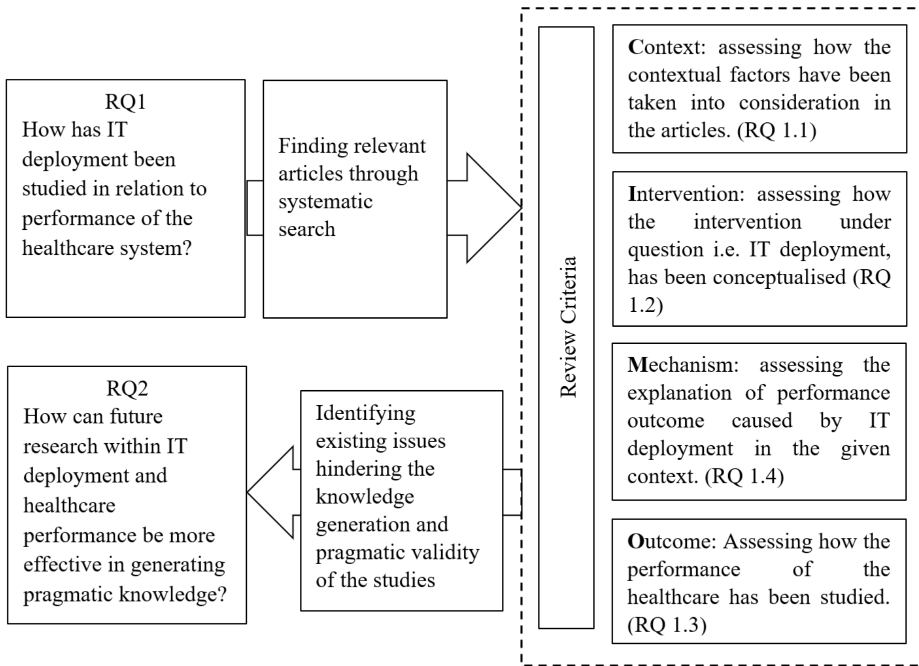
1.2 How do these studies conceptualise IT deployment in healthcare?

1.3 What are the performance attributes and other variables influenced by IT deployment?

1.4 What are the theories or mechanisms that have emerged or were tested in the studies?

2 How can future research on IT deployment and healthcare performance be more effective in generating pragmatic knowledge?

Figure 1 Research approach



3 Methodology

We followed the stages of a systematic literature review as proposed by Tranfield et al. (2003) to conduct a replicable, scientific and transparent study. The first two stages – *planning* and *conducting the review* – are discussed in this section, whereas the final stage – *reporting and dissemination* – is discussed in the findings section.

3.1 Planning the review

The research questions of the review and the framework against which the papers will be assessed have been presented in the previous section. The next step we took was to outline the scoping of our study, where the relevance of the literature was assessed and the subject areas delimited (Tranfield et al., 2003). The multidisciplinary field of healthcare technology management has been studied by looking at various scientific disciplines outside of the field of OM, such as information system (IS), organisations study (OS) and medical science (MS). Therefore, careful framing of OM and the identification of the characteristics that make a paper belong to OM is important. The coauthors analysed definitions of OM found in books (Jacobs et al., 2009; Meredith and Shafer, 2013; Reid and Sanders, 2013; Slack et al., 2004; Stevenson, 2014; Wild, 2002), along with looking at the aim and scope of OM in the editorials of various OM journals (e.g., *Decision Sciences Journal*, *International Journal of Operations and Production Management*, *International Journal of Production Economics*, *Journal of Operations Management*, *Journal of Supply Chain Management*, *Production and Operations Management*, *Production Planning* and *Control, Supply Chain Management: An International Journal)* and several papers that map OM's research focus and contributions.

It became apparent that the boundaries of OM are indeed difficult to define (Voss, 1995). OM has an unusually high degree of interaction with other subject areas, and theoretical models and analytical tools have often been attributed to competing fields of study (Pilkington and Fitzgerald, 2006; Slack et al., 2004). However, the three sources mentioned above gave a fairly consistent picture of OM's main purposes:

- improve the performance level of ongoing operations, services and processes
- make the integration and coordination among the actors (e.g., producers of goods and services, suppliers, consumers and other stakeholders) within the value chain more efficient
- plan and control the value creation processes more effectively.

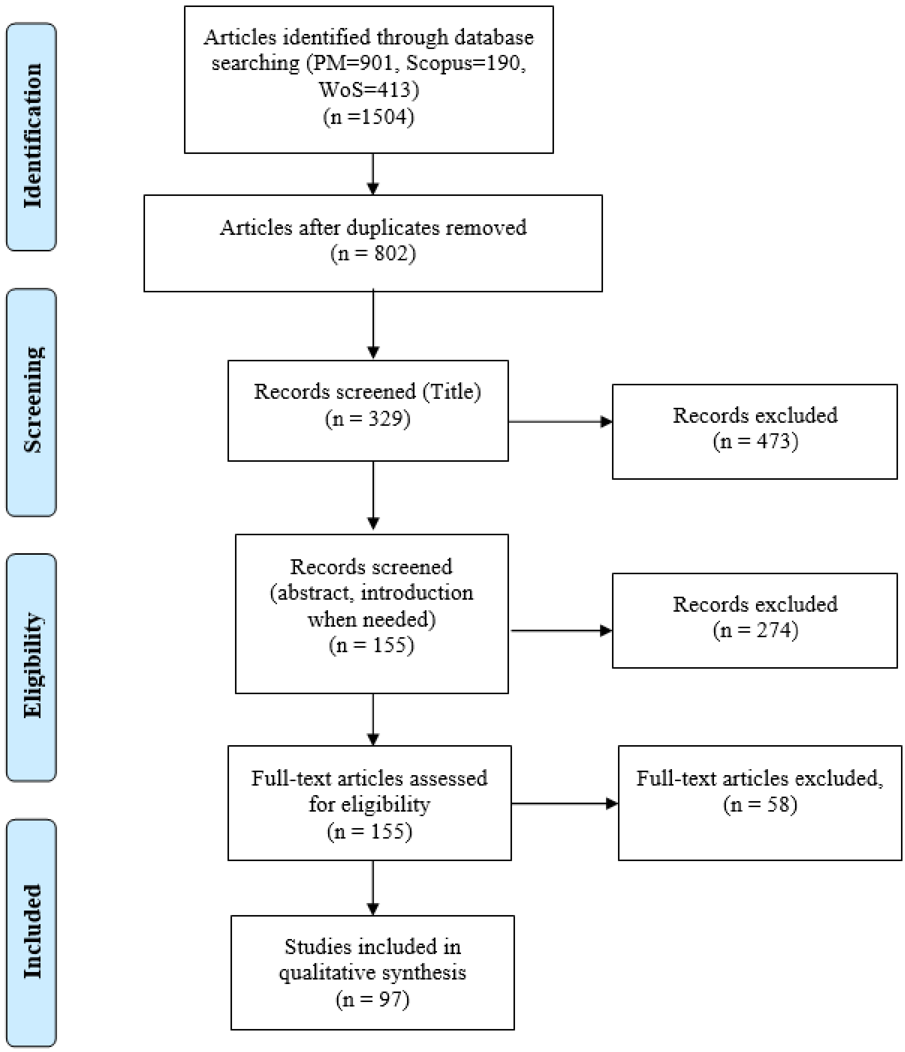
This framing of OM guided the review process, both in creating the search strings and in selecting relevant papers.

3.2 Conducting the review

To select the relevant studies, we followed the steps of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Liberati et al., 2009). This is consistent with the systematic review approach by Tranfield et al. (2003), which provides a step-by-step guideline for selecting papers. The paper selection process is shown in Figure 2.

The databases used for the literature search were PubMed (PM), Web of Science (WoS), and Scopus. The keywords used for the search were as follows: digital*or technolog* or electronic* or information or eHealth or ICT, and supply chain OR operations OR process OR management OR integrat* OR coordinat* OR performance OR service OR system OR planning OR control OR logistics, and health* OR hospital. This string was adjusted according to the advanced search options of the respective databases. Papers published until September 2020 were included, and the oldest paper found in the search was 1992. In total, 1504 papers were gathered from all the databases mentioned above and exported to Endnote for further processing. After removing duplicates, 802 papers remained.

Figure 2 The paper selection process following the PRISMA framework (see online version for colours)



The exclusion criteria were predefined by the authors and revised several times because papers from different fields showed up in the search results. We grouped the exclusion criteria into the following categories: papers primarily focusing on the

1 design or development of technology

2 procurement of technology

3 guidelines and research protocol for clinical trials

4 survey questionnaire design

5 healthcare insurance

6 application of data extracted from different technologies (e.g., electronic health record (EHR)) to answer treatment/drug/diagnosis related questions

7 financial, accounting and legal perspectives.

In addition, only journal publications were included to ensure the quality of the papers (David and Han, 2004). The papers were screened in two stages: title screening, which left us with 329 papers, and abstract screening, which resulted in 155 papers for full-text reading.

3.3 Data extraction and an overview of the selected papers

A data extraction form (Tranfield et al., 2003) was created in an Excel spreadsheet, consisting of the following categories: name of the journal, purposes and research questions; context (which country, what types of healthcare organisation, etc.); methodology; performance attributes; types of IT being studied; and, contributions and implications of the study. The aim was to collect rich data about each paper. During the reading of the full papers, several papers that seemed to be falling outside the scope of this review were identified. In these occasions, at least two of the coauthors had independently assessed the contributions of these papers and compared them with our framing of OM. Next, they presented their individual assessment on whether to include or exclude the papers; final decisions were jointly made to reduce the implicit biases of individual authors (Tranfield et al., 2003). At the end of these processes, 97 papers were selected for further analysis. The data extraction, including categorised summaries of 97 papers, was used as the primary database, but we also revisited the papers frequently to read the content when necessary. We conducted two types of analysis for the final 97 papers:

1 descriptive analysis, as presented in this section, which involves the assessment of formal dimensions of the papers, such as publication trends and methodological preferences in journals (Dobrzykowski et al., 2014)

2 content analysis, in which the papers were analysed based on the research approach (Figure 1).

Chi square testing demonstrates steady growth in the number of publications in this field from 1992 to September 2020 (Figure 3). This finding corroborates Dobrzykowski et al.'s (2014) findings in their literature review of healthcare OM, stating that studies relating to IT deployment in healthcare are burgeoning within the OM field. The Chi square test also confirms that the number of publications in this field has been increasing significantly over time ($T = 9.46$, $P < 0.05$).

Next, we evaluated the journals in relation to their methodologies and to the journals in which they were published. We borrowed the classification of methodologies used by Wacker (1998), which distinguishes among analytical conceptual research, analytical mathematical research, analytical statistical research, empirical experimental research, empirical statistical research and empirical case study. Moreover, we analysed the particular methods used by the papers to understand whether a predominant method exists. Table 1 presents an overview of the papers and journals in which they were published, their year of publication and the methodology used.

Figure 3 Growth in the number of published papers on IT deployment in healthcare OM

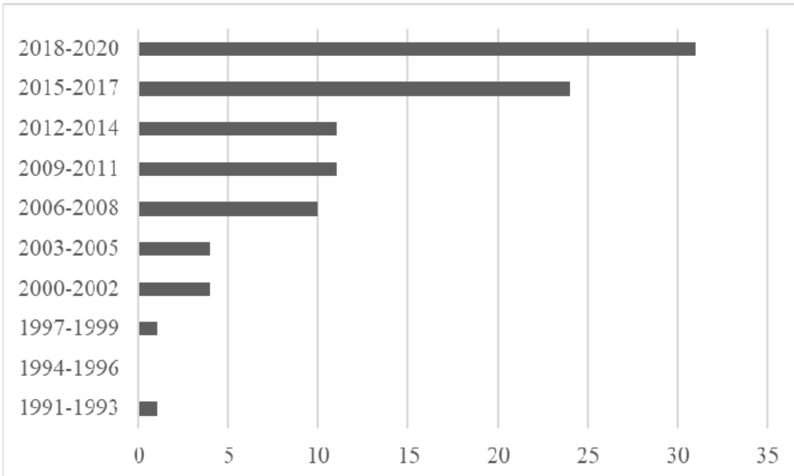


Table 2 shows that most of these studies are empirical statistical research (66%), among which regression analysis (44%) is by far the most prevalent research method applied. The second most used method is multiple and single case studies (28%). However, we could not find any time-dependent trends for any of the methodologies; for example, empirical statistical research has constantly been the most popular research methodology, and empirical case studies are also scattered evenly throughout the time period.

Table 2 Percentage of reviewed papers by study-type category

*Type of study**	*Number of papers*	*Percentage*
Empirical statistical research	64	66
Empirical case study	27	28
Empirical experimental research	1	1
Analytical conceptual research	4	4
Analytical mathematical research	1	1
Total	97	100

*No paper was found in the category of analytical statistical research.

4 Findings

This section outlines the findings of the literature review in terms of the context, conceptualisation of IT deployment, performance and mechanisms (Figure 1). The section ends by explaining the issues limiting the generation of pragmatic knowledge within the domain.

4.1 Context: the factors impacting the IT-performance relationship

In several papers, we identify a growing tendency to consider the context while assessing the impact of IT, particularly in the papers in the empirical case study research category. The authors of these studies have suggested that the influence on performance cannot be attributed to IT deployment alone because there are many other factors simultaneously present in the system. The adoption and implementation of IT are affected by factors such as supply chain structure, internal readiness (Bakker et al., 2008) and cultural differences in perception between the different units of an organisation (Procter and Brown, 1997). Contrary to the prevailing notion that the application of IT in an organisation is a technical process, some authors have proposed that it is also a social and political process where a change in work practices, internal staff adequacy, training, top management support and historical underpinning should be considered (Botta-Genoulaz and Millet, 2006; Russell et al., 2010; Waring and Wainwright, 2002; Wurster et al., 2009; Sousa et al., 2021). Emphasising the role of the overall context in healthcare performance, Green et al. (2006) argue that IT is one of the critical success factors, including organisational partnership, funding mechanism, practice models and knowledge translation practices. Studies from the analytical mathematical (1) and conceptual (2) categories also incorporated contextual factors into their models (Kochan et al., 2018; Singh and Sittig, 2016; Williams et al., 2019).

Regarding papers from the empirical statistical and experimental research categories, which constitute 69% of the papers reviewed here, only 21 out of 65 studies use either independent variables or control variables that represent contextual factors. The independent variables include hospital location and size, investment in technology, nursing staff training, nurse competence, job enlargement and sharing (Li and Benton, 2006), trust, knowledge exchange (Chen et al., 2013) and length of stay (Devaraj et al., 2013); and the control variables include teaching status, bed size (Dobrzykowski and Tarafdar, 2017; Wu et al., 2016), hospital size, case mix index, teaching orientation (Sharma et al., 2016), maturity of technology, number of staffed beds, location of hospital, year hospital opened (Angst et al., 2011), trust and collaboration (Bhakoo and Chan, 2011) and organisational commitment (Russell et al., 2010). These statistical studies, however, rarely explain why certain contextual factors are chosen as control variables instead of independent, mediating or moderating variables and whether prior analyses have been performed to prove that these factors do not have causal relationships with the other variables in the model – such treatment of the control variables weakens the reliability of a study (Williams et al., 2009).

Identifying the contextual factors and addressing them systematically to understand how they influence the relationship between IT deployment and the performance of any organisation is important (Ho et al., 2002; Zhang et al., 2011). However, the studies do not fully adopt this practice. In summary, empirical case studies are generally inclined to use context as a key measure in their studies, while the methodologies of empirical statistical and experimental studies require a constrained treatment of contextual factors in the analyses (Meredith, 1998). In the studies that analyse context, we could not find any consensus on the factors that are the most likely to impact the relation between IT deployment and healthcare performance.

4.2 Intervention: conceptualisation of IT deployment

Studies within the domain of IT deployment and healthcare performance have used many different terminologies, such as IT (Devaraj et al., 2013; Drupsteen et al., 2016; Li and Benton, 2006; Menon and Lee, 2000; Thrasher et al., 2010; Wu and Kuo, 2012), health information technology (HIT) (Dobrzykowski and Tarafdar, 2017; Singh and Sittig, 2016; Williams et al., 2019), digital technology (Gastaldi et al., 2018; Laurenza et al., 2018) and hospital technology (Li and Benton, 2006). Although Koumaditis and Hussain (2018) mention the unclear themes and blurred lines between perception, realisation and outcome that exist in the EHR literature, our study shows that the vast body of literature on healthcare technology follows a similar pattern. The variety of terms and lack of a prominent definition of the concept obstruct a comprehensive view of the studies within this domain; for example, we had to consciously accumulate various keywords while searching for papers to minimise the likelihood of missing a relevant paper. The different types of IT studied in the papers are listed in Table 3.

Furthermore, 37 out of 97 (38%) papers do not mention any particular technology. Instead, they use IT as an abstract concept but hardly outline the constructs or definition. Although these studies describe the effect of IT deployment in general, studies focusing on particular IT deployments provide insights into how these types of IT could guide practitioners in adopting IT. A few studies delve into the functionalities of the IT being studied; for example, Li et al. (2020) list clinical documentation, testing and imaging results, computerised provider order entry and decision support (i.e., clinical guidelines and reminders, drug–allergy alerts and drug–drug interaction as the functions of EHR that they have studied). The studies by Kazley and Ozcan (2008) and Plantier et al. (2017) list different groups of functionalities of EHR, eventually showing that different functionalities have different impacts on the performance attributes. Such analyses provide more specific information about the IT under study and its influence on performance than studies that do not analyse these functionalities. In addition, we can infer from these three studies that even a particular IT has many functions, and different hospitals choose different types.

In brief, the conceptualisation of IT deployment exhibits two common patterns: first, most of the studies focusing on particular IT do not point out the functions these IT perform; second, some studies use IT as an abstract concept but do not define or explain what constitutes IT. Overall, the conceptualisation of IT lacks clarity, which adversely affects the external validity of the studies (Yin, 2018).

4.3 Outcome: attributes of healthcare performance

The common performance attributes found in the papers (the attributes used in more than one study) are listed in Table 4. We could not group the performance attributes according to particular IT such as EHR, CPOE, EDI or RFID. This indicates that our knowledge on the relationships between these IT and performance is still in an explorative stage. Although a wide range of attributes have been used in different studies, only a few justify and explain the reason for choosing certain performance attributes (e.g., Li and Benton, 2006; Laker et al., 2018). Furthermore, different studies use different scales to measure the same attribute, which challenges both the construct and external validity (Yin, 2018).

For example, different papers use different expenditures to measure cost, which confounds the concept of cost as a construct and reduces the generalisability of the outcome. Finally, attributes from different levels of aggregation, for example, length of stay and mortality, have been used in the same model, where the effect on the former is more quickly realised while the second may take years. Combining different levels of aggregation reduces a model's ability to explain the effect (Beer, 1972).

Table 3 List of papers that mention particular technologies (the number in parentheses indicates the number of papers studying the type of IT)

Type of IT	*Papers*
Electronic health record (EHR), electronic medical record, electronic patient record (24)	Randeree (2007), Kazley and Ozcan (2008), Ilie et al. (2009), Bonacci and Tamburis (2011), Galimany-Masclans et al. (2011), Song et al. (2011), Smith et al. (2013), Bhargava and Mishra (2014), Ancker et al. (2015), Dobrzykowski and Tarafdar (2015), Landis-Lewis et al. (2015), van Poelgeest et al. (2015), Ford et al. (2016), Kim et al. (2016) Williams et al. (2016), Laker et al. (2018), Plantier et al. (2017), Alsyouf et al. (2018), Atasoy et al. (2018), Or et al. (2018), Tavares et al. (2018), Hydari et al. (2019), De Benedictis et al. (2020) and Enaizan et al. (2020)
Radio frequency identifier (RFID) (8)	Amini et al. (2007), Tzeng et al. (2008), Bhakoo and Chan (2011), Chong et al. (2015), Wamba and Ngai, (2015), Hornyak et al. (2016), Bradley et al. (2018) and Tang et al. (2019)
Information sharing system (5)	Procter and Brown (1997), Waring et al. (2002), Sharifan et al. (2014), Kochan et al. (2018) and Zhou et al. (2019)
Online consultation (5)	Diaz-Chao et al. (2014), Bavafa and Terwiesch (2019), Yang et al. (2019), Liu et al. (2020) and Xing et al. (2020)
Decision support system (DSS) (3)	Devaraj and Kohli (2003), Sambasivan et al. (2012) and van de Wetering (2018)
Group of health information technology (3)	Russell et al. (2010), Sharma et al. (2016) and Rubbio et al. (2019)
Medical technology (3)	Edmondson et al. (2003), Angst et al. (2011) and Greenwood et al. (2017)
Computerised physician order entry (CPOE) (2)	Queenan et al. (2011) and Escobar-Rodriguez et al. (2012)
Enterprise resource planning (ERP) (2)	Botta-Genoulaz and Millet (2006) and Escobar-Perez et al. (2016)
Fitness mobile app	Wei et al. (2020)
Web-based chronic disease management toolkit	Green et al. (2006)
Personal digital assistant (PDA)	Yi et al. (2006)
Computerised clinical reminders	Fung et al. (2004)
IT-based referral system	Lillrank et al. (2002)

Table 4 Performance attributes used in the empirical papers

Performance category		*Papers*
Patient related	Satisfaction, quality of care, mortality, continuity of care, patient safety, reliability (22)	Xing et al. (2020), Tang et al. (2019), Gardner et al. (2017), Plantier et al. (2017), Ford et al. (2016), Sharma et al. (2016), Williams et al. (2016), Wu et al. (2016), Ancker et al. (2015), Dobrzykowski and Tarafdar (2015), Gardner et al. (2015), van Poelgeest et al. (2015), Diaz-Chao et al. (2014), Devaraj et al. (2013), Wu and Kuo (2012), Galimany-Masclans et al. (2011) ; Queenan et al. (2011), Thrasher et al. (2010), Wu and Hsieh (2011), Kazley and Ozcan (2008), Menachemi et al. (2007), Li and Benton (2006) and Devaraj and Kohli (2003)
Practitioner related	Constructs of different technology adoption models, e.g., TAM, UTAUT (17)	Enaizan et al. (2020), Wei et al. (2020), Alam et al. (2019), Idoga et al. (2019), Tang et al. (2019), Zhou et al. (2019), Alsyouf et al. (2018), Tavares et al. (2018), Yang et al. (2018), Alaiad and Zhou (2017), Sezgin et al. (2017), Kim et al. (2016), Chong et al. (2015), Sharifian et al. (2014), Sambasivan et al. (2012), Ilie et al. (2009) and Chau et al. (2001)
	Decision making (4)	van de Wetering (2018), Greenwood et al. (2017), Laker et al. (2018) and Umanath and Kim (1992)
	Physicians' engagement	Liu et al. (2020)
	Working hour	Bavafa and Terwiesch (2019)
Organisation related	Cost and revenue (12)	Li et al. (2020), Bradley et al. (2018), Gastaldi et al. (2018), Hornyak et al. (2016), Sharma et al. (2016), Chen et al. (2013), Devaraj et al. (2013), Smith et al. (2013), Wu and Kuo (2012), Thrasher et al. (2010), Li and Benton (2006) and Devaraj and Kohli (2003)
	Readmission (4)	Bradley et al. (2018), Williams et al. (2016), Angst et al. (2011) and Thrasher et al. (2010)
	Learning and innovativeness for IT use (4)	Xie et al. (2016), Wu and Hsieh (2011), Yi et al. (2006) and Edmondson et al. (2003)
	Average length of stay (3)	Angst et al. (2011), Thrasher et al. (2010) and Menon and Lee (2000)
	Inventory related (2)	Kochan et al. (2018) and Chen et al. (2013)
	Medication error (2)	Escobar-Perez et al. (2016) and Escobar-Rodriguez et al. (2012)
	Availability of service/function (2)	Wu and Kuo (2012) and Fung et al. (2004)

4.4 Mechanism: generation of explanation and knowledge

This section focuses on how existing theories have been applied to explain the relationship between IT deployment and healthcare performance and on how theories have emerged or been extended from these observed relations. Both the emergence of new theory and application of existing theory can explain the relationship and contribute to the generation of knowledge (Oliva, 2019; Walker et al., 2015). We have mapped the theories, models or literature domains used in the studies (Table 5). The models related to technology adoption, such as the technology acceptance model (TAM) and unified theory of acceptance and use of technology (UTAT), are by far the most used. A few of the papers extend these models by adding new aspects, such as personality traits (Chong et al., 2015), top management support and continuance intention (Alsyouf and Ishak, 2018) or physical and logical accessibility (Ilie et al., 2009).

Table 5 Theory/model/literature used in the studies (the number in parentheses represents the number of papers using the theory or framework)

Theory/model/literature	*Paper*
Technology adoption model (TAM, UTAT) (19)	Chau et al. (2001), Yi et al. (2006), Ilie et al. (2009), Sambasivan et al. (2012), Sharifian et al. (2014), Chong et al. (2015), Kim et al. (2016), Alaiad and Zhou (2017), Sezgin et al. (2017), Alsyouf et al. (2018), Tavares et al. (2018), Alam et al. (2019), Feibert and Jacobsen (2019), Idoga et al. (2019), Tang et al. (2019), Zhou et al. (2019), De Benedictis et al (2020), Enaizan et al. (2020) and Wei et al. (2020)
Resource-based view and related theories (5)	Thrasher et al. (2010), Chen et al. (2013), Bradley et al. (2018), Mandal and Jha (2018) and van de Wetering (2018)
Information processing model (4)	Umanath and Kim (1992), Lillrank et al. (2002), Gardner et al. (2015) and Dobrzykwoski et al. (2017)
Coordination and interdependence theory (3)	Thrasher et al. (2010), Dobrzykowski and Tarafdar (2015) and Dobrzykwoski et al. (2017)
Business process management (2)	Laurenza et al. (2018) and Feibert and Jacobsen (2019)
System theory (2)	Wu et al. (2016) and Kochan et al. (2018)
Structure-process-outcome model (2)	Kazley and Ozcan (2008), Wu and Hsieh (2011)
Task-technology fit (2)	Bhargava and Mishra (2014) and Devaraj and Kohli (2003)
User resistance theoretical model	Alohali et al. (2020)
Institutional theory	De Benedictis et al. (2020)
Shared mental model theory	Fox et al. (2020)
Literature on gamification	Liu et al. (2020)
Interpretive model of technology	Mithas et al. (2020)
Justice theory, SERVQUAL	Xing et al. (2020)
Multichannel service delivery, professional service organisation	Bavafa and Terwiesch (2019)
Theory of dynamic capabilities	Rubbio et al. (2019)
Capability maturity model	Williams et al. (2019)
Top management support (TMS)	Alsyouf et al. (2018)

Table 5 Theory/model/literature used in the studies (the number in parentheses represents the number of papers using the theory or framework) (continued)

Theory/model/literature	*Paper*
Exploration exploitation theory of organisation	Gastaldi et al. (2018)
Literature on organisational mindfulness	Gardner et al. (2017)
Technology adoption and abandonment	Greenwood et al. (2017)
Literature on advanced manufacturing technology	Sharma et al. (2016)
Technology–organisation–environment framework	Xie et al. (2016)
BIG 5 (personality trait)	Chong et al. (2015)
Theory of swift even flow	Devaraj et al. (2013)
IT governance	Smith et al. (2013)
Balanced score card	Wu and Kuo (2012)
Process model, Prevention appraisal failure model	Queenan et al. (2011)
Business process engineering	Tzeng et al. (2008)
Knowledge management	Edmondson et al. (2003)
Critical social theory	Waring et al. (2002)
Econometric model	Menon and Lee (2000)
Computer-integrated manufacture (CIM) framework	Procter and Brown (1997)

Apart from the extension of different TAMs, no other extension or emergence of theory could be identified. Most of the studies are deductive in nature – that is, hypotheses are developed based on a certain set of the literature (e.g., information processing model) and tested. Most of the studies describe the relationship among the dependent and independent variables based on existing findings that are relevant to the study's research questions. However, they do not explain why such relationships are thought to occur; thus, they cannot be considered as testing or developing theory (Sutton and Staw, 1995). One of the few papers that explicitly uses theory is Bhargava and Mishra (2014), which uses task-technology fit theory to explain the temporal and dynamic impact of EMR on physicians' productivity, postulating that depending on the specialties of the physician, the impact of EMR on the physician's productivity would be different (Bhargava and Mishra, 2014). Moreover, we have identified that hardly any paper pinpoints the effect of IT deployment on service operations within the healthcare system, even though the changes in performance level are inevitably the aftermath of changes in operations within the care delivery process (Donabedian, 1966; Hung et al., 2019). Although a few authors have discouraged drawing a direct link between IT deployment and performance (Devaraj and Kohli, 2003), the tendency to draw such a direct link prevails in the literature. We consider this to be a major barrier to the generation of pragmatic knowledge because the search for direct links ignores the underlying mechanisms.

We also find inconsistent relationships among similar variables in different studies. For example, whereas some papers have found positive effects of IT deployment in relation to information availability, such as IT improving the quality of patient records, reducing delays in communication (Plantier et al., 2017), improving demand visibility, improving lead time, improving service (Kochan et al., 2018) and reducing hospital admission and mortality rate (Thrasher et al., 2010), other papers discuss the risk of information overloading because of the application of IT, which could end up delaying decision making (Laker et al., 2018) or negatively affecting the quality of decisions, thereby risking patient safety (Ford et al., 2016). Similarly, IT has been discussed, on the one hand, as one of the antecedents of integration in healthcare systems (e.g., Drupsteen et al., 2016), yet on the other hand, IT is said to be mediated by hospital integration (e.g., Chen et al., 2013). Thus, some studies propose that integration is enhanced by the application of IT; others conclude that integration is needed to realise the positive effects of IT.

Inconsistent empirical relationships do not necessarily have to result in ambiguity. When accompanied by the underlying mechanisms that explain under which circumstances these relationships are observed and why, these inconsistencies can contribute to a greater understanding of the domain. For example, one possible explanation of such an inconclusive relation is that the influence of IT deployment varies over time – for example, it is moderated by the coordination situation of healthcare in the initial stage of deployment, and it strengthens the coordination during the mature stage of deployment. In brief, scant use of theory, both in terms of applying existing theories and developing new ones, along with the neglect of changed service operations, are predominant in the literature. Such research traditions can be seen as the cause for the inadequate explanation of the relationship between IT deployment and healthcare performance, which hinders pragmatic knowledge generation.

4.5 Status quo of literature on IT deployment and healthcare performance

A summary of the findings is presented in Table 6, with exemplar papers being given that best illustrate the respective assessment criteria.

These current research practices reduce the ability of knowledge creation in several ways. First, the lack of contextual consideration limits the external validity (Wacker, 1998). Next, studying IT as a black box – a device that is described simply in terms of input and output, while its contents, structure and origin are neglected for convenience (Winner, 1993) – can only observe and describe the effect of IT deployment on performance; it cannot explain and control that effect and is discouraged in both the OM and IS fields (e.g., Dobrzykowski and Tarafdar, 2017; Orlikowski and Iacono, 2001). Similarly, overlooking the consequences of IT deployment on service operations results in inconsistent conclusions, contributing to the unpredictability around IT deployment.

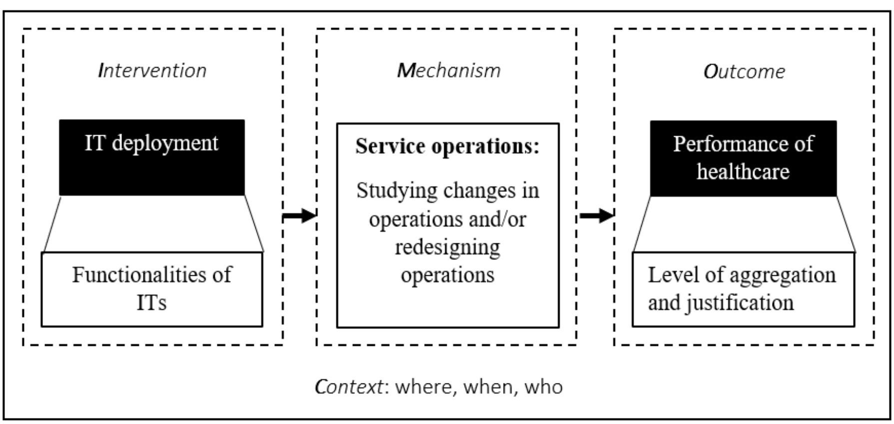
5 Framework for future research

Based on the assessment above, we propose a framework (Figure 4) for future research. The framework amends the identified issues in the literature that limit the generation of pragmatic knowledge.

Table 6 Status quo of literature on IT deployment and healthcare performance

Assessment criteria of the studies	*Assessment*	*Exemplar papers*
Context (C)	Few studies consider the contextual impact regarding the relationship between IT deployment and performance. A large number of studies are imprecise in stating where and when the results of the study are valid, applicable and reproducible	Li and Benton (2006) and Waring and Wainwright (2002)
Conceptualisation of IT deployment (I)	The papers mostly lack a definition of the constituents of IT as a concept and a demonstration of the functionalities or capabilities of the particular IT	Kazley and Ozcan (2008) and Plantier et al. (2017)
Explanation of relation between IT deployment and healthcare performance (M)	The studies largely overlook the influence of IT deployment on the service operations of the care delivery process, thereby lagging in their explanation of the relation between IT deployment and healthcare performance	Bhargava and Mishra (2014) and Devaraj et al. (2013)
Performance attributes (O)	Attributes from different levels of aggregation are measured simultaneously, and no justification for selecting these attributes is provided	Lillrank et al. (2002) and Dobrzkowsky et al. (2017)

Figure 4 Framework for future research on IT in healthcare OM



5.1 Opening the black box of IT

We propose that IT must be studied in terms of its functionality so as to understand how and why IT deployment leads to particular performance changes. Functionality specifies what IT does or provides to support or accomplish tasks when set up in an organisational context (Dishaw and Strong, 1999; McNamara and Kirakowski, 2006). Without considering the functionalities of IT, one cannot frame the mechanisms of performance improvement, and the real scope of IT – whether it is to measure or control biological parameters or enhance communication or trigger and support behaviour – will remain vague (Colucci, 2015). The importance of studying the functionalities of IT to understand its influence has been discussed in both the IS and OS fields, showing that without clarifying the content and properties of a piece of technology, the knowledge of it and its influence on organisations remain incomplete (e.g., Kallinikos et al., 2013; Orlikowski and Iacono, 2001). The Healthcare Information and Management Systems Society (HIMSS) recognises that healthcare IT such as EHR comprises multiple functions, and different hospitals adopt a different range of these functionalities (HIMSS, 2006). Therefore, researchers should be more specific than mentioning the name of IT while analysing its effect.

There are a few studies that classify healthcare ITs using different categories, including time of innovation and area of focus (Gastaldi et al., 2018; Oueida et al., 2018; Tortorella et al., 2020). A comprehensive classification of healthcare IT based on functionality could not be found in the literature. However, following the classification proposed by Oueida et al. (2018) and supported by Tortorella et al. (2020), we have classified healthcare IT found in the current review study into two groups: clinical IT and administrative IT. Clinical IT can refer to IT explicitly used for patient treatment and administrative IT for managerial activities that support the treatments. Table 7 provides an overview of the classification, including the functionalities and examples from literature.

Table 7 Classification of healthcare IT according to their functionalities

Generic classification of healthcare IT	*Functionalities*	*Examples*
1. Clinical IT	• Assists the practitioners to detect, measure and treat patients' conditions • Real-time transmission of audio-visual and numerical data between practitioners and patients • Receives, stores, analyses, visualises and shares data among healthcare personnel and patients	Automatic blood sugar meter, surgical technology, PDA, CPOE, remote consultation, web-based or app-based disease management toolkit
2. Administrative IT	Receives, stores, analyses, visualises and shares data among healthcare personnel and patients and healthcare management	EMR, EHR, RFID and ERP

As can be seen from Table 7, there are functional overlaps between these two groups of IT, so future research is required to create a comprehensive classification of healthcare IT based on its functionalities. Moreover, whereas Table 7 exhibits generic healthcare IT functionalities, studies focusing on a particular IT can dive into more specific functionalities. For example, in their research on EHR application, Plantier et al. (2017) study electronic drug prescriptions, discharge records and care records as the functions of EHR. The merit of such analysis is that it informs the future design and implementation of the particular IT, enabling users to delineate their expectations of that IT. These features can explain ambiguities, such as why some hospitals are more successful in implementing and using IT than others and why some ITs are quickly abandoned by practitioners. Therefore, we propose the following:

Proposition 1: *Studies conceptualising IT in terms of functionalities will better explain the relation between IT deployment and healthcare performance.*

5.2 Studying the consequences of IT deployment through changes in service operations

We propose studying the consequences of IT deployment on service operations to discover the causal links between IT deployment and performance. Operations are sequences of events and actions involving time and organisational resources, and they result in particular outcome(s) (Fynes et al., 2015). Service operations consist of all the direct and indirect operations taking place in a healthcare context to treat patients. The lack of a clear understanding of how new IT can change the clinical workflow can negatively affect the deployment of IT in healthcare (Mora, 2012). Moreover, Sambamurthy et al. (2003) posit that IT deployment influences a firm's performance through organisational capabilities and strategic processes. Similarly, we contend that changes in healthcare performance can only be inferred through changes in ongoing service operations because of IT deployment.

The mechanisms of performance changes can be identified by analysing aspects such as how the use of new IT affects the patients and material flow; how demand variability can be controlled or predicted by real-time information access and its implication for planning and control; how bottlenecks are revealed and treated; how the decision-making process is changed and shifted to another service unit or personnel; how the requirement for new skills emerges; and how patients' involvement and care coordination are reshaped. A case in point is the study on the effect of e-visits by Bavafa and Terwiesch (2019), in which the authors examine how e-visits influence the work content of physicians' practices, thus providing deeper insights into technology use in the healthcare context.

Moreover, IT deployment may result in unintended changes. For example, a recent study shows how incorporating new IT systems into healthcare leads to confusion among care providers, leading to disruption in operations (Brodersen and Lindegaard, 2015; Qian et al., 2019). These unintended effects of IT deployment on performance cannot be identified without studying changes in service operations. On the one hand, the decomposition of IT into its functions will inform researchers about which operations in the healthcare system are likely to be affected by IT application. On the other hand, the identification of these operations will inform researchers about which performance attributes are the most relevant for measuring the effects. The second proposition states the following:

Proposition 2: *Studies identifying the consequences of IT deployment for service operations will better explain the mechanism(s) of the IT deployment and healthcare performance relationship.*

5.3 Opening the black box of performance

We propose that performance attributes should be chosen rationally based on the functionalities of IT and consequences of deployment for service operations. Healthcare organisations use various clinical (e.g., quality adjusted life year), processes (e.g., waiting list), and financial (e.g., cost per bed) attributes to measure performance. The reasons for choosing certain attributes from this wide array of performance measures also need to be clearly explained so that the underlying logic can be reused or improved in future studies. In addition, selecting attributes arbitrarily or because of practical convenience, such as the availability of a certain database for some performance measures, may not capture the actual effect of IT deployment, leading to imprecise, even misleading, conclusions in a study (Lillrank et al., 2002). Therefore, we propose the following:

Proposition 3A: *Studies selecting the performance attributes based on the functionalities of IT and its consequences for service operations will better explain the relationship between IT deployment and healthcare performance.*

The level of aggregation in performance attributes is another aspect to consider. Depending on the infrastructure of IT functions, IT deployment may influence various attributes at all levels of aggregation. For example, the effect of a distance monitoring app deployed for a patient group in a hospital influences the information processing demands of an operational unit, whereas the effect of ERP software deployed organisation wide reaches the strategic level. However, the changes in attributes from different aggregation levels arise from different mechanisms, thereby demanding separate analyses. For example, attributes such as mortality rate and revenue per admission are more likely an aggregated effect of the multiple ongoing processes of a hospital when compared with attributes such as access to patient records and time to make decisions in surgical procedures. Consequently, the mechanism that explains the relationship between a particular type of IT and a highly aggregated performance attribute consists of more mediating and moderating factors than the relationship between the IT and a less aggregated performance attribute. Therefore, we discourage the application of the same relational model for performance attributes from different managerial levels to avoid ambiguity. Hence, we propose the following:

Proposition 3B: *Studies separately assessing the relation between IT deployment and performance attributes from different managerial levels will better explain the relationship.*

In Table 8, we present the IT functionalities and relevant performance attributes for future studies. The performance attributes found from the current literature review have been sorted into three focus areas: patient-, practitioner- and organisation-related outcomes. Depending on the IT and empirical setting of a study, different performance attributes can be chosen from the below table. Our research framework (Figure 4) suggests that the link between IT functionalities and healthcare performance depends on the changes in service operation (Proposition 2) and the context of the study (Proposition 4). Therefore, instead of connecting each functionality with certain performance attributes, we provide a pool of attributes pertinent to healthcare IT deployment.

Table 8 The pool of IT functionalities and performance attributes for future studies

Functionalities of healthcare technology	*Relevant attributes to assess outcomes*
• Assists the practitioners to detect, measure and treat patients' conditions • Real-time transmission of audio-visual and numerical data between practitioner and patients • Receives, stores, analyses, visualises and shares data among healthcare personnel and patients	*Patient-related outcome* Satisfaction, quality of care, mortality, continuity of care, patient safety, reliability, duration of hospital stays *Practitioner-related outcome* Quality of decision, time to make decision, ease of use (of IT), work content, working hour *Organisation-related outcome* Cost, waiting time, readmission rate, facility utilisation, personnel expense, net patient revenue, error in medication, service time

5.4 Considering the context of deployment

We propose that the link between IT deployment, affected service operations and healthcare performance can best be explained when the context of deployment is taken into consideration. Context implies the antecedent conditions of IT deployment, including both external features, such as economy and political stability, and internal features, such as the structure of the organisation and nature of the stakeholders and employees (Denyer et al., 2008; Pettigrew, 1987). Studies that consider context can provide practitioners with information about specific instances in which IT deployment improves (or does not improve) performance, thereby enhancing the external validity of the studies (Wacker, 1998). Hence, we propose the following:

Proposition 4: *Studies considering the context of IT deployment will better explain the relationship between IT deployment and healthcare performance.*

To summarise, the framework and propositions present a logic for framing the research problem and research design. If these propositions are followed in designing future studies, it is more likely that a coherent body of knowledge will develop over time, which can then provide readership with better conceptual understanding and guide practitioners to better predict and control the relation between IT deployment and healthcare performance. Consequently, the framework does not place any constraints on the choice of methodology for the studies. Both analytical and empirical studies that use statistical, mathematical or qualitative data can be designed using the framework. More than guiding the methodology, this framework encourages reshaping the research questions and providing propositions for doing so. However, we emphasise the importance of using multiple methodologies to develop a holistic understanding of the scope of IT deployment in improving healthcare performance (Boyer and Swink, 2008; Wacker, 1998), whereas the literature has a strong inclination towards empirical statistical methodology (Table 2). Along with Ketokivi and Choi (2014) and Voss et al. (2002), we call for more empirical case research in this domain because studies in this area have a high potential in theory extension and building.

6 Conclusion

The rapid advancement of technology employment in healthcare creates an increasing need for managerial knowledge that is scientifically rigorous and practically applicable. Multiple research disciplines have a significant role to play in creating this pragmatic knowledge. The current paper has shown how OM can contribute to this burgeoning field of healthcare technology management. We urge the research community to consider operations when studying the relation between IT deployment and healthcare performance. Our findings suggest that the OM literature within the domain of IT deployment in healthcare tends to measure performance without considering the changes in related healthcare operations. We argue that studies that analyse these changes in relation to IT functionalities, rational performance attributes and contextual factors can generate pragmatic knowledge. Thus, the present study contributes by devising a guideline for future research to advance knowledge on technology management in healthcare. Next, it also demonstrates how as an applied discipline, OM can increase its relevance within the domain of healthcare technology management.

Moreover, we anticipate that once studies begin to identify the relevant mechanisms underlying IT deployment and performance, the extension of existing theories and emergence of new theories will become more frequent, enriching the field of technology management. Current studies are apt when it comes to making predictions in the form of hypotheses that set out to measure variables, whereas theory development requires causal logic in the form of propositions that involve concepts (Whetten, 1989). Although existing studies answer the questions of *what* – and partly *how* – our framework can help answer the question of *why*, which is a fundamental aspect of theory (Meredith, 1998; Sutton and Staw, 1995; Wacker, 1998).

The current study is not without its limitations that can be addressed in future studies. The present study takes a systematic literature review approach towards assessing the status quo of ongoing research in technology management in healthcare. However, the literature can also be assessed using a bibliometric technique, which primarily provides a quantitative analysis of the literature. It will be valuable to conduct a bibliometric analysis of similar groups of the literature and compare the findings with those in the current paper. Finally, although we have used a broad range of keywords for searching relevant papers, changing the keywords and conditions may provide a marginally different set of papers to review. Therefore, conducting a literature review on a regular basis would lead to a more extensive view of the literature than what the current one can provide.

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