IN DEPTH STUDY OF 'DE-COUPLING POINT' AS A REFERENCE MODEL:

AN APPLICATION FOR HEALTH SERVICE SUPPLY CHAIN

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ABSTRACT

This paper reports the findings from a case study research about in depth analysis of 'decoupling point' as a reference model to address a particular management dilemma. Managers from a health service organisation contacted the researchers to investigate possible causes of a managerial dilemma where managers and clinical professionals were not able to agree on a satisfactory decision. Researchers designed a decoupling point reference model where decision making was taking place to decide which particular process would be chosen for treatment. Clinical professionals were favouring a particular process because of health benefits to patients, whereas managers were more inclined to support a different process, which seemed to bring better outcomes for the organisation. The decoupling point implied applying a hybrid strategy where lean and agile paradigms coexisted so that particular operational views of these different groups of professionals could be taken into account simultaneously. The current performance management system indicated some limitations in the sense that it did not include relevant knowledge of the processes that the reference model suggested. The paper concluded that reference models have potential to offer benefits if considered as tools of process driven analysis for service organisations. They could serve to find out about potential conflict between different professional groups, as well as indicating the limitations or weaknesses of other critical aspects of management such as measuring of performance and allocations of resources so that better integration across all facets of the service could be achieved.

Keywords: decoupling point, reference model, health service.

1.Introduction

The rise of information and communication technologies that improve automation and connect global labour markets has resulted in a shift of people out of manufacturing into knowledge-intensive service industries that support manufacturing and innovation. As a result of these dramatic changes service operations have emerged as an important research domain for both theory and practice. To address these changes Chase and Apte (2007) suggest that research in the following areas would be useful: transference of industrial management concepts to service industries, frameworks for service design and management, and tools and techniques of service operations to improve productivity in services. Maguire (2012) argued that service science and related work on theoretical and practical aspects of service operations management can provide a significant difference to the way these organisations undertake their business processes. He then suggested that improvements in service operations could only be realized if there is an effective combination of people, process and technology, both within the organization and across the value chain. Also, Maguire et al (2012) provided evidence from the literature regarding the need for developing models and frameworks in order to better understand the service organisations, as there are different dynamics in each service operation, as well as to take into account interests and expectations of different stakeholders. Fernandes (2012) supported this view and suggested a 'service framework' modelling interactions associated with people, processes and technology across service systems as a tool for analyzing complexities associated with these systems.

On the other hand, there is evidence to suggest that researching interaction and integration between people, processes and technology is not easy (Pagell, 2004). The

lack of integration between the aforementioned components leads to lower levels of organisational performance (Stock et al, 2000; O'leary-Kely and Plores, 2002, Pagell, 2004). As explained by Chan (2007), not only organisational level integration but also inter-organisational collaboration on specific aspects of the operation is desirable in order to achieve better outcomes for related parties.

Review of above studies in relation to integration and reference models highlighted the following issues: Integration between people, processes and technology in operations is not easy; integration should take into account the value chain outside of the organization as well as internal integration; there are performance related benefits of undertaking such integration work; models frameworks could be used for integration of processes, people and technology.

Above mentioned studies on how to model service operations have had a more holistic approach in the way these components were brought together and attempted to provide evidence that would be applicable for service operations in general. In this study however, the aim was to be more case specific and to produce a purposefully designed reference model to address a particular managerial problem. More specifically, the reference model regarding decoupling point which divides the lean and agile operations is studied. Holistic models were referred to and employed to include the basic components but then the model was adapted according to input from various stakeholders so that a consensus model could be designed for the particular managerial dilemma investigated.

The study, with a focus on health service processes, indicated that reference models have a number of benefits to offer for building integration between processes, people and technology requirements. They helped communication and understanding of opposing views between different staff groups with different but relevant technical knowledge. They served to identify different service pathways and how and why each pathway was chosen. Hence the reference models can help to compare requirements and implications of technologies used at different stages of the operation.

Findings of this study implied that purposefully designed reference models integrating service processes, stakeholder expectations and technology requirements have the potential to benefit resolving organizational dilemmas. Furthermore, the implications of using such models could impact on performance management and resource allocation practices.

The next section provides a review of literature and the research questions of this study. Background information about the case study organization and management dilemma being investigated are explained afterwards. Then the methodology applied in the study is reported. This is followed by the findings section. The paper ends with some concluding discussion and implications of findings.

2. Literature Review and Questions

2. 1 Health Service Operations Management

The literature on health service operations management ranged from application of lean thinking (Womack and Jones, 2003; Heines et al, 2004; La Ganga, 2011) to

process improvement (Breyfogle and Salvaker, 2004) and more recently to leagility and the importance of a decoupling point (Rahiminia and Moghadasian, 2010).

Another stream of research is concerned with reengineering the processes of the healthcare operations (Christopher and Marino, 1995) to implement lean concept (Jarrett, 1998). Process mapping was used as a tool to help analyse the core processes in particular. To evaluate the lean thinking in practice, Lillrank et al (2011) broke down the diagnostic processes of two departments (Otorhinolaryngology and Nephrology) by using a process mapping approach to quantify the measures (such as time delay) in relation to these processes.

Healthcare processes are accepted as more complicated than traditional manufacturing processes, hence system dynamics modeling is strongly advocated (Samuel et al, 2010) The underlining characteristic of health processes is arguably the 'uncertainty': number of patients, usage of medicine, clinicians' time, equipment and the demand are all uncertain. These process related uncertainties are important components of a service framework and should be considered in decision making. McKone-Sweet et al (2005) suggested that because of this setting, misaligned and conflicting incentives could be a barrier to implement operations management practices in healthcare organisations.

A crucial factor to make lean successful is the ability to match supply and demand. In other words, this concept is particularly applicable to processes with high volume and low variability, and hence a low level of uncertainty. Agility, on the other hand, can be simplified as the ability to react quickly and flexibly (Christopher, 2000). Furthermore, studies on combining both streams, in this case, leagility in the healthcare sector are

quite limited and underdeveloped. Leagility originates from a two operations concept- Leanness and agility (Naylor et al, 1999). In the healthcare sector, those operations with high level of uncertainties (like Accident and Emergency cases) could be categorized and improved under this family. Despite the often used lean concept, a traditional mass- production type philosophy is not applicable to these kinds of processes.

In operations, it is not easy to find pure lean and pure agile processes. Therefore a system always consists of a portion that is lean and a portion that could be described as more 'agile' (Christopher, 2000).

2.2 Decoupling Point as a Reference Model

Decoupling point that divides the make-to-stock (i.e. push) portion and make-to-order (i.e. pull) portion of a manufacturing or supply chain system was a very popular model being investigated in the 1990s (e.g. Giesberts and Van Der Tang, 1992 – coincidentally this study was published in this journal). The origin of this model is not very clear but early research studies can be found as early as in the 1980s (e.g. Wortmann, 1987). The rationale behind this model is very straightforward – to combine the advantages of both systems in the resulting hybrid system. Make-to-stock systems are more beneficial to high volume production in order to achieve economy of scale, but the response of such system is not very good. In contrast, the make-to-order systems respond only to customer demand and hence such systems can satisfy customers faster and perhaps better. In the late 1990s, Naylor et al. (1999) coined a new term for this system which is leagility, an amalgamation of two famous paradigms: lean and agility. These two paradigms complement each other and thus

leagility is a concept tries to capture the capability of both paradigms (Herer et al., 2002). A commentary on this model was later presented by one of the "inventors" of this concept (Naim and Gosling, 2011). They concluded that, based on over 100 papers citing the work conducted by Naylor et al. (1999), "there has been extensive exploitation and testing of the 'leagility' supply chain model". Therefore, this model (decoupling point or leagility) is widely regarded as a reference model in the operations and supply chain domain (e.g. Banomyong et al., 2008; Chan and Kumar, 2009; Huang and Li, 2010; Kisperska-Moron and de Haan, 2011; Soni and Kodali, 2012). The reason behind that is also straightforward. Such systems consist of many entities and the operations span across a number of activities. Therefore, a single universal system is not able to cover the complete scope of the systems.

Two recent studies on the decoupling point in healthcare operations investigated whether or not 'leagility' is applicable and provided interesting and significant results relevant to our study. Rahiminia and Maghadasian (2010) collected interview data at a specialist hospital to investigate applicability of leagility. They broke down the whole operation into different pipelines and showed that, for a particular pipeline, a high proportion (80%) of the appliances were used for most of the patients. The demand for that part of the service was quite stable and predictable, therefore lean concept could be applied in this portion of the operation. Treatment however, which was the remainder part of the service, had a low level of predictability and a high degree of variability. Thus the lean approach was not a suitable option for that portion of the operations. The researchers then located the decoupling point between these two portions of the operation (at the point of diagnosis).

Another study by Aronsson et al (2011) presented a case focused on Swedish healthcare organizations. They studied 12 organisations and collected interview data to conclude that some processes can be standardized and consequently lean can be applied to those processes. However these did not constitute a significant part of all processes and hence the leagility was considered to be not applicable in the healthcare organisations studied (p.181). This was because the processes investigated were of a high level of variety in demand, as well as high level of uncertainty. The authors concluded that it was not easy to define a decoupling point along the processes and they advocated a hybrid strategy so that leanness and agility could be applied throughout the system in an intelligent way.

These two studies concluded that recent literature indicate relevance of modeling the processes. This paper contributes to this by suggesting purposefully designed reference models for decoupling point where in depth analysis and understanding of people, process and technology components could be understood simultaneously in making decisions.

Based on the above review of literature, the following observations have been made:

- Previous studies on health service processes in relation to decoupling point used flow of stocks/inventory but paid limited attention to the flow of patients
- In order to improve service operations it is essential to establish better integration between processes, people and technology
- There is significant evidence of the usefulness of frameworks/models in order to achieve better integration between the above three factors

- There is limited evidence of analysis of such integration within the health service decoupling point/decision making related studies used as reference models.

With the help of the above observations, this study aimed to find out some answers to the following research questions (RQs):

RQ1 To what extent a purposefully designed decoupling point reference model would be useful in an investigation of integration between processes, people and technology in service operations?

RQ2 To what extent would such an investigation help address a particular management dilemma where managers have different preference over alternative processes

3. Case study organisation and the managerial dilemma

3.1 Case study organisation

Case study organization was a specialist health center located in the eastern region of England, UK. It has been running for eight years and was one of 26 specialist centers providing services to patients with the same health problem.

Diagnostic services at the center included the following: collecting information about patients' health history, routine laboratory tests, routine diagnostic tests and reporting of results. If a diagnosis was positive then the patient would have agreed on a treatment plan following a discussion with the relevant clinician(s). Treatment services offered at the center were as follows: detailed examination and discussion of particular issues in relation to patient's complaints, further tests (depending on the individual needs of

patients) and if necessary seeking of help and advice from other specialists (surgeons, anesthetists etc), admission to the center, removing of the body part causing the condition (i.e. surgery), aftercare at the hospital, discharge, follow up visits.

The center has been running for over eight years successfully but recently managers felt that they were under increasing financial pressure which indicated that controlling costs and increasing revenue was one of their main priorities. In addition, advances in technology demanded that newer and better devices be available to carry out surgeries. The center was able to invest in those new technologies and clinicians began using them competently. According to clinicians and managers that contacted the researchers, the new technology (called 'laparoscopic surgery') was not used efficiently. It was used only for a limited number of patients whereas it should have been possible to use it for all patients when a surgical procedure was to be carried out. Laparoscopic surgery also known as minimal invasive surgery, is a technique that allows surgery to be performed without the long traditional incision. By using multiple small incisions, the surgeon inserts instruments including a tiny camera. The camera allows the surgeon to visualize the surgery. These smaller incisions make laparoscopic surgery safer than a traditional incision, as less tissue is cut.

3.2 The management dilemma

The management dilemma was described to researchers as follows: clinicians and managers had different opinions about which surgical procedure to offer to patients. Clinicians argued that; there was decreasing benefits to offer the traditional method of open surgery and that they should be doing laparoscopic surgery - described above- only to all patients that needed a surgery. On the other hand, managers argued that this

would entail a financial and operational risk; hence the center should continue providing both. According to clinicians, patients could go through laparoscopy should they need a surgery. Contrary to this, managers argued that the two (open surgery and laparoscopy) should co-exist and one or the other would be advised by clinicians. This created a major dilemma in the organization. Clinicians and managers were of opposing views for what the processes should be and how the organization should proceed strategically and in terms of resource allocations.

When the problem was discussed with the Clinical Director and a consultant surgeon during an initial meeting they concluded that the issue was about making a decision over whether to use open surgery or laparoscopic surgery for treatment of the same health problem. This discussion led the researchers to investigate the decision making process in depth through the decoupling point as a reference model. The next section provides the methodology applied for this purpose.

4. Methodology

In this section, main steps of methodology applied and justification for applying this methodology are explained.

4.1 Main steps and case study research

Main steps of conducting the fieldwork could be summarised as follows:

- Initial meeting: A meeting was held with clinicians and Clinical Director of the centre in order to gain access.
- Collection of data: Researchers spent eight months at the centre to collect data. These were observation in meetings, field notes and internal documents from various sources (clinical information, administrative information-eg. waiting times and lists-, financial information)

- Designing of decoupling point reference model through an iterative process

Below are some details in relation to above steps:

Following a request from managers of the organization, the Director of the Center was contacted and an introductory meeting was held to secure access to the organisation and relevant individuals. The researchers observed the processes at the organization for eight months in order to define the processes constituting the managerial dilemma. At the same time literature around the topic was explored and areas of investigations were identified. Designing of a consensus business process model was the next stage. During the observation period, researchers collected observation data and interview data in the form of notes. The next stage was to get copies of costing information for each process as this issue appeared as a critical component of decoupling point. The results were reported and communicated to the management team and their views about the suggested reference model were collected at the end of concluding meeting.

As discussed in the preceding section, the literature covering the decoupling point in the healthcare sector is inadequate to make generalisations. For this reason it was considered appropriate to use the case study research technique (Barratt et al., 2011; DeHoratius and Rabinovich, 2011). A detailed case study methodology was used in this study to examine the processes of service delivery with participant observation. Participant observation is one of the recognised field research techniques in the operations and supply chain management domain (Voss et al., 2002; Yin, 2003; Barratt et al., 2011; DeHoratius and Rabinovich, 2011).

The case study approach creates a "distinctive opportunity" to gain access to the operations, and thus can preserve the reality of the data collected (Voss et al, 2002;

Yin, 2003). The attempt was to minimise the major shortfall of participant observation; namely presence of subjectivity in the data collection process (Yin, 2003), through collecting objective, quantifiable data such as operating costs and time consumed in the operations, rather than solely qualitative information such as from the interviews. Additional field notes of observers as well as notes taken during meetings were useful sources to report on organizational internal dynamics which could not have been evidenced otherwise.

4.2 Data collection

Meetings were observed and a member of research team was present in all types of fourteen different surgical procedures investigated. One member of the research team was present at the Centre to observe the clinical team during a period of eight months from August 2008 to March 2009. The team member observed operations and surgeries, took part in daily activities and also searched for statistical and other managerial information. During that period, 240 patients were admitted and 204 patients had one of the 14 different types of surgeries offered at the centre. Six of those were 'day case' procedures (patients admitted and discharged on the same day) and eight of them were in-patient procedures (patients stayed at the hospital). Five of these eight types of in-patient procedures were open surgery procedures and the remaining three were laparoscopic surgery procedures (please see appendix 1 for a detailed account).

Information was obtained regarding the average operating theatre time used to carry out each group of procedures. The number of days that patients stayed at the Centre for aftercare was also noted for each patient. Cost information was collected for the

following: Operating theatre staff and their salaries, costs of equipment including disposable and sterilization costs for reusable equipment, sutures and antibiotics used. However, the costs of management of health complications were not included. The time taken to operate on each patient was also recorded. This was calculated from 'skin to skin', where anaesthetic time was not included as it varied significantly from patient to patient.

4.3 Analytic strategy, validity and reliability

General analytic strategy applied in this research followed the recommendations by Yin (2003) and a strategy of case description was devised (p.114) with use of an organisational-level logic model (p.130). To secure validity of the data, multiple sources of evidence were used (Patton, 1999) at data collection stage such as internal documents from clinical groups (clinical information of diagnosis, patient pathway, operating theatre information) local administrators (booking of patients, schedule of operating theatre times etc) and finance office (resources used of different types of treatments, costing of selected resources, reimbursement monetary amounts to the Centre etc). Multiple sources enabled the researchers to establish a chain of evidence. This was particularly beneficial whilst devising the reference model. For validation a team of clinicians and managers reviewed the draft case study report and the reference model. The team comprised of the clinical director, consultant surgeons, specialist nurses, administrative support personnel and two finance officers at the studied centre. After their views were sought and incorporated, a revised consensus model was devised and shared with these professionals. The model has been through an iteration process that lasted about four weeks to conclude with a consensus reference model

(presented in Figure 1) and representation of resources used at each step of the model (Table 2 below).

To establish reliability, case study protocol was used to manage the documentation problem in detail. The protocol included an overview of the case study, field procedures and case study questions, as well as an outline of case study report. This protocol was shared and agreed with the clinical director of the centre prior to the start of fieldwork, as the clinical director was the clinical, managerial and administrative lead in the studied centre.

5. Case study findings

5.1 Integration of processes

As presented in Figure 1 we constructed a patient pathway as a reference model to depict the steps that make up the service delivery process (Bashford *et al.* 2002). It therefore represented the journey that a typical patient goes through from the point of referral to the surgery and then to discharge. This model helped to analyse the processes, people and technology at each step of the service operation. The processes were first defined and discussed with the management team. Those discussions revealed that the processes were isolated with separate groups working for each process almost independently. There was not much evidence of integration between them. The model therefore served as a mediating tool between different groups of people working separately and helped building connection. There was evidence of confusion between trainee doctors as to why these different processes were needed for treatment of the same health problem.

Insert Figure 1 here

Process A started with the referral of the patient to the health centre by a family doctor (i.e General practitioner). The patient then had a first visit to the centre and went through the routine process of diagnostic services.

There were two main sub processes following the treatment decision number 1 (TD1). This was whether medical treatment or surgical treatment would be needed. For processes that a surgical treatment was decided then a second treatment decision took place (TD2) whether the patient would be admitted to the hospital as an inpatient or would be treated as a day case procedure depending on the severity of the condition. For patients that were admitted to the hospital then a third treatment decision had to be made (TD3) whether to undertake a laparoscopic or an open surgery. This point was a decoupling point as all cases could be treated with laparoscopic surgery but the option of open surgery was also present. Process B on Figure1 represents laparoscopic surgery, and process C represents open surgery for treatment of the same condition. This is the point which refers to the managerial dilemma explained above in section 3.2

Process B and Process C were on offer to patients that had to have a surgery but there were some differences between the two. Process B was the laparoscopic surgery with three different types of surgical procedures on offer. It had a shorter lead time and generally less complication for aftercare. On the other hand it was essential that an experienced surgeon was leading the surgery and oversaw the aftercare too. Process C on the other hand was open surgery with more variety of surgical procedures on offer (eight different types of surgeries). Open surgery had a longer lead time and higher possibility of complications for aftercare. On the other hand it was the type of surgery

that has been offered for long time and did not involve competent use of any new equipment. For that reason all clinicians were capable of performing this type of surgery compared to limited surgeon capacity for Process B. Table 1 compares the two processes.

Figure 1 clearly indicates that the early processes are quite standard and all patients have to go through Process A before they can be diverted to later stages. Although the second part, which is the treatment process, is more agile in nature, it was more complicated to analyse. Whether day case laparoscopy for mild cases or another decision to divert more severe cases to inpatient laparoscopy or open surgery should be applied was not a straightforward judgment. In other words, for pipelines of processes after the TD1, it is difficult to apply a pure agile management. The laparoscopic surgery could be classified as lean to a certain extent, whereas open surgery could be described as more "agile" in nature. In other words, the whole process is not really a "chain" of processes. It would be possible to identify lean portion of the whole operations, but it is not easy to apply a pure agile strategy to the treatment process because of its complexity. Therefore, a hybrid strategy at the point of decoupling could offer benefits for making decisions.

Lean principles seemed to be more in line with Process A at the diagnostic stage and hence the procedures could be standardised according to lean philosophy. This could help smooth the flow of both inventory and patients in this portion of the operation. Even if the later part of the whole process consists of a number of operations, the earlier part of the operations can be used to categories patients into different groups according to severity of their cases, nature, and so on so that they can be diverted into a

proper treatment branch of the later operations. Detailed information of surgical procedures under Process B and C are presented below in table 1.

Insert Table 1 here

Information such as resource requirements and lead times can also help the planning of activities such as booking of operating theatre time. For example, diverting more patients to laparoscopic surgery may help reduce the total operating time, as well as the patient stay-in time in the hospital. This "agile" thinking can introduce more "lean" elements in the later process (and that's why hybrid thinking could offer benefits at that point).

5.2 Technology and People

Characteristics of technology were distinct for each part of the processes. Process A had been running successfully for several years. The team, the laboratory testing and reporting facilities were well established. Technological environment did not seem to cause any issue for people for efficient running of the service. For Process B however the technological capacity in terms of latest equipment and facilities was perceived by health professional to be one of the best in the country. The main issue was expressed as the lack of expert clinicians that are capable, knowledgeable and experienced to use available technology. Junior doctors were complaining about operating theatre time slots being booked as 'blocked out time' for Process C and not enough slots being available for Process B. When the reasons to this were investigated the clinical director mentioned that Process C was more efficient and should be done more whereas process

B was being considered as more risky managerially but not necessarily clinically. The causes of this argument are discussed in the next section.

Process C was perceived to be part of routine services without pressure of constraints around technological and/or expert knowledge, or availability of time slots at the operating theatre. Junior doctors felt comfortable with undertaking this process. Despite some of its disadvantages as listed in above Table compared to Process B, Process C constituted more than 65% of all surgical operations provided at the centre and was generating about half of the total income of the Centre. There was not much tension between people or any evidence of bottom up change pressure for this process. It was deemed to be successfully running and bringing necessary financial inflows to the Centre.

5.3 Financial Inflows and its Impact on Process B and C

The centre received their income from the Department of Health of England, according to number of cases that they were referred to by family doctors and according to type of treatment that they provided for each case. The fund allocation mechanism called Payment by Results (Department of Health, 2002) indicated how much would be transferred to the health centre according to different types of treatments and surgeries that they carried out. The value for each type of treatment or surgery was determined centrally and was published as the tariff prices (Department of Health, 2010). These tariff prices were used to calculate the fund that are transferred to the centre as a budget allocation. The centre reports the total number of each treatment and surgery carried out during the financial year and receives the monetary amount of the multiplication of tariff

price by the quantitiy reported as their financial inflow. (Please see Guven-Uslu, 2012 for a detailed account of financial flows between Department of Health in England and health service providers such as hospitals and health centers)

In order to complete the analysis, the costing information for processes B and C was further studied. In depth analysis of these costing revealed considerable differences between our underestimated costs for these procedures and the tariff prices reimbursed by Department of Health for laparoscopic and open surgery. These differences were investigated further as this issue seemed to have a high impact on the characteristic of the service provided as well as in making decision at the decoupling point.

The weighted average costs for each type of procedure- laparoscopy versus open surgery- that the centre was offering were not significantly different from each other. £751.84 for a typical Laparoscopic surgery and £801.02 for a typical open surgery. On the other hand the reimbursements from the Department of Health for each of these type of procedures were significantly different: £1,158 for laparoscopic surgery and £2,823 for open surgery. This had an influence on the managerial and financial decisions. The clinicians were expected to produce viable business case for their specialist centre to continue their operations. Although the reimbursed amount was higher in both cases, the open surgery continued to be reimbursed higher than the costs calculated compared to laparoscopic surgery, bringing higher levels of financial surplus to the centre. A breakdown of the cost of the two types of operations is listed in Table 2.

Insert Table 2 here

This evidence indicated the importance of external factors on people and their decision making at the decoupling point and beyond. In this particular health service provider the presence of the decoupling point relates to the nature of the treatments, managerial procedures and its financial costing, hence the clinical decisions were impacted. Although there were some clear benefits of laparoscopic surgery to open surgery for patients, other issues impacted the decoupling point. These were operational issues, cost benefits, need for expert knowledge, availability of space and equipment.

At the decoupling point, the specialist decision rests by the above mentioned three aspects at the decoupling point, but the existence of externally imposed financial guidelines drove towards a shift in decoupling point, in which the specialist decision was influenced. This might cause for the health service provider to become less agile moving from the decoupling point at an earlier stage towards a shift in decision making. This appeared as an important implication of the findings as previous literature and recent studies clearly indicated that agility was an important aspect of health service operations for a patient centred, safe and efficient service provision and delivery (Towill and Christopher, 2005; Rahimnia and Moghadasina, 2010). The decoupling point mentioned in the literature in health service operations is explained to be shaped by demand, (i.e. patient needs, emergency treatment required), but discussions around implications of the resultant postponement have been limited. The presence of a shift in decoupling point encourages standardisation through centrally designed financial regimes and the application of more lean practices, which introduces a reference point across the health operations' procedures and use of resources.

In addition to that, the 'use of laparoscopy' requires additional training for health professionals and investment in resources (i.e. equipment and tools). One of the main limitations surrounding laparoscopic procedures was limited number of skilled professionals resulting in limited 'hands on' training opportunities for junior doctors, as mentioned by consultant surgeons in this study. Considering the full service operations cycle, this has an impact on the capability and resources available caused by a narrow pool of limited number of experienced staff who can lead and participate in laparoscopic surgery. The absence of experienced staff and lack of training would impact the decision of the specialist at the decoupling point to undertake such an operation. This is in line with Rahminia and Moghadasian (2010) who states that "the ability of the service supply chains to respond quickly to different needs of the patients making the organization to invest on this aspect by employing the most skillful staff and holding training courses". The absence of well trained staff is one of the capacity limitations surrounding the decoupling point. This is the second external factor that affects people and therefore the analysis of the decoupling point.

5.4 Limitations

This study had limitations in the areas of qualitative aspects of services. It was not possible to collect data and investigate issues such as patient care and safety, hospital acquired infections and errors, patient and user satisfaction issues. Further research could attempt to include these aspects as well so that combined influence of financial, operational and qualitative measures could be considered simultaneously in decision making and therefore in decoupling points.

6. Conclusion and Implications

The study concluded that purposefully designed reference models can help improve integration between the processes, technology and people components of service operations. They have a potential to help document details of each sub processes so that people at different parts of the organization can become aware of technological and process related necessities of the service. It does then also become possible to document and consider the influence of other factors that are outside the organization but have a considerable impact on people and their judgments.

The case study highlighted the critical importance of people's reasoning in decision making at decoupling point. It concluded that different employee groups could be under influence of different external factors that affect their operational decisions. For example; clinicians in the case study were impacted by application of laparoscopic surgery only and open surgery not being offered in some other countries health systems. Whereas managers were influenced by financial regime and the need to keep open surgery on offer to maintain financial balance at the centre. Those indicated that external factors impact people's managerial decisions and these external factors are not always consistent. This issue should be considered carefully when dealing with managerial dilemmas where further research could be undertaken.

The study of interrelationships between processes, technology and people through a reference model indicated the crucial role of people and their apparent strong influence to realise 'change' in processes. It is also these people that learn and use the technology so therefore technology became an important intermediary in analyzing the managerial dilemma.

As in the case study dilemma; laparoscopic surgery should be discussed with all its pros and cons and whether any external factor (e.g financial regime) need to be adjusted accordingly would remain again in the hands of people. These people with different expert knowledge that the processes require, should together attempt to resolve managerial dilemmas by referring to changing technological needs and changing processes. Purposefully designed reference models could be an important mechanism for such efforts to achieve change in processes.

7. Future directions

This study was undertaken at a health center which provided the same treatment that 25 other centers located in UK specialized to do. Therefore, it might be probable that these other centers were facing similar management and operational dilemma. An investigation into this issue would be useful. Combined results of another similar study would help to provide some policy guidance on performance management issues covering financial and operational aspects of public sector management in general and health services management in particular.

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