16. Technology, Innovation and Supply Chain Management
Competitive

The Development of a Typology for the Management of Healthcare Improvement Events

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The Development of a Typology for the Management of Rapid Process Improvement Workshops in Healthcare

ABSTRACT: The provision of healthcare is complex. In manufacturing there are many well established typologies that can be used to select appropriate technologies and systems. Interest has grown in the design and delivery of services, typologies, and other approaches from manufacturing. There has been an increased focus on continuous improvement in healthcare with Lean being adopted to improve quality, patient safety, stakeholder satisfaction and efficiency. This paper develops a typology to help manage 'standardised' Rapid Process Improvement Workshops deployed as part of a Lean programme. In order to manage (future) workshops effectively, the typology will allow healthcare professionals to identify what workshops have been undertaken. Managing improvement activities is necessary for determining the success of particular events and whether the desired benefits have been achieved.

Keywords: continuous improvement; lean production; operations improvement; process improvement team; quality management; service industries

INTRODUCTION

There has been an increased focus on continuous improvement in healthcare, which seeks to improve quality, patient safety and stakeholder satisfaction and efficiency (Morrow, Robert, Maben, & Griffiths, 2012). Healthcare spending increased by an average of 74% in real terms between 1990 and 2008 in Organisation for Economic Co-operation and Development (OECD) countries (OECD, 2011). In 2008, this accounted for an average of 15% of general government spending (OECD, 2011). Immediately after the 2008 economic recession, spending on healthcare levelled off before slowing quite dramatically in 2010 (OECD, 2014). In 2012, health spending began to rise again (in nominal terms) and continues to rise to this day (OECD, 2014). Population aging, rising costs and new technologies are putting upward pressures on healthcare budgets (Bloom, Canning, & Fink, 2010). Continuous improvement of healthcare 'systems', therefore becomes a key operational process.

Toyota (see Spear & Bowen, 1999; Sugimori, Kusunoki, Cho, & Uchikawa, 1977) is viewed as the pioneers of Lean, which adopts 'Kaizen' as part of the philosophy of Lean (Brunet & New, 2003; Suarez Barraza, Smith, & Dahlgaard-Park, 2009). In Japan, Kaizen is realised through a combination of Quality Control Circles (QCCs) (Japan Human Relations Association, 1997), *Teians* (individual suggestion schemes), Total Quality Control (TQC) and labour relations (Imai, 1997). Japanese *Kaizen*, is never ending

(Bond, 1999, p320), hence is continuous (Imai, 1986). Research has been undertaken to understand how 'Kaizen' style improvement workshops have been adopted by other manufacturing organisations outside of the automotive sector (Herron & Braiden, 2004; Herron & Braiden, 2006; Herron & Hicks, 2008). Such events are undertaken as part of Lean programmes as a standardised way to bring about improvements as well as monitor how the improvements have been embedded and sustained over a period of time. Research is now being undertaken to identify how service operations can adopt such 'Kaizen' style events (usually as part of Lean programmes), normally referred to as Rapid Improvement Events (RIEs), or Rapid Process Improvement Workshops (RIPWs) (for example, Boyer, 2002; Radnor, Holweg, & Waring, 2012; Thompson, Wolf, & Spear, 2003; Upton, 1996) as part of a Lean service production system.

This paper develops a typology specifically for RPIW events undertaken in healthcare. This paper, therefore, asks what typology can be developed for the purpose of exploring and categorising rapid process improvement workshops in healthcare? This paper begins by evaluating current and historical manufacturing typologies and taxonomies that have been developed in the area of operations management. The second section explores the development of typologies. The third section investigates rapid process improvement workshops (RPIWs) and their use in healthcare. The fourth section develops a typology for the management of Rapid Process Improvement Workshops (RPIWs) in healthcare. Finally, the fifth section concludes the paper.

LITERATURE REVIEW – MANUFACTURING TYPOLOGIES AND TAXONOMIES

A look at the literature demonstrates a number of models that can be used to classify an organisation's operations functions. Whilst these literatures focus primarily on the manufacturing sector, there is nothing to indicate that they are not applicable to services, specifically healthcare. It is argued by Bozarth and McDermott (1998), however, that these models could take the form of either a typology or a taxon, with the difference being the purpose of the model, the characteristics, and the theory applied to them. This difference seems to be more philosophical than operational, however, it is important that these distinctions are understood. The characteristics of a typology relate to producing a grand theory that can be applied to each type that is also empirically testable. In contrast, a taxon uses existing theory to classify and

categorise the variables under investigation that attempts to provide an insight into the area of investigation (Bozarth & McDermott, 1998).

Miller and Roth (1994) viewed taxonomies as a useful way of discussing and learning about organisations. For example, they see the outcome of a taxon as a way at looking differently at structures from the view of the operations function as opposed to the organisational perspective. Looking closer at these definitions, it seems that the process of developing a typology or taxonomy relates to how the model will be tested. A typology is argued to be tested by looking at the alignment between the organisation and the type under consideration to see if it leads to greater effectiveness, whilst taxonomies look at the stability of the groupings through the data that is collected (Bozarth & McDermott, 1998). The development of a typology therefore takes a more inductive approach, whilst applying data to the created typology, creating a taxon, is more deductive in nature.

Historical Typologies

Developing a typology relates to arranging elements into a classification scheme that has a few number of categories (Adam, 1983). It is proposed that organisations could be used as classification criteria. Organisations can be looked at similarly to other elements that can be classified in either natural or social science terms, as organisations can contain similarities as well as differences (Mills & Margulies, 1980). This grouping around common traits and other characteristics is a good form of inquiry, especially when it concerns looking at manufacturing classifications (Safizadeh, Ritzman, & Mallick, 2000). Mills and Margulies (1980) pointed to the success typologies have played in developing and building theory. Typologies encourage thinking around a classification as the elements have been reduced to a more manageable form or 'ideal type' (Bozarth & McDermott, 1998; Mills & Margulies, 1980). This approach would be useful for looking at the operations of improvement events in hospitals.

Skinner (1974) called for the development of the focused factory. The focused factory concentrates on five characteristics as part of its operations. These characteristics include process technologies (either proven or unproven), market demands (quality requirements, price per unit, lead time), product volumes (a consistent

approach to producing products), quality levels (the attitude placed on issues associated with quality inspections) and manufacturing tools (where a factory must be excellent to be able to compete) (Skinner, 1974, pp. 115-116). A number of typologies have been developed from the area of manufacturing by focusing on a limited number of variables that Skinner (1974) identified, that is, volume, cost, and flexibility, against the type of operation the organisation adopted, for example, job shop, batch, line flow, and continuous flow (for example, Hayes & Wheelwright, 1979; Hill, 1994; Safizadeh et al., 2000; Woodward, 1965).

This historical review has identified the usefulness that typologies can play in helping organisations focus on particular aspects of their operations. The problem identified seems to be one of focus. If it is possible to group a few characteristics together and create a typology, then the process of identifying any problems, similarities, and differences becomes simple. Organisations are more complex than that, especially when different goods are produced and different services offered. This has led to a variety of different typologies being developed to try and help. If a typology is to be developed for the purpose of classifying healthcare system improvements, a review on the typologies developed would be a good place to start.

TYPOLOGY DEVELOPMENT

With the number of typologies that have built on or adapted the work of Woodward (1965), Burbidge (1978), and Hayes and Wheelwright (1979), it is perhaps important to start looking at typology development from here. Bozarth and McDermott (1998), however, have provided a good review of manufacturing strategy configurations and in their table, they are able to split work out into taxonomies and typologies, and focuses on the level of analysis (for example, the firm, strategic business unit, plant etc.) as well as the environmental and internal fit.

Woodward (1965) looked to the relationship between organisational structure on performance, whilst Burbidge (1978) was concerned with production flows, and Hayes and Wheelwright (1979) focused on the products produced and their variety. The research of Woodward (1965) aimed to investigate if a particular form of organisation was related to efficiency and success in the market place as well as how the

organisation and operation of the manufacturing firms was set up. The characteristics adopted to look at this issue were: unit and small batch; large batch with unit; large batch and mass; large batch with process; and process on its own – as well as whether an organisation is predominately: a line organisation; a functional organisation; or a line-staff organisation. The work of Burbidge (1978) developed an arbitrary classification of seven main types of production processes which included: line production; line batch production; group batch production; functional batch production; line jobbing production; group jobbing production; and functional jobbing production. These characteristics were compared with the batch frequency (for example, order, run, transfer, set-up), and whether these were produced in low, medium, high, or very high volumes. In comparison, Hayes and Wheelwright (1979) investigated the product life cycle stage in terms of volume characteristics, which included: low volume – low standardisation (one of a kind); multiple products (low volume); fewer major products (higher volume); high volume – high standardisation (commodity products) and mapped these against the process life cycle stage: jumbled flow (job shop); disconnected line flow (batch); connected line flow (assembly line); and continuous flow. The characteristics adopted by all of these works are clear to understand, which is perhaps why they are heavily referenced and used. Research has been conducted that builds on these works. For example, Hull and Collins (1987) build on the work of Woodward (1965); whilst Hicks, McGovern, and Earl (2001) adopted the work of Burbidge (1978); and Brown and Bessant (2003) adapted the work of Hayes and Wheelwright (1979).

This review has drawn together a number of works that have created specific typologies. This review is not presented as a systematic literature review but demonstrates that typologies have been created and can be applied to products and services in order to aid decision making and/or help management focus on particular priorities. It may be beneficial to think of these works adopting a 2 by 2 grid, or plotting elements on a graph across an ‘X’ and ‘Y’ axis. It must be remembered, however, that organisational life is more complex than a simple matrix or a grid may portray (Arlbjørn, Freytag, & Haas, 2011), as capturing actually what happens within the ‘production process’ is difficult (Kim & Lee, 1993).

RAPID IMPROVEMENT EVENTS (RIE) AND THEIR USE WITHIN HEALTHCARE

Toyota used the Rapid Improvement Workshop, or what is sometimes called a 'Gemba Kaizen Event' to eliminate waste in the value stream (Boyer, 2002). This approach can be beneficial when applied to healthcare if more people are requiring access to services due to an aging population as well as continued rising costs, which need to be met by healthcare budgets (Bloom et al., 2010). These features can also relate to issues associated with quality, cost and delivery, which are metrics manufacturers are always trying to manage (Department of Trade and Industry., 2002). As a consequence, a programme seeking to make substantial and rapid improvement through the people undertaking the work (Boyer, 2002), was deemed an appropriate strategy to pursue. Boyer (2002) believed these form of workshops are beneficial, not just because of the improvements they facilitate, but due to raising management awareness and a focus on assessment and planning before the workshop commences.

This paper will not provide an in-depth history of the MasterClass, but readers are pointed towards the work of Bateman and SMMT Industry Forum (2001), Bateman (2005) and Bateman and David (2002). Readers may also be interested in the work of the Lean Enterprise Research Centre at Cardiff University Business School, who worked with the Society of Motor Manufacturers and Traders (SMMT) Industry Forum, and the Department of Trade and Industry (DTI), to investigate how Continuous Improvement (CI) initiatives (see Bateman & SMMT Industry Forum, 2001) could be spread and sustained over time. To summarise, Bateman (2005) described the MasterClass as involving four stages. These stages include a diagnostic, a workshop, some form of follow-up and post follow-up (Bateman, 2005). A diagnostic investigates what needs to be undertaken in the area identified for improvement – this can include collecting and analysing data, whilst the workshop is when any changes identified will be implemented (Bateman, 2005). The diagnostic and workshop are key activities in demonstrating that individuals are empowered to bring about change in their work environments (Bateman, 2005). The follow-up activities are designed to check the new methods of working have been maintained as well as finalise any issues that may have occurred in the workshop (Bateman, 2005).

As there has been increased interest in using Lean as a method for improving healthcare processes (for example, Ballé & Régnier, 2007; Brandao de Souza, 2009; Fillingham, 2007; McIntosh & Cookson, 2012;

Radnor, 2011; Radnor et al., 2012; Spear, 2005; Young & McClean, 2008, 2009), it is important that learning can be captured around the types of improvements that are taking place. One of the most widely cited examples of Lean in healthcare is the Virginia Mason Medical Centre in Seattle Washington, USA (Bohmer & Ferlins, 2006; Kenney, 2011; Nelson-Peterson & Leppa, 2007; Plsek, 2014; Weber, 2006). Virginia Mason Medical Center developed the Virginia Mason Production System (VMPS) (based on the Toyota Production System). One of the most visible aspects of this 'Lean' programme is the Rapid Process Improvement Workshop (RPIW) and the application of Lean Tools (see Bicheno, 2000). Rapid Process Improvement Workshops (RPIWs), or as has been pointed out, 'Kaizen' events, are undertaken as a standardised way to bring about improvements as well as monitor how such improvements have been embedded and sustained (for example, Bateman & David, 2002) over a period of time. The structure of the Rapid Improvement Events adopted by both the Virginia Mason Production System (VMPS) shares characteristics of the 'MasterClass' approach.

Rapid Process Improvement Workshops (RPIW)

An RPIW is an established part of the Virginia Mason Production System (VMPS), and can be described as a five day workshop (that can include up to six-weeks of preparation time) that aims to get participants to focus on the designated activity or process to improve (Bohmer & Ferlins, 2006; Bush, 2007). Following the example set by Toyota, value-steam mapping is also a key tool used in RPIW's (Bohmer & Ferlins, 2006). Other Lean tools covered by the Virginia Mason Production System (VMPS) are: 5S/ workplace organization (Gapp, Fisher, & Kobayashi, 2008); visual control; Kanban; flow of materials; standard operations; Jidoka; the VMPS House; autonomous maintenance; production levelling; mistake-proofing; and set-up time reduction (Hicks et al., 2012). Similar to the MasterClass, team selection is important. Boyer (2002) argues that a team should include the working members from the area and any wider individuals who are required to support the area, as well as line management of the area, and any else that has detailed knowledge and would positively influence the results of the workshop.

A summary of a typical RPIW can be summarised as being five days in duration and includes: a Sponsor, who is responsible for setting the direction, scope, goals and targets; a Process Owner, who will approve

project goals and targets, as well as negotiating the scope and boundaries – as well as identifying a local process expert to assist with data collection, and is responsible for planning follow up actions; the Workshop Leader, who negotiates direction and scope with the Sponsor and Process Owner, develops the value stream maps, leads the workshop, and schedules 30,60,90 day follow-up events; a Team Leader, who is responsible for planning, logistics and documentation, as well as the collection and analysis of data, and leading and facilitating the team and acting as a facilitator; Participants, who are team members and offer subject expertise; as well as a Sub-Team Leader, who assists the Team Leader; and finally, an Advisory Group, which supports the Team Leader with facilities, tooling and equipment changes as required during the workshop (Hicks et al., 2012). Each RPIW has a mid-week and a final report-out where all RPIW team members jointly present the results of the intervention. This tries to foster teamwork, co-operation, and commitment to bringing about change. These report-outs are based upon a standard framework that includes: an overview (team members, current situation, process flow, TAKT time (Miltenburg, 2001), targets and boundaries); an analysis of standard work; a progress report that measures prior performance and targets (for example space, inventory, staff walking distance, parts travel distance, lead-time, quality, productivity, 5S and set-up reduction) (Hicks et al., 2012). The report-outs should include the value stream map, TAKT time calculations (where applicable) and work flow diagrams that show the status before and after the intervention, as well as a 30, 60 and 90 day follow-up (which forms part of the complete RPIW process). Managing improvement activities is necessary for determining the success of the event and whether the desired benefits have been achieved.

CONCEPTUAL FRAMEWORK – THE DEVELOPMENT OF A TYPOLOGY FOR THE MANAGEMENT OF RAPID PROCESS IMPROVEMENT WORKSHOPS (RPIWS) IN HEALTHCARE

The development of a healthcare typology for RPIW events begins with the work of Woodward (1965) and Burbidge (1978). Whilst focusing on different aspects of an organisation (namely, organisational structure on performance and production by flow types), these authors adopted similar units of analysis. Condensed down, these included line, batch and jobbing. Applying such a classification to RPIW activities could be useful, but may present a number of challenges. For example, what would be constituted as a ‘batch’

process in healthcare? Would it incorporate particular surgical procedures that are categorised as routine, or would a 'batch' process transfer directly to healthcare as the process of conducting laboratory tests in batches? RPIW events are designed to address a variety of identified problems. A simple classification could be used to identify if the improvement addresses issues associated directly to a patient (primary) (namely, an operation for example), indirectly (secondary) (recovery after surgery), or through looking at support functions (tertiary) (for example, improvements to working areas, laundry, supplies etc.). One of these characteristics could therefore create the 'Y' axis.

Adapting a primary, secondary, tertiary classification moves away from the manufacturing perspective by trying to focus more on the activities of healthcare. Whilst these axes could be argued to be interchangeable (i.e., jobbing can be viewed as primary), it is proposed that they will be classifying different activities. The issue becomes one of acceptance to the individuals who may use such a typology (or taxonomy once the data set is applied). If the characteristics of a manufacturing typology are not suitable, what other elements does the typology need to identify. There is a lot of work published in the implementation science area, which looks at specific healthcare improvements. This area is quite wide ranging and incorporates many aspects and facets of healthcare. As a consequence, identifying elements that can be incorporated into a typology becomes very challenging. One response to this may come from a book written by Grunden and Hagood (2012) on Lean-Led hospital design. This would tie in nicely with the principles behind RPIWs. Grunden and Hagood (2012) identified 'seven service families'. These service families were developed in response to grouping hospital functions by department. The seven service families as stated by Grunden and Hagood (2012, p. 60) include: Patient access/intake services-business services; Unplanned/emergency services; Procedural/invasive services; Imaging/diagnostic services; Clinical support services; Operational support services (materials management, IT, environmental services); and Inpatient services. Using these classifications could start to create a typology.

Hayes and Wheelwright (1979) identified that operations that move towards more standardisation are moving towards providing more reliable and predictable products and services at lower costs. This is one planned outcome for RPIW events. Two key points, however, have been identified that look at successful

quality control programmes – in the first instance, defining what is to be monitored and secondly, appropriate data to monitor the improvement programme (Da Silveira, Borenstein, & Fogliatto, 2001). Taking this perspective it becomes clear that what the RPIW activities are 'monitoring' relates to the metrics identified and collected as part of the RPIW process (which can include: Space, Inventory, Staff walking distance, Parts travel distance, Lead time, Work in process (WIP), Standard work in process (SWIP), Quality defects, Productivity gain, Environmental Health and Safety (5S) and Set up Reduction). This could provide a further characteristic of a suitable typology is being looked for in this work. If the typology demonstrates that staff walking distance is the primary metric collected, it may allow more focused improvement activities around the flow of particular departments that may not have been considered. This could represent the 'X' axis. The problem then becomes one of key metric identification. For example, a number of metrics may be important for a particular RPIW, therefore, identifying just one to use in order to categorise the RPIW may be difficult. This inclusion of RPIW metrics, however, could be important in communicating the usefulness of the typology. Until data is collected and applied (to create the taxonomy), it is unknown how helpful including these metrics will be. As a consequence, a typology that incorporates these metrics as well as the seven service families could look like Figure 1 (with arbitrary data points used to demonstrate how the typology could look).

Insert Figure 1 about here

Another characteristic that could be included in the typology is the aspect of sustainability of the RPIW. For example, an RPIW would have been initiated to bring about change and try and embed improvements within the area. In some cases this may not happen. Exploring, therefore, if particular improvements are able to be monitored and measured through 30, 60 and 90 day follow-ups (as is standard procedure for RPIWs) would be useful to know. A potential problem of adopting this characteristic would relate to knowing precisely why a follow-up was not undertaken. This could be down to time pressures, difficulty of the improvement event, or the RPIW paper work not being available. In order for the typology to be useful, understanding the reasons why a follow-up did not occur might be important. Unfortunately, the RPIW will not reveal this answer. What the typology could identify is how far in the follow-up process did the RPIW progress to. For example, if the 30 day follow-up had not been completed this could be

captured. This would allow managers to identify if there are any particular patterns occurring between the types of improvements attempted and the lack of follow up activities that may occur.

If the typology could be extended to capture the follow-up activities, the service used (the 'Y' axis) would need to be consistent. If this could be resolved, the problem then becomes one of complexity. One way to do achieve this and reduce any complexities could be to present the typology through a two-by-two format, similar to the way Krafcik (1988) did. Bozarth and McDermott (1998) implied, a typology of this nature is trying to incorporate multiple elements. Only by adopting multiple elements might a typology for the development and classification of healthcare system improvements be created and be useful. By using multiple elements does provide synergy with the work of Krafcik (1988), as one of the characteristics he was classifying was the Toyota Production System (TPS) approach (Lean) to manufacturing. An example of the development of a healthcare typology is shown in Figure 2.

Insert Figure 2 about here

Figure 2 seeks to demonstrate one possible way a typology could be developed for the development and classification of healthcare system improvements. Figure 2 is one of three identified versions of a suitable typology. This work set out to explore if a manufacturing typology could be used to help with this process. The 'X' axis of the typology was populated with the metrics that associated RPIWs are designed to collect, whilst not perfect (as RPIWs may collect and focus on more than one metric), this was deemed a good place to start. It was identified that the work of Woodward and Burbidge developed processes around Jobbing, Batch and Flow. This approach was raised questions around classifying healthcare improvements against these criteria. As a consequence, a more straightforward classification of primary, secondary and tertiary was also discussed. This second classification may engage healthcare professionals' more than jobbing, batch and flow classifications, but unhelpfully may end up with a lot of the data clustered together around one of the classifications. This would result in an unhelpful typology. A third option was presented from within the healthcare setting based around hospital functionality rather than departments. This then moves away from the manufacturing aspect all together. Each of the typologies could be argued to represent the areas of manufacturing, service and healthcare. This paper started to explore if a manufacturing typology could be used to help with the development and classification of healthcare

improvements. Whilst there is strong body of knowledge that has been developed in this area, it will be the acceptance of any typology to the 'users' that will determine its success. It is proposed, therefore, that data needs to be collected from improvement events, by collecting such data and applying it to the typologies, will create a taxon of healthcare improvements. This will allow the identification of the most useful typology for the development and classification of healthcare system improvements.

CONCLUSIONS

This paper began by highlighting the need for an increased focus on continuous improvement in healthcare. A key method adapted to aid in this quest, primarily developed in the manufacturing sector, and now being applied to the area of healthcare is Lean. Kaizen style 'MasterClass' workshops called Rapid Process Improvement Workshops (RPIWs) have been developed as a key method in facilitating this transfer. In order for healthcare providers to strategically monitor and target what type of RPIWs should be undertaken, this paper focussed on generic typologies of manufacturing systems that can be used to create a typology of such improvement events.

Through a review of manufacturing typologies, it was identified that there is a difference between a typology and taxonomy. This paper sought to develop a typology firstly. This typology investigated the characteristics of the Rapid Process Improvement Workshop (RPIW). Building on the typology work developed from the manufacturing sector, the processes of Jobbing, Batch and Flow were identified as approaches that other authors have adopted within their typologies. A second perspective was based around a second simpler classification, identified as primary, secondary and tertiary forms of care. A final concept was introduced based around service families for healthcare classifications. It was not clear which approach would be more beneficial to adopt but adopting the seven service families with the data collection metrics seemed the most logical. A second typology was argued to be required to be joined with any of the three other typologies to explore the follow-up procedure an RPIW should follow. The development of any typology needs to be exclusive, internally consistent, capture all elements and be relevant (Kim & Lee, 1993). This is the biggest issue for this typology development. As has been pointed out by Bozarth and McDermott (1998, p. 431), '*taxonomies are 'empirical' while typologies are*

'conceptual". This paper finished by proposing that the possible typologies developed (conceptual) need to be tested with data collected (empirical). A follow up to this work will collect and apply data to create a taxon of healthcare improvements.

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Figure 1: A typology of healthcare improvements based on the seven service families

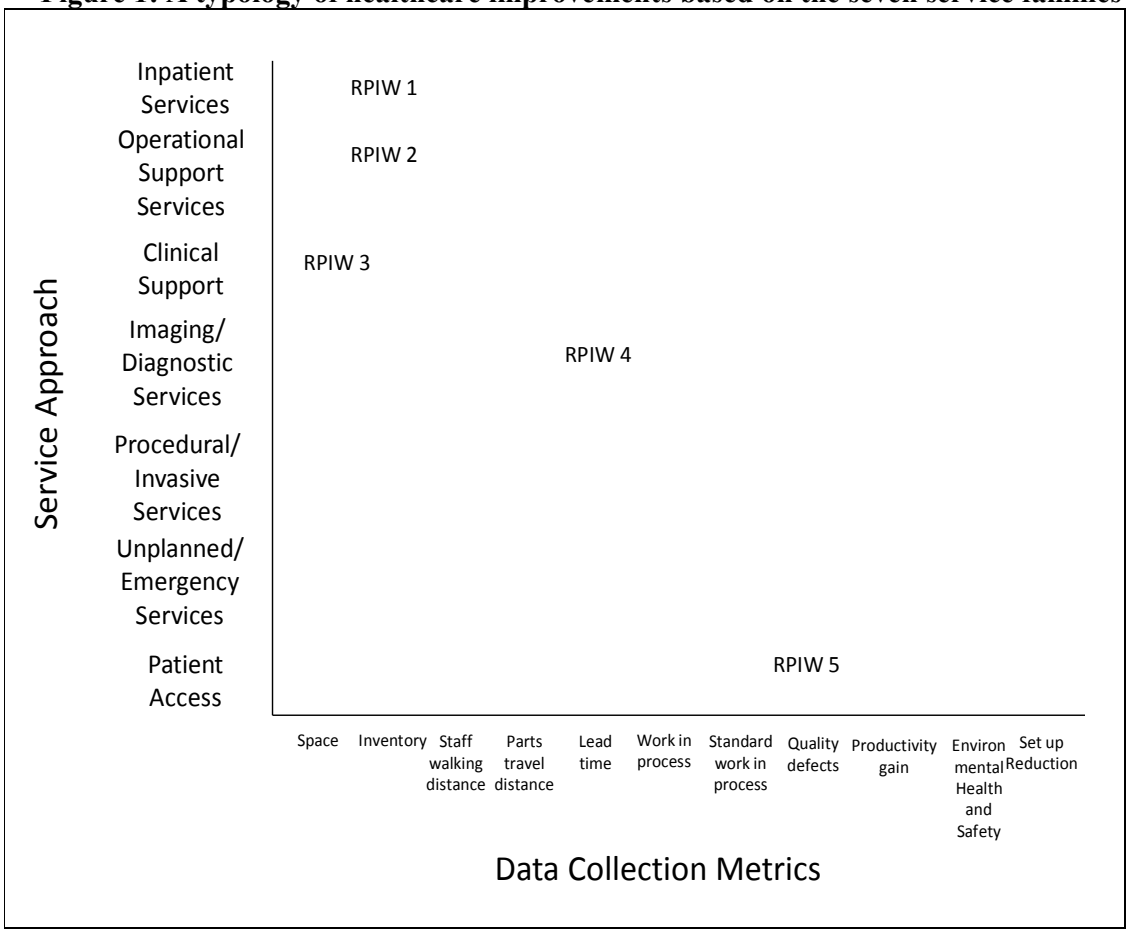
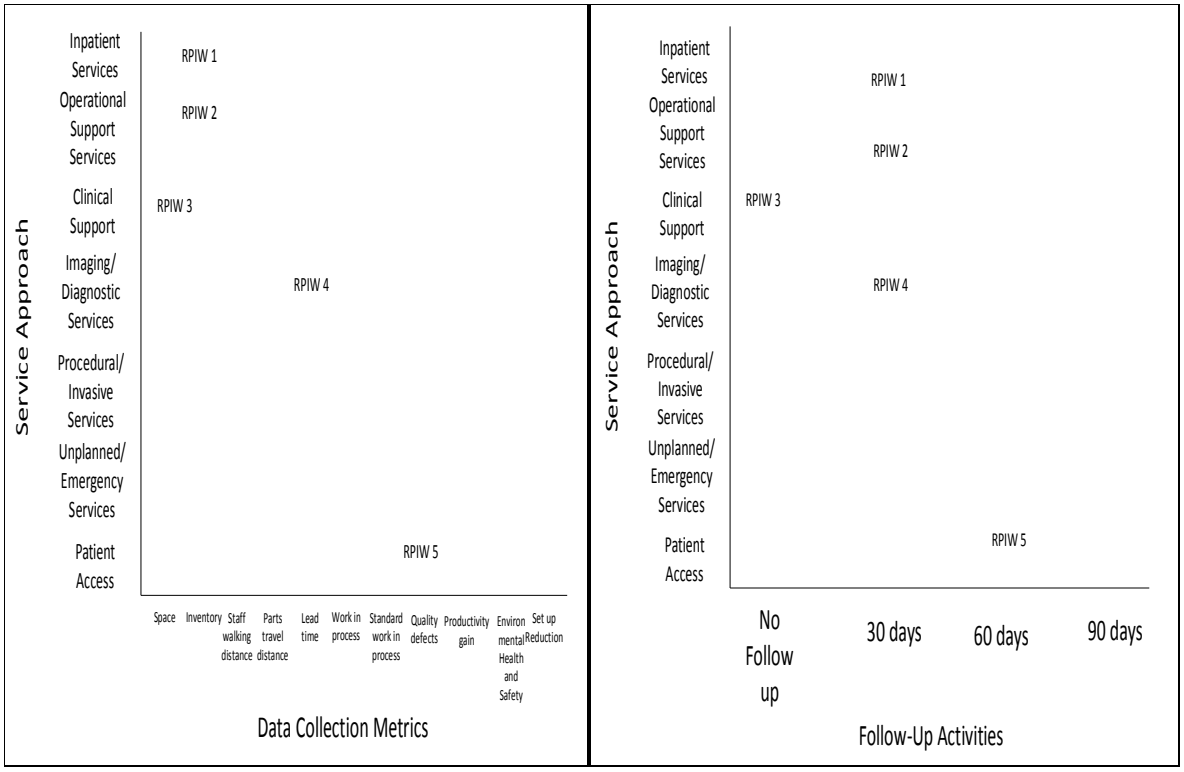


Figure 2: The development of a typology for healthcare system improvements


Service Approach
Inpatient Services
Operational Support Services
Clinical Support
Imaging/ Diagnostic Services
Procedural/ Invasive Services
Unplanned/ Emergency Services
Patient Access
RPIW 1
RPIW 2
RPIW 3
RPIW 4
RPIW 5
Space
Inventory
Staff walking distance
Parts travel distance
Lead time
Work in process
Standard work in process
Quality defects
Productivity gain
Environ mental Health and Safety
Set up Reduction
Data Collection Metrics
Service Approach
Inpatient Services
Operational Support Services
Clinical Support
Imaging/ Diagnostic Services
Procedural/ Invasive Services
Unplanned/ Emergency Services
Patient Access
RPIW 1
RPIW 2
RPIW 3
RPIW 4
RPIW 5
No Follow up
30 days
60 days
90 days
Follow-Up Activities