Stakeholder dynamics and the implementation of process innovations: the case of Lean thinking in a UK NHS Hospital Trust

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Abstract: This paper addresses the dynamics and mechanisms underpinning the trajectories and outcomes of process innovation. It deploys actor-network theory to explore the role of emergent stakeholder dynamics and networks in shaping the trajectory and outcomes of a project to implement Lean thinking (Lean) in a theatres unit of a UK National Health Service hospital. It traces the process of network formation, stabilisation and maintenance over time, and shows that different meanings for Lean become manifest during the implementation process, manifested through the emergence and mobilisation of a global and a local network that interact with each other using the project as a negotiation space in order to achieve their diverse interests.

Keywords: actor-network theory; healthcare; Lean thinking; process innovation; stakeholder dynamics.

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1 Introduction

In recent years, the turbulent healthcare environment has been accompanied by urgency for innovation and change in the health services. Governments, managers and clinicians are investing financial and human resources in the development of innovation. While increasing attention has been paid to such initiatives and their potential role in improving the lot of staff and patients, there is a limited understanding of how to ensure their adoption (Savitz, Kaluzny and Kelly, 2000).

This paper is concerned with the implementation of Lean thinking (Lean) (Womack, 1990; Womack and Jones, 2003) as an innovation in healthcare (e.g. Glossman et al., 2000; Silvester et al., 2004; Tragardh and Lindberg, 2004; Tolkki and Parvinen, 2005). Extant literature emphasises the appropriateness of Lean for public sector service delivery (Walley, 2004; Radnor et al., 2006), but its implementation remains a challenge.

The literature highlights the organisational complexity inherent in Lean implementation and underlines the importance of stakeholder[1] engagement, networks and policy alignment for the success of Lean and innovation projects (Van de Ven et al., 1999; Newman, Raine and Skelcher, 2001; Crowley et al., 2002; Hines et al., 2006; Hodgson et al., 2007). However, it is relatively sparse in its elucidation of the dynamics and mechanisms underpinning the trajectories and outcomes of Lean and process innovation in general (Pettigrew, Woodman and Cameron, 2001). Apart from a few exceptions (e.g. Tragardh and Lindberg, 2004), it does not sufficiently address the role of emergent associations between diverse stakeholders and underlying technologies/processes (dynamics) in shaping the trajectories and translating the meaning of innovations in specific contexts. Aiming to address this paucity in the literature, we explore the role of stakeholder associations in shaping the trajectory of Lean implementation in the operating theatres (theatres) unit of a hospital in the UK National Health Service (NHS). We draw on actor-network theory (ANT) (Callon, 1986; Latour, 1986, 2005; Law, 1992; Law and Callon, 1992; Law and Hassard, 1999) and Law and Callon's (1992) local/global network framework to follow the dynamics of stakeholder interactions and associations and the emergence of the project trajectory. Our findings suggest that the meanings attributed to Lean and the implementation trajectory emerge from dynamic stakeholder associations, manifested through the emergence and mobilisation of a global and a local network – as an outcome of these associations– that interact with each other using the project as a negotiation space in order to achieve their diverse interests.

The paper is structured as follows. Sections 2 and 3 introduce Lean and an overview of ANT, and Section 4 presents the research methodology followed. The results of the case study are presented in Section 5, with discussion and concluding remarks in Section 6.

2 Process innovation in healthcare

Innovation in healthcare can be broadly defined as

> "… a novel set of behaviours, routines and ways of working that are directed at improving health outcomes, administrative efficiency, cost effectiveness, or users' experience and that are implemented by planned and coordinated actions." (Greenhalgh et al., 2004, p.582)

Our focus is on implementation of process innovation, which may change stakeholder roles, rules, procedures, structures and communication, and affect their interaction with the external context (Walker, 2006).

Process innovation is a long-standing focus of scholarly work, and many different theoretical positions are evident in the literature. For instance, attention has been paid to external and internal receptivity to innovation and change (Pettigrew, Ferlie and McKee, 1992; Van de Ven et al. 1999; Newton et al., 2003), innovation fit (Rogers, 1995; Ferlie et al., 2005), foci of professional knowledge (Champagne et al. 1991; Goes and Park 1997; Fitzgerald et al., 2002; Rashman and Hartley 2002; Newton et al., 2003;) and absorptive capacity (Ferlie et al., 2005). Of particular prominence are studies that focus on the social network perspective to innovation implementation (Westphal, Gulati and Shortell, 1997; West et al., 1999; Borgatti and Foster, 2003; Brass et al., 2004; Addicott, McGivern and Ferlie, 2007; Provan et al., 2007) in which networks are seen as communication channels through which knowledge or working practices are disseminated, network-based organisations (Bate, 2000; Pettigrew and Fenton, 2000), and Communities and Networks of Practice[2] (Tagliaventi and Matarelli, 2006; Ormrod et al., 2007).

However, generally, the social network perspectives focus on the structural properties of networks and assume their *a priori* existence and influence, among other factors, on shaping the innovation process and possible outcomes. These studies pay little attention to the role of heterogeneous actors and their associations in facilitating or restricting new forms of interactions/associations within networks that may span professional communities (Boland and Tenkasi, 1995) and the local organisational context, nor to the activities of individual actors–entrepreneurs who are embedded in such structural arrangements (Boland, Lyytinen and Yoo, 2007). From a methodological perspective, this strand of research does not often suggest a thorough analysis of the process in which networks come into being and give rise to innovation in practice. The use and study of variables and their impact on the structure of organisational networks do not address explicitly the processes of 'how' and 'why' specific phenomena take place, nor the processes of network creation and dissolution (Fulk, 2001). Furthermore, these studies, apart from few exceptions (e.g. Czarniawska and Sevón, 1996; Tragardh and Lindberg, 2004), do not focus on how different meanings may be constructed during innovation implementation and how issues, such as the power over meaning in innovation, are brought into the analysis (Swan and Scarbrough, 2005; Ormrod et al., 2007). They tend to

view the process of innovation as a directed phenomenon, and tend not to address how an innovation is translated into something that was not originally envisaged, or explore innovation implementation in healthcare as a dynamic process in which meanings are framed and reframed at different levels (micro, meso, macro) (Pope et al., 2006).

Therefore, there is a need to account more fully for the complex patterns of innovations, using language that allows articulation of diverse heterogeneous actors' interpretations of innovation and their individual motivations, as well as the way these actors are associated and influence the trajectories and outcomes of innovation and its subsequent implementation and spread in the organisations, and paying attention to the process and dynamics that are manifested in networks and shape innovation (Hislop et al., 2000; Swan and Scarbrough, 2005). Additionally, the recognition that time must be explicitly incorporated into the study of innovation and change (e.g. Orlikowski, 1996; Van de Ven et al., 1999; Pettigrew, Woodman and Cameron, 2001) creates a need to conceptualise and study the *emergent* dynamics of stakeholder associations over time. These concerns motivated our approach in this study of Lean implementation.

2.1   Lean as process innovation in healthcare

Lean can be traced on innovations at Toyota Motor Corporation (Monden, 1983, in Hines et al., 2006). In the NHS context, it denotes both an innovative philosophy/strategy and a set of principles/practices for improving the quality of healthcare services. Its principles in the public sector involve the identification of citizens' definition of value, the creation of end-to-end primary processes to design, deliver and support this value with minimum waste, and the establishment of a management system to improve and sustain these processes and organise people over time (Womack, 1990; Womack and Jones, 2003; Radnor et al., 2006). It is perceived as a radical techno-organisational innovation, promoting changes not only in processes but also in structure, strategy and culture (Bhasin and Burcher, 2006). Its implementation is conceived a continuous journey rather than a fixed point transformation (Karlsson and Ahlstrom, 1996; Rees, Scarbrough and Terry, 1996).

Lean is currently at the forefront of innovation for healthcare services, following the implementation of other initiatives borrowed from the private sector, including total quality management (Dean and Bowen, 1994; Hackman and Wageman, 1995; Shortell et al., 1995; Westphal, Gulati and Shortell, 1997) and business process re-engineering (McNulty and Ferlie, 2002, 2004). In healthcare, over the last years, a proliferation of Lean applications has taken place (e.g. Glossman et al., 2000; Walley et al., 2001; Silvester et al., 2004; Tragardh and Lindberg, 2004; Tolkki and Parvinen, 2005; Kollberg et al., 2007; Essain, Williams and Massey, 2008; Lodge and Bamford, 2008; Papadopoulos and Merali, 2008; Proudlove, Moxham and Boaden, 2008), with the aim of putting the patient/customer at the centre and creating outcomes such as low waiting times and improved medical quality and patient satisfaction. The literature (Hines et al., 2006; Kaplan and Rona, 2004) also stresses the possibility of combining Lean with other approaches in practice, and in particular Six Sigma[3] (Bossert, 2003; Dahlgaard and Park Dahlgaard, 2005; George et al., 2005), but there is no consensus among practitioners on how they should be used (Proudlove, Moxham and Boaden, 2008). Our focus is on Lean, as it is currently the main focus of attention in the health services and in UK NHS in particular, coupled with the prevalent

view that "there is undoubtedly huge potential for wider use" (Proudlove, Moxham and Boaden, 2008, p.33). However, over the last years, despite its popularity, Lean has been seen as an operational technique, and until recently its strategy and scope aspects have tended to be ignored (Hines et al., 1996).

Popular Lean methods include value stream mapping (VSM) and rapid improvement event (RIE). Typically, VSM is used to analyse the flow of patients, information and resources and generate ideas for process redesign; it highlights areas where activities consume resources but do not add value from the citizens' perspective (Radnor et al., 2006). It enables the alignment of healthcare processes by organising the requisite processes so as to facilitate the flow of patients and information. RIE commonly comprises a workshop to make small and quick changes in three phases, comprising a preparation period, followed by a 5-day event to identify changes and a follow-up period when changes take place (Laraia, Moody and Hall, 1999).

The literature on Lean argues that any organisation can gain substantial benefits, including improved quality, reduction in waste and unit costs, increased responsiveness (e.g. Sohal and Egglestone, 1994; Swank, 2003; Spear, 2005; Radnor et al., 2006) and better planning of service operations (Kollberg and Dahlgaard, 2005) through Lean implementation. Hence, the success of Lean implementation in the public sector depends on the organisational readiness to take on board change; the nature of the processes involved, e.g. 'high-volume and low-variation' projects that involve standardised processes may be more successful than 'low-volume and high-variation' projects (Jones, 2004); the experience of public sector in driving continuous change through bottom-up approaches (Sanderson, 2001); the full support and long-term commitment of managers and staff (Lucey et al., 2004; Bhasin and Burcher, 2006); and an organisational culture that leverages communication (Hines, Holweg and Rich, 2006; Radnor et al., 2006). Consequently, Lean is not an invariable concept but dependent on the context and stakeholders who will adopt and adapt it to their everyday working practices (Rees, Scarbrough and Terry, 1996).

However, Lean in healthcare has mostly been applied in non-patient areas, which some have argued resemble a manufacturing processes' context (Radnor and Boaden, 2008). The academic literature is still in its infancy, and Lean applications have rarely been evaluated from an academic perspective (Proudlove, Moxham and Boaden, 2008). Arguably, there is a lack of width and depth of understanding of Lean implementation in healthcare (Hines et al., 2006; Radnor et al., 2006). Moreover, the literature on Lean implementation recognises interactions between the context, stakeholders and their adaptation of Lean to their everyday working practices as germane to the success of Lean implementations (Rees, Scarbrough and Terry, 1996), but does not deal significantly with the mechanisms that shape their trajectory. The next section introduces ANT as a means to address this gap in the literature.

3   Theoretical approach: ANT

ANT (e.g. Callon, 1986; Latour, 1986, 2005; Law, 1992; Law and Callon, 1992; Law and Hassard, 1999) focuses on the constitution/construction of innovations (Munro, 1995; Harrison and Laberge, 2002), "which involve both forms of adaptation, co-operation and accommodation, as well as conflict" (Harrison and Laberge, 2002, p.500). It has been employed in healthcare to examine clinical budgeting (e.g. Preston et al., 1992) and the

introduction of technologies in UK NHS (e.g. Silva and Backhouse, 1997), to analyse professionalism and the changing configuration of professional–managerial relations within an acute hospital (Dent, 2003) and recently in evaluating a national medical e-prescription system (Hypponen et al., 2007).

ANT characterises networks of associations (interactions) in innovations, how they are composed, their emergence over time, their construction and maintenance, how they compete with other networks and how they are made more durable over time, influencing the meanings, trajectories and results of innovations. It is based on the idea that actors owe their position and power to a network in which they are related (Nicolini, 2009). ANT suggests that innovation rarely lies in the hands of individuals or 'heroes,' but that it is attributed to a complex assemblage of human and non-human elements that need to be considered as heterogeneous and agential configurations (Dopson, 2005). Hence, innovation is constructed of these assemblages, and its implementation (construction) depends on its "symbolic, interpretive or material transformation" (Nicolini, 2009), as to implement and transfer is to transform.

ANT brings together human and non-human, social and technical factors into the same analytical view. The term *actor* in ANT embraces all human and non-human (e.g. the technology and artefacts associated with Lean implementation) factors that are implicated in implementation of technologically based projects. This is consistent with the wider sociotechnical tradition where technology is treated not as an inert object, but as something that both shapes and is shaped by its context of use and the actions of its users.

In our case, human stakeholders, medical technologies, documents, workshops and processes (non-human stakeholders), which are significant in implementing Lean, are captured in the analysis. These various heterogeneous elements constitute 'actors' that are constantly manifested and shaped in actor networks through a process of translation. Hence, an actor network is a dynamic, actively shifting alliance of actors that generates and reproduces itself recursively, depending on the actions of the actors and actor networks that it is constituted from.

ANT recognises that the diverse actor agendas will affect and be affected by the implementation of innovations (or, in our case, the implementation of Lean concepts). This is particularly relevant in the case of Lean implementation in the hospital setting where the diversity of actors (from different professional groupings and across different departments) and agendas may result in diverse prescriptions for the constitution and implementation of the Lean concepts (Papadopoulos and Merali, 2008).

An *actor network* is a dynamic, actively shifting alliance of heterogeneous actors. Its evolution depends on the actions and interactions of the actors that it is constituted from. The process of engaging individuals so they become part of particular emerging networks is referred to as *translation*. The underlying principle in ANT is that an actor will become part of a network (i.e. become '*translated into*' the network) because he/she perceives this as being the only means through which his/her own problem can be solved.

Translation, according to Callon (1991), explains how networks are formed and how network constituents change associations and networks, as they change agendas during the implementation process. Translation denotes transformation. This means that as an innovation is implemented, its constitution will be modified or composed by different actors as the process unfolds, translating the original conceptualisation of the innovation into something different, according to their diverse agendas (Latour, 1986). Translation has a threefold purpose (Nicolini, 2009): firstly, to capture the movement of innovation in

space and time through which associations and relations between actors are established; secondly, it denotes that the movement of innovation from one context to another, implying a shift in meaning; thirdly, translation has a political meaning, in that the establishment of associations between actors involves pursuing specific interests, creating differences and sustaining unequal power relationships.

Translation comprises of four steps: *problematisation, interessement, enrolment and mobilisation*.

During *problematisation*, an actor makes an effort to make other actors subscribe to its own conceptions by demonstrating that (s)he has the right solutions to others' problems. The problem is refined in terms of solutions formed by the actor, and the enrolment of the other actors to the proposed solution (so they become constituents of the emergent network) is through the establishment of an obligatory passage point (OPP). Establishing the OPP entails setting conventions, rules, assumptions and ways of operating that have to be followed by constituent actors. The concept of the OPP is a powerful one, as it articulates conscious commitment of actors to specific networks with explicit and visible conditions for coherence within the network.
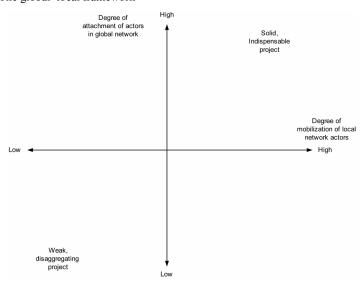
Interessement entails imposing the identities and roles defined for other actors in the *problematisation*, thereby locking actors in the roles proposed for them, so that any already established networks may be replaced by the new network. During *enrolment*, the emergent network is stabilised as actors yield to their defined roles. During mobilisation, the proposed solution gains wider acceptance, becoming taken for granted. Actors in a network are said to be *mobilised* when their investment in the network reaches a point when withdrawal becomes unlikely. The network now behaves as a coherent entity: the identities of the individual actors are no longer discernible, and their stabilised actions and interactions collectively constitute the actor networks, which are the products of translation (Czarniawska and Sevón, 1996).

Translation is fundamental to Law and Callon's (1992) local/global actor-network framework, which deals with Lean multiactor implementation, but has been rarely used in past research, apart from few exceptions (Heeks and Stanforth, 2007). The global network in a Lean project is a set of interactions that comprise the 'outside' of a project, enabling it to take place with the resources provided (money, expertise, executive and political support). The local network is the 'inside' of a project, representing interactions and associations of actors that actually implement the projects. Project documents and deliverables are 'intermediaries' that pass from local to global network actors, while *translation* is the locus that controls the dynamic interactions between these networks.

The trajectory of a project is a function of three interrelated factors: firstly, the capability of the project to be built around a global network that supports the proposed changes, providing (for a time) resources of various kinds in the expectation of an ultimate return; secondly, the emergence of a local network that will implement the project and ultimately offer "… a material, economic, cultural or symbolic return to actors lodged in the global network" (p.46); thirdly, the capacity of the project and its benefits to function as an OPP between the two networks.

The changing strength of the global and local networks over time can be plotted on a two-dimensional graph, with the *x*-axis representing the degree of the local actors' mobilisation, and the *y*-axis representing the extent to which global actors are linked (Figure 1).

Figure 1   The global–local framework

Source: Law and Callon (1992).

Law and Callon's (1992) framework deals with the shifting focus, engagement of actors and trajectory of innovation over time and helps elucidate what, how and why actors behave the way they do. It provides a means of explaining how emerging stakeholder dynamics arise, and how they can be rendered temporarily stable over time, helping to establish Lean. The reason behind choosing *translation* and the *global–local* framework in our case analysis is twofold: firstly to identify the chains of actions and events implicated in the Lean implementation process over time, and secondly, to analyse the diverse actors' actions and agendas and their manifestation in the emergence and interplay of the global and local networks to determine the trajectory, meaning and result of Lean.

4   Research methods

The richness of data required to characterise the actors and their associations and to elucidate the dynamics underpinning the project trajectory dictated the deployment of a qualitative case study research strategy (Lincoln and Guba, 1985; Yin, 1999; Silverman, 2001).

A qualitative, 15-month study was carried out in order to study the implementation of Lean as an innovation in a UK NHS Hospital Trust. Data were collected from a period starting in December 2006 until January 2008. The triangulating sources of data were interviews, observation and documents/records from the Trust, and the researcher kept a diary throughout the research process.

Twenty-three semi-structured audio-tape recorded interviews, 30 min on average, were conducted in three intervals: at the start of the project, during the RIE of the project and during the adoption process. The informants were sampled according to their different posts, seniority and the nature of their involvement in the Lean projects.

Interviewees included administrative, managerial, nursing and medical staff, as well as members of the Board. The majority of interviews were formal, but a few informal discussions were conducted and were kept in notes after the discussions had taken place. The interview questions were mainly about the views of informants with regard to Lean and the way it was implemented, the benefits or drawbacks of Lean for them and their views in respect to the support from the implementers. To get their views in more detail, the researcher also asked for examples with regard to the changes Lean brought (or did not bring) in their working practices. The interviews were transcribed by the researcher immediately after they took place in order to capture the context in which they took place. The researcher also kept notes during the interviews, which were then transcribed.

In keeping with the ethos of ANT, the researcher followed actors in their associations, as visiting (case) construction sites provides an ideal opportunity to observe the connections between humans and non-humans (Latour, 2005). Observations of the way Lean was adopted were conducted, with observation notes kept by the researcher during the process, and transcribed at the end of each observation day. Observations helped the researcher grasp the dynamics between actors during the implementation process and trace any inconsistencies with the interview data.

Relevant written material, including presentations, strategy documents and project plans, were reviewed and studied. The documents were supplied by the Trust and described the positioning of the project within the Trust's structural, policy, strategic and operational landscape, and the benefits accruing from Lean, as well as plans that determined the implementation process and further actions that had to be taken. The documents helped track earlier actions and events that were of crucial importance in understanding the project. Finally, a research diary was kept to record the researcher's daily experience.

Although the research project did not start from the beginning of implementing Lean in the hospital, the researcher got access to the field before the 'black box' was closed (Latour, 1987), that is, when Lean was still controversial and being constructed and reconstructed.

Transcribed data were analysed using NVIVO software.[4] The specific software provided a sophisticated workspace that enabled the researcher to organise, manage and make sense of the information from interview transcripts, observation and documents and helped the researcher to deal with the bulk of data gathered over the fieldwork period. Data analysis involved three interwoven flows of activity: data reduction, data display and conclusion drawing and verification. Data reduction started in the early fieldwork stage and involved selecting, focusing, simplifying, abstracting and transforming the data in the field notes and interview transcripts. Using NVIVO, the researcher conducted content analysis (Miles and Huberman, 1994). Initial codes were assigned to the transcripts based on description; these codes were refined as analysis proceeded through reviewing field notes and interview data, and interpretive codes were assigned, which were later transformed refined into pattern codes (Miles and Huberman, 1994) as the process continued. Themes and patterns emerged, guiding further data collection, and they were further refined in the process. Data were organised and displayed in graphs to aid analysis. The theory-building process – or according to Miles and Huberman (1994) conclusion drawing and verification activity – took place while iterating between field observations and theory. As the study was exploratory, the analysis did not start with any

specific predetermined theory; rather, patterns stemming from the field were compared with theoretical perspectives and the initial theories were revised, modified and/or discarded in the light of field observations (Miles and Huberman, 1994; Langley, 1999).

5   Lean implementation in the Theatres unit of NHSCO hospital

5.1   Case overview: NHSCO hospital

NHSCO is a leading centre for acute care, providing a wide range of services including a dedicated A&E Unit, day case and routine surgery and outpatient clinics for a range of services and specialties. Since 2002, it has been operating under the private funding initiative (PFI), which enables it to make partnerships with private companies. Under this arrangement, the partners undertake to build facilities to the specifications agreed, operate the facilities with NHSCO for a specified time period under a franchising contract and then transfer the facility to NHSCO when the contract expires (Department of Health, 1999). In the case of the Theatres Unit at NHSCO, the PFI scheme operated with two private companies: Company A, the provider of sterilisation service for instruments, and Company B, responsible for providing the maintenance of equipment for washing the dirty instrument kits after operations. Moreover, Company A provided a portering service to the hospital, being responsible for all transportation of patients, equipment and instrument kits in the theatres and hospital.

The research was conducted at a time when NHSCO was undertaking a major process revision to meet the Unit of Health target of delivering an 18-week pathway from referral to treatment as an early achiever in December 2007. The Board articulated the need for rapid change to comply with this target, and the chief executive, familiar with Lean from previous posts in the NHS, advocated the use of Lean principles. These principles had been adopted successfully in other units, for instance in Pathology (see Papadopoulos, 2007; Papadopoulos and Merali, 2008). The adoption of Lean in Theatres aimed at reducing the time patients spent in the unit by improving turnaround times and quality of processing for all instrument kits, clarifying roles and responsibilities, improving communication between units, and improving staff moral. This was expected to lead to reduction in the waiting lists for patients and help in the achievement of more efficient patient care.

5.2   Identifying areas for Lean implementation in operating theatres unit

The operating theatres unit included nine theatres, performing approximately 12,000 operations per year, and was managed by Companies A, B and NHSCO. As part of the 18-week target, the patient throughput in Theatres had to be improved. The slow turnaround was associated with difficulties associated with the turnaround times for instrument kits and the condition on delivery of kits. The turnaround time (the time from when the operation is done and instruments have to be moved to the sterilisation department till the time they are back in the surgery for use) was unacceptable at up to 3 days. Sometimes, the delivered kits failed to incorporate the appropriate instruments. Moreover, sometimes the instruments were dirty and not appropriately sterilised due to rips and tears in the bags and they had to be resterilised. This caused cancellations or significant delays in operations, as well as disputes and animosity between the staff of theatres and Company A.

Table 1   Lean principles followed and corresponding benefits

Lean Process Innovation	Benefits
Just in time delivery of kits	Decreased turnaround times
Changes in process to reduce handling	Improved kit availability
Storage of kits in sterilisation unit	Quality of kits
Redesigned layout in all sterilisation unit's rooms	Staff time saved in Theatres and SSD (efficiency savings)
Layout of theatre stores	Morale in Theatres
Clean route for delivery of kits	Reduced disruption to theatre lists (improved theatre utilisation and efficiency savings)
Changed maintenance schedule and service	Cost savings related to maintenance
Clear process for scheduling & kit selection	Improved cooperation between units
Regular communication	

Delays in turnaround times were also caused by insufficient maintenance of the instrument kits' washers by Company B: for instance, in a normal working day, only two out of four washers worked properly. These inefficiencies gave rise to financial problems: according to the theatres' manager, overspend was approximately £500k. A demand from Company A for the hospital to buy an additional washer presented the unit with an additional financial hurdle of £100,000. Hence, to 'cure' these problems, the board decided that changes should take place. The areas to be improved with their associated benefits are summarised in Table 1.

5.3 Designing and implementing Lean in theatres unit

In order to design and implement Lean, a service improvement team (SIT) was established with the hospital chief executive and the director of operations, an external clinical process consultant and the hospital's clinical systems engineer. The SIT, together with the theatres manager, deputy manager and one of the hospital's non-executive directors, aided by a private Lean consultancy firm (Company C), decided to organise an RIE using VSM to address the unit's problems.

Lean implementation took place in three phases. The first phase included invitations to the RIE for stakeholders from theatres, Company A and Company B. More specifically, invitations were sent to nurses and surgeons from the Theatres, two managers and supervisors of Company A and four managers and engineers from Company B. However, despite the invitation they received, the surgeons did not participate in the RIE.

The second phase included the 5-day RIE. In the first day, team introductions took place, the process was walked through so as to trace steps that needed improvement and the core processes were mapped. On the second day, the participants went through the existing problems and tried to map out a future state of the processes. However, a climate of animosity and scepticism begun to rise between participants, who were blaming each other for the existing problems, e.g. for the dirt, the rips and tears in the instrument kits and their insufficient cleaning and sterilisation. This negative dynamic was partly smoothed away in the following day when a Lean simulation game – the 'three-pin plug game' – took place: participants had to build a plug following incomplete instructions

and consequently they had to exchange views and support each other in order to accomplish the task. Additionally, during that day, hospital executives assured the participants that they would be provided with resources to carry out any changes. Finally, in the last 2 days, the processes' future state was mapped, based on consensus and cooperation of participants, which was correlated to a project plan. This plan was presented to the hospital executives (that is, director of operations, non-executive director, chief executive) and to managers of Companies A and B.

In the months that followed, changes were carried out in the units (third step). For instance, in Company A, supervisors – aided by Company C – used pedometers to count the steps staff needed to carry out their work, and the results showed that about 60% of everyday steps were unnecessary. Consequently, after securing managers' consent, they changed the unit layout by removing the washers to different places to reduce the steps needed to unload the instruments from the washers, pack them up and store them in racks to be transported to the Theatres by portering service. Additionally, despite Theatres' staff scepticism to the transferring the storage of a percentage of instrument kits to Company A (apart from the orthopaedic instruments that are bulky), these were moved into Company A. Better quality paper was bought to wrap kits, and it was agreed to use double (instead of single) wrapping. These changes had a twofold purpose. Firstly, handling of the kits and rips and tears would be reduced. Secondly, space in Theatres would be secured and the delivery of kits by porters would be streamlined, as new routes from the Theatres to the sterilisation unit would be designed and the frequency of moving instruments to and from the theatres' unit would be rescheduled from three up to six times a day. Additionally, a pick list had to be filled in by theatre staff and sent to Company A to secure the timely sterilisation and transportation of instrument kits to theatres.

Nevertheless, the changes did not prevent staff, especially in theatres and Company A, to perceive Lean as a way of getting more resources or staff by negotiating with the senior managers.

For instance, Company A staff did not appear to be in total agreement with the changes in layout and instrument storage, as these would entail modifications in their working habits and take up much of their free space. A percentage of nurses were not persuaded at all to try changes, as they claimed that this was a proposal enforced by the management and would lead even to job losses. Consequently, they found ways of 'sabotaging' the changes and showing their resentment, for example by deliberately causing delays in sending the pick list to Company A, so that the staff responsible for cleaning, packing and carrying the instruments to the theatres could not know until the last moment which instruments that had to be brought to the theatres the next day.

Apart from changes in the Company A, it was also decided that the manager in Company B would change the maintenance schedule and service for washers and autoclaves, after gathering and analysing data stemming from measuring the frequency by which machines needed maintenance. Furthermore, by conducting a survey of the parts that used to breakdown most frequently, Company B decided that they would hold a stock of the these parts to reduce waiting times. Currently, parts had to be ordered from Sweden, causing severe delays in maintenance of the equipment and triggering delays in instrument sterilisation and packing by Company A, and delays or cancellations of operations in theatres. After the changes, the drop in the maintenance time was dramatic (from up to 6 weeks, down to 3–4 days), significantly reducing the running costs in Company B.
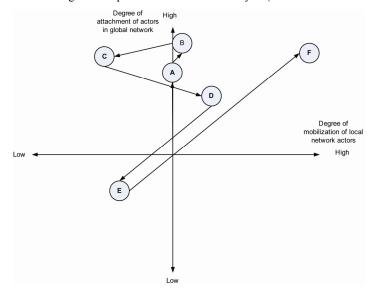
Other tangible benefits also started to accrue as outcomes of the trial implementation of Lean in the first months (e.g. drop of average turnaround times from almost 3 to 1.7 days, kit availability from 86 to 94% and the kit quality to 99.8%, no overtime work). The support from the executives and Theatre manager in terms of intervening in cases where disputes between the three PFI partners were taking place, as well as the visual management tools (e.g. communication boards and future process state maps) that allowed staff to participate in changes by suggesting ways of further improvements, facilitated the *translation* of staff into the Lean approach. Consequently, resistance, scepticism and demand for new resources were replaced by a more positive reaction towards Lean, and the willingness to try "… this new way of thinking in the NHS" (nurse, theatres unit). The executives also perceived Lean as beneficial, as it turned out that no additional staff or costly resources were to be invested. The satisfaction of both managers and nursing staff brought a successful trajectory in the Lean implementation.

At the time of writing this paper, changes are still ongoing; it is planned that the orthopaedic instrument kits will be moved to Company A. Negotiations have already commenced between Theatres staff and management in NHSCO, and staff and management in Company A with respect to the use of a specific room in Company A for storage, and the resources that might have to be invested and the scheduling issues that may arise (e.g. the creation of pick list and the frequency of moving instruments to the theatres). The time plan has yet to be announced.

6   Discussion and conclusion

The empirical findings of the study have shown the way actors interacted with each other during the Lean project and how their dynamics were manifested during Lean implementation. The trajectory of the project can be explained using Law and Callon's framework (1992). Figure 2 presents an overall analysis using this framework.

Figure 2   The lean design and implementation network analysis (see online version for colours)

The project was initiated when theatre managers, Companies A, B and C, the hospital executives (chief executive, director of operations), the non-executive director and the SIT agreed on designing and implementing Lean in order to improve efficiency in Theatres as part of the 18-week target. Thus, a global network was formed (point A in Figure 2) and it made resources and conceptual space available for Lean to take place. The project was delineated and elements of a local network – composed of the participants in the RIE and staff members from Theatres and Companies A and B that had to carry out and adapt to changes – were beginning to be engaged (point B in Figure 2).

However, further progress in the formation of a local network was not possible during the first 2 days of RIE. The *problematisation, interessement and enrolment* were at best partial, as local network actors were sceptical towards forthcoming changes and thought they were enforced to participate in an event that would not bring any changes. They were experiencing turbulence from competing potential *problematisation* perspectives as evidenced on the second day when they accused each other for flaws in the instrument sets and for the delays in the system. Thus, there was limited mobilisation of local network (point C in the Figure 2). These actors interpreted Lean differently: for the Theatres managers, Lean was a tool for achieving the 18-week target without overspending, buying the new washer and investing in new staff. For Companies A and B, Lean meant investing in wrapping for instrument kits and equipment for washers correspondingly; but they were reluctant to take any further action that might incur a high cost (e.g. the need for more staff, the disruption of work routines). Therefore, at this point, the *translation* suggested by SIT of the staff belonging in the three units towards Lean principles was not successful, as they were sceptical towards Lean and could not see any benefits accruing.

In the third day, after the Lean simulation game took place, the local network started to 'come into life' again. It seemed that local actors had understood the importance of working together and were based on the global network for resources and support (point D in Figure 2); they also seemed to be partially translated by the project that started to establish itself as OPP as they understood the importance of Lean as an underlying philosophy that would enable them to achieve improvements in their own performance through collaboration between the three units to reduce waste and promote efficiency. In this vein, they attempted to propose changes in units by translating and consequently problematising, enrolling, and mobilising more actors in the local network. This aim was manifested in the last day of RIE, when staff by presenting future state processes and measures to executives and mangers, were positive that the transition to the future state would be smooth and straightforward.

Following the RIE, implementation went through two further phases: firstly, an attempt was made in the first week to problematise more actors in Lean. Theatres staff reacted to changes that they thought could be opposed to the departmental efficiency; for instance, the storage of the instruments in Company A meant that they were loosing control over valuable resources (that is, instruments) and the ownership of the specific resources which, they thought, was crucial not only in conducting their everyday work, but in retaining their status as the main unit in the PFI scheme. Consequently, they resisted in being enrolled and promote changes. They even used the pick list as a way of 'taking revenge' for the loss of control in respect to the instruments, as they did not send the list at the required time. In Company B, the changes in layout of the department promoted by the managers was thought of as loosing space which was to be given to

Theatres staff. Arguably then, the translation process was stalled and this caused the shrinkage of the local network (point E in the figure 2).

However, after a few weeks (second phase, that is), staff started to see the associated tangible benefits, i.e. time savings and the reduction in the percentage of dirty instruments and tears in the kits. At that point, the project established itself as an OPP between the global and local network and actors started adopting changes by enrolling in the local network, after realising that Lean was beneficial. Hence, they were enrolled and mobilised not merely towards the Lean implementation; rather, they conceived Lean as a way of negotiating with the global network for more resources and staff, even if Lean philosophy itself, as translated by the global network, would not deal with their demands, but with the achievement of the 18-week target set by UK Department of Health. The translation had an impact on the meaning of Lean for nursing staff; started as a negotiation tool for gaining access to more staff and resources, and used as a coercive tool against the loss of their status as the main partners, now it had a new denotation: it was seen as the means of better working conditions. For the executives, their perception of Lean was the identical to the one they had before the project: they had succeeded in translating staff and achieving operational efficiency in the unit.

The capability of the project to visualise its tangible benefits (changes in wrappings, instrument cleansing and scheduling that brought efficiency, cost and waste reduction) and establish them as intermediaries that were passed in the global network strengthened both networks and established its success (point F in the Figure 2). Consequently, the trajectory of Lean is a reflection of the dynamic interactions between actors, which led to the establishment of a local and a global network that were mobilised for the specific project, and of the acceptance of the project as the OPP holding these two networks together (Law and Callon, 1992).

Throughout the implementation process, there were various attempts by the global and local networks to make Lean principles work in practice and align it with the existing routines (Rees, Scarbrough and Terry, 1996). However, this study demonstrated that actors did not passively copy the model of Lean principles proposed; on the contrary, the process involved an ongoing translation, in which the new idea or model (in the case, the Lean project and its benefits) is modified and integrated with existing traditions (Czarniawska, 2002) and the final idea is "adopted in different ways – it was used pragmatically to fit what the organisation members felt was best needed at the time." (Tragardh and Lindberg, 2004, p.396). It is demonstrated that the Lean implementation involved a process of negotiations, articulations and conflicts, as "managers and medical staff had their own 'truths' or, more sensibly [logically], 'rationales' regarding the hospital and its future." (Dent, 2003, p.123). However, Lean has not yet been institutionalised as a taken-for-granted management tool, incorporated in the organisational culture. Neither has it disappeared, which is to say that the 'black box' remains open (Latour, 1987).

The use of global–local network framework depicts the way network dynamics determine the trajectory of Lean, not merely paying attention to their structural characteristics (cf. Westphal, Gulati and Shortell, 1997; West et al., 1999; Borgatti and Foster, 2003; Brass et al., 2004; Addicott, McGivern and Ferlie, 2007; Provan et al., 2007), but using a longitudinal study (Fulk, 2001) and incorporating the element of time in the analysis (Orlikowski, 1996; Van de Ven et al., 1999; Pettigrew, Woodman and Cameron, 2001). It specifically suggests a means for shedding light upon the negotiations entailed to establish and maintain coherence between dynamic, *global*, policy-level

perceptions and agendas and dynamic, diverse, *local* perceptions and agendas while moving the organisation as a whole in the direction required. In particular, the global–local framework offered:

- The concept of translation for achieving coherent, temporary stable global and local networks.

- The agency of the OPP in dynamically maintaining coherence between the global and local networks.

In contrast to Addicott, McGivern and Ferlie (2007), in this case, networks emerged as the outcome of actor associations that negotiated using the project and its benefits in order to succeed in either getting more resources and staff (local network), or cost reduction, efficiency and achievement of top-down driven target (global network). Although the global network provided the top-down support and resources needed for Lean implementation, it did not aim to corrupt the local network by "leaving out some of the pre-existing networks between clinicians" (Addicott, McGivern and Ferlie, 2007, p.102), and this was justified by the invitation clinicians received to participate in the RIE and express their opinion for the forthcoming changes. Even though we suggest that change brought by Lean is an outcome of action, negotiation and meanings shaped in the global and local network and has a dynamic nature, our approach does not distinguish between different meanings generated at three levels – macro, meso and micro (Pope et al., 2006), but on meanings created through the interaction of actors in microstructure, which make up the macro one (McLean and Hassard, 2004).

The concept of 'Lean project' endorsed by the global network:

- provided the legitimisation of the SIT to support the Lean implementation

- enabled the project to act as an OPP – the gateway connecting the global agenda (meeting the 18-month target) with the diverse local agendas (improving the work conditions by making things work more smoothly, chasing more resources etc.).

Our study, therefore, provides insights into the process of implementing a management idea in healthcare as an outcome of the associations between different actors, providing explanations of their associated behaviour (cf. Tragardh and Lindberg, 2004). The findings presented here do not demonstrate any interprofessional competition for jurisdictions blocking radical innovation (Swan, Scarborough and Robertson, 2003), neither a strong ideological dispute between segments within the same profession (Ormrod et al., 2007) and there is not enough evidence of clinicians having accepted they have both managerial and clinical responsibilities (Dent, 2003). Rather, Lean implementation included the translation of Lean from both the global and local networks into something that was not envisaged at the start of the project.

The contribution of this study lies in the following. Firstly, we suggest that the trajectory and outcome of Lean depends on stakeholder dynamics, manifested through the mobilisation of two heterogeneous networks: of a global network of actors that provide the resources for such projects, of a local network of actors that implement such projects and of the imposition of the project as a single connection between these networks. The ANT perspective adopted offers an insight into the complexity of stakeholder dynamics during process innovation. By drawing on ANT, it is possible to "… delineate more clearly the complex configuration of relationships within which a hospital is embedded" (Dent, 2003, p. 123).

Law and Callon's global–local network framework specifically deals with the need to establish and maintain coherence between dynamic, *global*, policy-level perceptions and agendas and dynamic, diverse, *local* perceptions and agendas while moving the organisation as a whole in the direction required, offering firstly the translation mechanism for coherence between global and local networks and OPP to act as an agent to secure the maintenance of coherence between these networks (Papadopoulos and Merali, 2008).

The use of Law and Callon's (1992) framework in depicting the trajectories of Lean implementation in the Theatres Unit highlights the importance of global actors in supporting the innovation through the provision of resources, but the support provided is not sufficient *per se* to ensure the successful trajectory of Lean implementation. Rather, the support of global actors should be accompanied by committed participation by local actors who engage with the innovation; however, the satisfaction of their individual needs precedes and determines their participation in the networks. In this vein, the Lean project should be able to provide a space – as in this case – in which actors can negotiate in respect to satisfying their own agendas or to adjust them in relation to others' agendas and needs. However, as our findings show, the negotiations and associations between the actors and networks have a dynamic nature and in particular they emerge as actors negotiate their participation in the networks. The emergent and dynamic nature of networks suggests the use of a mechanism to dynamically maintain coherence between the two networks. This mechanism is translation and the use of project as an OPP and negotiation space, aiming to link the global and the local networks. The Lean project and in particular the tools used by Lean (VSM, RIE) facilitate the negotiation by creating an environment in which all the actors (global and local) come together to engage in active intervention necessary for the emergence of networks and Lean. However, the emergence of networks in ANT and the sustainability of Lean both require changes in mindsets of the actors, which cannot be imposed and which takes time (see also McNulty and Ferlie, 2002).

From the discussion above, it is underlined the applicability of the global–local network in depicting how implementation trajectories play out in complex contexts with multiple and diverse stakeholder constituencies. The application of the framework to a complex innovation implementation process, such as the Lean implementation in the Theatres of NHSCO, gives the opportunity of exploring further the opportunities rising in a complex environment and renders appropriate its use for other innovation projects or locations in healthcare or in public sector in general. This is due to its ability to monitor the implementation process through network formation, stabilisation and maintenance over time, handling thereby with the dynamics of process innovations.

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Notes

[1]A human stakeholder in general is defined as "any group or individual who can affect or is affected by the achievement of the organisation's objectives" (Freeman, 1984, p.46).

[2]The term *community of practice* denotes relationships between a number of different organisational communities within the boundaries of an organisation that share practices and knowledge, although network members have few opportunities to know one another on a personal basis (Brown and Duguid, 2001).

[3]Six Sigma is a business process aimed at that allowing organisations to radically improve their bottom line by designing and monitoring everyday business activities in a way that minimises resource consumption and waste while increasing customer satisfaction and adhering to core business objectives (Harry and Schroeder, 2000).

[4]For more information: http://www.qsrinternational.com/.