

The North East Transformation System: A Scoping Study of the Background and Initial Steps

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October 2008



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Executive Summary

Background

The North East SHA commissioned researchers from Durham and Newcastle Universities to undertake an evaluation of the implementation of the North East Transformation System (NETS). As a preliminary stage to contributing to the commissioning of a full evaluation proposal, the SHA supported a six month scoping study between January and June 2008. This was aimed at capturing the history of NETS, its aims and objectives and the initial developments occurring in the first wave seven pathfinder organisations. The Pathfinders are:

- County Durham PCT
- Gateshead Health NHS Foundation Trust
- North Tees & Hartlepool NHS Foundation Trust
- Northumberland Tyne & Wear NHS Trust
- South of Tyne PCTs Cluster
- Tees Esk & Wear Valleys NHS Trust
- North East Strategic Health Authority

A draft report was submitted to Stephen Singleton, RDPH, in mid-July and discussed at a meeting in early September. The scoping study findings also informed the evaluation proposal submitted by the report's authors in their October 2008 response to the NIHR SDO Programme call.

The NETS initiative is made up of three elements often referred to as the 'three-legged stool': vision, compact and method in the form of the Toyota Production System (TPS), including Lean thinking and tools. The three elements are viewed as mutually reinforcing with each being given equal weight in the transformation process. A *vision* is essential to chart the purpose and direction of the health system in the north east; a *compact* is essential to align professional and organisational culture with behaviour; and to manage the change a consistent *method* is required which is where the TPS and Lean tools come in. Binding all three elements together, and ensuring an optimal balance between them, is strong and committed leadership among the key enablers.

The vision for improving health and health care services in the North East is set out in the SHA's 10 year strategy published in June 2008, *Our vision, our future*, as part of the locally-led NHS next stage review led by Lord Darzi. A key feature of this document is the urgent ambition to resolve the regional paradox of having high quality, high performing health services but relatively poor population health. The NETS is seen as a bold attempt to overcome this dichotomy by embedding continuous improvement and by avoiding any temptation to complacency.

The compact is critical as it aims to align clinical aims and objectives and those of NHS organisations. A key tension in management-clinical relations has been a perception of actual or perceived differences between these activities. Clarifying and sharing goals and obligations – described in the NETS materials as ‘gets’ and ‘gives’ – is the purpose of the compact which is being developed by AMICUS working with the NETS team.

Finally, the method advocated by NETS is Lean thinking as developed by the Virginia Mason Medical Center (VMMC) in Seattle with which NHS North East has established a close strategic and learning partnership. VMMC’s pioneering approach to continuous quality improvement is based on adapting the TPS to the healthcare setting.

In order to explore the three elements – vision, compact and method – making up the NETS, and the manner of their implementation, the scoping study comprised several steps in gathering information. These were:

- a series of 16 interviews with key ‘movers and shakers’ in the seven pathfinder sites conducted between April and June 2008¹
- a perusal of any relevant documentation on the NETS initiative, including items on the NETS intranet such as VMMC and AMICUS training materials, NETS coalition minutes, programme schedules, web links and other background documents
- attending two meetings organised by the NETS team following a visit by CEOs and other directors to Japan, and a feedback meeting on RPIWs respectively
- a rapid review of the literature (both published and ‘grey’ literature) relating to lean thinking in the manufacturing sector and its application to the public sector, notably health and health care; the review also drew upon the literature on organisational culture, leadership styles, complexity thinking insofar as these were pertinent to what the NETS was aiming to achieve by way of transformational change in the organisation of health services across a whole health community.

The report on the scoping study is in two sections. The first presents the key issues arising from the rapid review of the literature, and the second presents the key themes from the completed interviews.

1. Rapid Literature Review: Key Themes

The key themes to emerge from the various bodies of work consulted in the course of the literature review are as follows:

- the importance of organisational culture that is contingent upon context and is dynamic, changing over time in response to the changing environment in which policies are developed and implemented

¹ Owing to constraints on the availability of both the interviewing team and representative of the Gateshead Health NHS Foundation Trust, it was not possible to arrange interviews with this pathfinder organisation.

- successful change cannot happen without attention to leadership styles that are also adapted to their context and take account of history and relationships
- health care systems are examples of complex adaptive systems and managerial notions founded on linear thinking and mechanistic concepts are deemed dysfunctional when set alongside services and systems that are nonlinear, complex, and ambiguous
- the TPS is the best known example of a Lean production system
- TPS may be viewed as a set of tools for reducing waste or as a set of principles that led to the development of the tools
- the Toyota Way comprises four elements: long-term philosophy; the right process will produce the right results; developing people adds value to the organisation; and continuously solving routine problems drives organisational learning
- standardisation is important because all variation from best practice leads to lower productivity, inferior quality and higher costs
- although having some elements in common with Taylorism and scientific management, TPS is distinctive: whereas Taylorism seeks to maximise the efficiency of the individual, TPS aims to maximise the efficiency of the system with all workers acting as a team rather than individuals
- in applying Lean principles and tools, differences in culture, society and history need to be acknowledged and allowed for
- implementation of Lean techniques and philosophies requires the transfer of explicit and tacit knowledge
- the literature on Lean in public sector organisations and healthcare is in its infancy and is not yet mature
- for Lean to work there needs to be a critical mass of appropriately trained personnel
- the success of Lean in public service organisations depends on several critical factors, including: organisational culture, management commitment and capability, a strategic approach to service improvement, team work and whole systems thinking, timing, and effective communication
- defining the customer is important although this can be tricky in public service organisations where there may be many customers and not a single easily identifiable one
- the majority of examples of Lean in healthcare relate to the hospital sector rather than from a whole system perspective

- there is very little material of practical value relating to primary care and public health interventions.

2. Stakeholder Interviews: Key Themes

The interviews were designed to elicit information about the background and context for the NETS initiative, including the manner in which its three components – vision, compact and method (Lean tools) – were being implemented. The interviews were not intended to serve as an interim evaluation of the NETS initiative. Their purpose was to raise issues which might form a future evaluative research agenda of the type being planned. As far as possible we were after facts and evidence about activities and achievements since the NETS team had begun work in collaboration with the VMMC in Seattle. The interviews provided a rich source of material on all aspects of the NETS initiative and its roll-out across the region.

The key themes and highlights to emerge from the interviews are as follows:

- patient safety is seen as the main ‘selling point’ for staff involved in the NETS initiative
- the enthusiasm and commitment of key individuals (‘product champions’) in establishing NETS and driving the vision, compact and method cannot be overestimated
- much of the push behind NETS was to change ‘hearts and minds’ across the region and across the whole health care community
- embedding NETS thinking was being done through ensuring that awareness of Lean principles was an important part of the recruitment process and a component in the assessment of NHS Trust CEOs and senior directors
- the approach adopted was deliberately long-term – ‘a journey and not a destination’ – with the SHA in it for the ‘long haul’
- despite the commitment to the long-term having some ‘quick wins’ was desirable to aid experiential learning
- there are issues about the transferability of the transformational changes being sought particularly issues around geographical distance and also distance in terms of cultures, history and so on which apply to adopting practices and techniques from the US as well as training methods borrowed from the US and Japan; there are also issues about the limits to transferability in respect of differences between the US and English healthcare systems
- though critical, the method and use of Lean tools were a means to an end and not an end in themselves – there should not be an over-emphasis on the toolkit
- NETS initiative not to be seen as SHA imposed

- failure should not be feared – it should be tolerated
- RPIWs are regarded as the main intervention tool but their sustainability is an issue for several reasons including moving on from a completed RPIW to the next ('eye off the ball' syndrome), possible loss of a particular 'champion' could prove detrimental
- much work remains to be done on establishing the requisite metrics and clarifying what these should be
- on the issue of appropriate metrics to measure performance improvement, there are issues over how far routine data collection is sufficient and how far additional data sets are needed
- the commitment to Virginia Mason is regarded as crucial with a considerable amount of emphasis on the initial training as instrumental in achieving 'conversion' among staff groups
- staff are experiencing mixed emotions ranging from a healthy scepticism to curiosity and interest
- some staff regard TPS and Lean thinking as a threat to clinical decision-making with standardisation being viewed as a form of 'dumbing down' but others regard the approach as empowering since it puts power in the hands of frontline staff
- the NETS initiative should not be oversold – its acceptance is best achieved by doing and by successful projects that will encourage staff to spread the word
- system-wide change is the aim, not confining change to individual units and/or hospitals – this gives NETS its unique selling point as a region-wide exercise
- general awareness training for staff is in place but will grow over the next couple of years or so with the aim being that 80% of staff will have been introduced to the key concepts and principles behind NETS.

Metrics

As part of the scoping study, the Durham/Newcastle research team questioned pathfinder and SHA representatives in regard to the use of metrics in the NETS programme. This is clearly an area that is still developing as organisations reach agreement on their versions of the compact and as members of staff are trained in the TPS approach and in Lean thinking and Lean tools. Discussion of metrics with SHA NETS representatives revealed the following key points (see also Section 2, subsection 2.2.6 below):

- Some Lean interventions – especially those in clinical areas – can make use of some routinely gathered NHS data (e.g. ALOS, activity data, benchmarking information, some publicly available data sets) to measure process improvement.

- However, many RPIW-type interventions require organisations to establish new data-gathering mechanisms; these usually require careful thought and refinement over time (e.g. SPC data on surgical outcomes).
- The NETS team has an extensive library of documents, based on VMPS materials, that provides a basis for pathfinder organisations to decide on appropriate metrics and to begin the process of recording data and analysing outcomes.
- In the Trusts, the areas of interest are currently around patient safety, infection rates, untoward incidents, readmission rates, ALOS, and some national targets (such as the 18 week ‘referral to treatment’ target).
- Metrics concerning the impact of NETS in terms of cultural change and behaviour are much more difficult to define, choose, and analyse. However, a number of pathfinder sites are looking to make use of annual appraisal information and staff satisfaction surveys, at least as a starting point.
- From the SHA perspective there is an ongoing need to develop further the use of metrics to measure NETS activity within pathfinder Trusts (e.g. numbers and types of RPIWs, together with outcomes).

From interviews with pathfinder sites, it is clear that the importance of choosing appropriate metrics, at both strategic and operational levels, is well understood by the senior directors and managers who have received TPS training. In the case of an SHA NETS interviewee, for instance, one example given was that of using an organisational ‘energy index’ to assess motivation and staff alignment with the organisation’s objectives. At a more operational level (but still connected with behaviour/culture), one Trust interviewee mentioned the use of data on staff leaving early as an indicator of satisfaction and enthusiasm levels. In general, interviews revealed general acceptance that time spent on choosing metrics, and subsequently analysing the outcomes, was time well spent. However, a common theme was that this area still needed a commitment to long-term development, and that there was still much to do in terms of linking high level, strategic thinking with the detailed metrics involved in operational and day-to-day activities.

Next Steps

NHS North East’s attempt to implement the major region-wide transformational change initiative it has embarked upon amounts to a unique opportunity to evaluate the effectiveness and efficiency of the approach that has been adopted.

As mentioned, the scoping study findings have been used by the study team to prepare a proposal for a full evaluation of the implementation and impact of the NETS over a minimum of 3 years. This was submitted to the NIHR SDO Programme in response to a call to evaluate the NETS commencing in January 2009.

If successful, the evaluation will aim to establish evidence on the empirical relationship between movements in a set of reform variables (the 3 elements – vision, compact, method –

collectively referred to as the NETS and which constitute the intervention) and movements in a set of performance variables (the consequences). In particular, we will seek information on the following issues and questions:

- What the intervention is
- Does it work and for whom?
- Does it improve the quality and efficiency of care?
- How does it work, or, if it does not, what stops it working?

The research will take the form of both a process and an outcome evaluation, using a mix of qualitative and quantitative methods. It will provide a comprehensive evaluation of the NETS, identify lessons for the adoption of a similar approach elsewhere in the NHS, and add to the evidence base relating to the use of Lean thinking and tools in public services.

1 Rapid Literature Review

The rapid literature review undertaken for the scoping study involved searching a wide body of work that included professional and managerial tribalism in health systems, organisational culture, leadership styles, complexity thinking, and the evolution of Lean thinking in both the wider industrial and manufacturing context and the public sector, including the NHS. The review of literature on professional-managerial relations, organisational culture, leadership styles and complex adaptive systems is only briefly reported here. The review focuses upon the evolution of Lean and its application to the NHS since much of the effort underway in the seven wave one pathfinders is being expended on the deployment of Lean principles and tools. The content of sub-sections 1.1-1.3 and 1.14 are largely drawn from publications, teaching materials and reports produced by the Durham team, while the content of sub-sections 1.4 to 1.11 is largely drawn from publications, teaching materials and reports produced by the Newcastle team.

1.1 Management-profession interface

The tension between managerial and professional values is well documented in the literature and underpins the rationale for a compact. A *British Medical Journal* editorial in 2001 posed the question: why are doctors unhappy (Smith 2001)? It suggested the causes were multiple although one in particular was highlighted – ‘the mismatch between what doctors were trained for and what they are required to do’. Trained in some speciality or field of medicine, ‘doctors find themselves spending more time thinking about issues like management, improvement, finance, law, ethics, and communication’. In an article in the *BMJ* the following year, Edwards, Kornacki and Silversin (2002) suggest that the cause of doctors’ unhappiness ‘is a breakdown in the implicit compact between doctors and society: the individual orientation that doctors were trained for does not fit with the demands of current healthcare systems’. They describe the old compact and why it is no longer regarded as legitimate and outline what a new compact might look like. The old compact comprises two aspects: what doctors give and what they get in return (see below). The mismatch between these has been the cause of dissonance over what doctors might have reasonably expected the job to be and how it now is. ‘The psychological contract or compact is a useful concept to explain this problem’ (Edwards et al 2001; see also, Silversin and Kornacki 2000 and 2002).

What doctors give:

- Sacrifice early earnings and study hard
- See patients
- Provide ‘good’ care as the doctor defines it

What doctors get in return:

- Reasonable remuneration

- Reasonable work/life balance later
- Autonomy
- Job security
- Deference and respect.

A new and more sustainable compact is required because the old promise to doctors is either no longer valid or can act as a barrier to modernisation. Among the new imperatives to be addressed in a new compact are the following (Edwards et al 2002):

- Greater accountability (eg guidelines)
- Patient centred care
- Be more available to patients, provide personalised service
- Work collectively with other doctors and staff to improve quality
- Evaluation by non-technical criteria and patients' perceptions
- A growing blame culture.

Edwards et al (2002) assert that 'we cannot return to the old compact' and that clinical leaders and managers must 'work together...to develop a new compact that improves care for patients, improves the effectiveness of the healthcare organisation, and helps create a happier workforce'.

The following year, once again in the *BMJ*, Davies and Harrison (2003) return to the theme of the discontented doctor and argue that a principal reason is the dissatisfaction doctors experience in their relationship with managers. This manifests itself in a perceived sense of diminished autonomy and reduced dominance. The authors argue for 'better alignment between doctors and the organisations in which they provide services' while noting that the extent of 'cultural divergence between managers, doctors, and other professional groups suggests that such a realignment will be far from easy'. They conclude by insisting that there is no practicable alternative to doctors engaging with management. Yet, despite such calls, the unease felt by many doctors and their lack of being valued has persisted (The Joint Medical Consultative Council and NHS Confederation 2007) and was a major reason for inviting a surgeon, Ari Darzi, to lead the next stage review of the NHS which has clinicians and other frontline staff at the heart of the change process – change that is 'locally-led, patient-centred and clinically driven' (Darzi 2008).

For their part, managers are often no less unhappy with their lot. They can appear beleaguered functionaries in a system that is more politicised than ever and whose political heads regard themselves as its leaders (Blackler 2006). A major exponent of Lean in the UK, Seddon (2003), holds the target regime responsible for distortions in the health system which ensure the patient is not put first. The result is an elaborate set of managerial ploys which are

in effect forms of cheating or gaming to arrive at the results desired by their political masters. But it is a further contributor to the unhappiness felt on both sides of the management-medicine divide.

The awkward and often dysfunctional relationship between managers and professions is far from being a new phenomenon. In their study of hospital organisation in 1973, Rowbottom and colleagues noted that ‘the position of doctors...presents a fascinating, and possibly unique, situation to any student of organisation. Never have so many highly influential figures been found in such an equivocal position – neither wholly of, nor wholly divorced from, the organisation which they effectively dominate’ (Rowbottom *et al* 1973).

The work of Degeling and colleagues (Degeling, Kennedy, Hill 1998; Degeling, Hunter, Dowdeswell 2001) has demonstrated the importance of getting professionals and managers to:

- recognise interconnections between the clinical and financial dimensions of care
- participate in processes which will increase the systemisation and integration of clinical work and bring it within the ambit of work process control
- accept the multidisciplinary and team-based nature of clinical service provision and accept the need to establish structures and practices capable of supporting this
- adopt a perspective which balances clinical autonomy with transparent accountability.

The findings from Degeling *et al*'s work point to significant profession-based differences on each of the four elements of the reform agenda. They also demonstrate the barriers that face those seeking to introduce changes in the delivery of health care. For those changes to happen there needs to be a common sense of purpose and a set of core values shared by the key stakeholders. These prior conditions do not exist. Degeling *et al*'s work shows that all attempts to impose managerial controls on clinical work are doomed to failure unless a different approach to managing change and engaging with clinicians and other healthcare staff is adopted.

1.2 Organisational culture and leadership styles in health care

Culture is something of a weasel word that may simply be empty rhetoric. It is often invoked too readily and simplistically in a health care context, the belief being that if culture change can occur then issues of organisational performance will be resolved. Despite this, culture matters with many commentators such as Schein (1985) and Mannion, Davies and Marshall (2005) emphasising the importance of culture in shaping organisational behaviour and hence improved performance. Change can be stifled by culture. As Mannion *et al* state, culture constitutes the informal social aspects of an organisation that influences how people think, what they regard as important, and how they behave and interact at work. Organisational culture has been defined by Schein (1985) as ‘the pattern of shared basic assumptions – invented, discovered or developed by a given group as it learns to cope with its problems of

external adaptation and internal integration – that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems’.

Culture is therefore not merely that which is observable in social life but also the shared cognitive and symbolic context within which a society or institution can be understood (Mannion *et al* 2005). But Mannion *et al* resist the temptation of searching for a ‘magic bullet or simple cultural prescription for the ills of the NHS’. In their view, ‘what works’ is contingent upon context ‘and on how and by whom efforts targeted at culture reform are evaluated and assessed’. They counsel against the adoption of a ‘one size fits all’ approach to culture management in the NHS and ‘encourage the adoption of more nuanced strategies which seek to deploy a judicious mix of instruments and supporting tactics depending on setting and application’.

One of the principal components of effective culture management relates to leadership styles (Goodwin 2006). Much has been written about leadership and hundreds of definitions offered but, as Goodwin observes, ‘it is principally local context that largely determines the leadership approach to be adopted, meaning local challenges, the history and relative strength of local relationships, local resource issues and local ways of doing things’ (Goodwin 2007). Some writers on leadership subscribe to a trait or competency approach, ie one size fits all, which ignores context. The NHS competency framework is an example of this. Competencies have been criticised for being overly reductionist, overly universalistic or generic, focusing on the past or current performance, focusing on measurable behaviours and outcomes, and resulting in a limited and mechanistic approach to development (Bolden and Gosling 2006). Critics also believe that ‘such frameworks reinforce the underlying assumption that leadership resides in the individual’ (Western 2008). They are regarded as too generic and ignore ‘the context of a situation and the complexity of running very challenging and diverse workplaces’. As Western argues, ‘the experience on the ground may be that there is little room for *seizing the future* and *empowering others* when the context feels disempowering due to a production-line atmosphere where success is measured against meeting targets and deadlines’. Situational leadership is therefore regarded as more appropriate in the context of complex adaptive systems.

In their study of the impact of leadership on successful change in the NHS, Alban-Metcalf and Alimo-Metcalf (2006) found that competencies did not predict effectiveness but that a culture of ‘engaging’ leadership significantly predicted motivation, satisfaction, commitment, reduced stress and emotional exhaustion, and team effectiveness/productivity. For them, ‘engaging’ leadership was key in increasing productivity, motivation and well-being as long as leadership was viewed as a shared or distributed process and one that was embedded in the culture.

Like other writers on leadership, Goodwin also notes that leadership is not a characteristic of one person but rather is a process ‘played out between leaders and followers, without whom leadership cannot exist’. Not all commentators believe leadership and management are entirely separate entities (Western 2008). Those who do consider leaders are different from

managers because they view people from an emotional perspective, seeing them as individuals. But managers can demonstrate leadership and a leader can have managerial skills. Bennis (1986) defines leaders as those who ‘master the context’ whereas managers ‘surrender to it’. Leadership is about passion, vision, inspiration, creativity and cooperation rather than control which is the hallmark of management (Western 2008). A variant on this view is that a leader creates change while a manager creates stability. Running through all these definitions is the derogatory assumption that management is the ‘other’ to leadership – an outdated mechanistic functionalist. Leadership is very clearly in vogue and ‘sexy’ – whereas managers are regarded as transactional in their approach, leaders are seen as transformational.

In keeping with this view of leadership as being about emotions and meaning rather than control, Goodwin claims that leadership is a dynamic, relationship-based process that uses a twofold approach:

- creating an agenda for change using a strong vision, and
- building a strong implementation network to get things done through other people.

In their leadership for Health Improvement framework (see Figure below), Hannaway, Plsek and Hunter (2007) apply service improvement thinking which borrows many of the ideas and principles from Lean. The approach has been applied in the NHS as a result of the work of the former NHS Modernisation Agency and its successor, the NHS Institute for Innovation and Improvement. The 10 High Impact Changes for Service Improvement Delivery include the optimisation of flow and the reduction of bottlenecks, the application of systematic approaches, improved access, and role redesign (NHS Modernisation Agency 2004).

The 'Leadership for Health Improvement Programme' Framework

Successful Health Improvement Systems...

(Hannaway, Hunter & Plsek 2006)

- Promote and protect the population's health and well-being
- Develop health programmes and services and reduce inequalities
- Proactively build on surveillance and assessment of the populations health & well-being
- Encourage and implement evidence based practice
- Operationalise a strategic vision of the future
- Promote seamless partnership working across boundaries for the benefit of staff and communities
- Earn and retain the confidence of politicians and the public
- Prioritise and focus on key issues and leverage points in the health improvement system
- Continuously increase capacity to deliver the health improvement agenda
- Engage operational staff and others in actively delivering health improvement
- Nurture organisational cultures that are receptive and positive environments for change

A Successful Leader...

- Communicates clear vision, direction & roles
- Strategically influences and engages others
- Builds relationships and works collaboratively across organisational boundaries
- Challenges thinking and encourages flexibility, creativity and innovation
- Drives for results and improvement
- Practices political astuteness
- Displays self-awareness and emotional intelligence
- Manages personal and organisational power and values diversity
- Nurtures a culture in which leadership can be developed and enabled in others
- Ethically manages self, people and resources
- Commits with passion to values and mission
- Demonstrates mastery of management skills



A Successful Improvement Leader...

- Sees whole systems and any counter-intuitive linkages within them
- Brings in the experiences and voice of staff and the community
- Seeks to create new evidence and to translate evidence into practice
- Exposes processes to mapping, analysis and redesign
- Encourages flexible, innovative rethinking of processes and systems
- Sets up measurement to demonstrate impact and gain insight into variation
- Facilitates reflective practice
- Develops quality and risk management within an evaluation culture
- Works constructively with the human dimension (psychology) of change
- Sustains and embeds past improvement and drives for continuous improvement
- Spreads improvement ideas and knowledge widely and quickly

1.3 Complexity and health

It is generally accepted that leading and managing a health system is a complex business where there are few certainties and where ambiguity and paradox are often present. They need to be managed rather than denied or obscured by an inappropriate managerial model. Failure in public policy and public services is, according to Chapman (2004), that ‘assumptions of separability, linearity, simple causation and predictability are no longer valid’. Under such conditions of growing complexity, it is essential that those responsible for managing and governing take on a wider, more holistic perspectives, ‘one that includes complexity, uncertainty and ambiguity’. Systems thinking marks a shift away from regarding the entities being managed as if they were linear, mechanical systems. As Plsek (2006) puts it, ‘existing principles of management and leadership are based on old metaphors that fail to describe adequately or accurately complex situations’. In a complex system, the complex adaptive manager and/or leader

- manages context and relationships
- creates conditions that favour emergence and self-organisation
- lets go of ‘figuring it all out’
- relies on ‘good enough’ analysis of the problem and its solution
- requires minimum specifications to act rather than prescribing actions in advance.

A complex adaptive system has been defined as ‘[a] collection of individual agents with freedom to act in ways that are not always totally predictable, and whose actions are interconnected so that one agent’s actions changes the context for other agents’ (Plsek and Greenhalgh 2001).

The rest of the literature review presented below focuses on Lean thinking and tools as these have been central to the NETS initiative and, in particular, in demonstrating that successful change is possible and motivational for staff. Subsections 1.4 to 1.12 focus on the origins and evolution of Lean in the manufacturing sector, including its impact in the North East Region of England. Subsection 1.13 examines the recent take-up of Lean thinking in the UK NHS as well as the public services sector more widely.

1.4 The evolution of lean

The lineage of Lean Production can be traced back to Eli Whitney who devised the concept of interchangeable parts, Taylor (1911) who developed Scientific Management, Henry Ford’s mass production and Ohno’s Toyota Production System.

Taylor found that the skill and knowledge of how to perform a job had been handed down and evolved through generations. Management was unknowingly buying knowledge which was the property of the workers. Braverman (1998) referred to this as the workers’ capital.

People doing the same job in several different ways created variations in the volume and quality. He commented that deliberately working slowly to avoid doing a full day's work, 'soldiering', was almost universal in industrial establishments (Taylor, 1911, p.3). Taylor observed a daily conflict of workers and management fighting for the control of the ownership of labour and pay. The end result of such conflict was prosperity being lost through the lack of training and methods for both the management and work force (Eldridge et al., 1991).

It is difficult to overestimate the importance of the Scientific Management movement in the shaping of the modern corporation and indeed, all institutions of capitalist society, which carry out labour processes (Braverman, 1998). Taylor states: "the principle object of management should be to secure the maximum prosperity for the employer, coupled with the maximum prosperity for each employee" (Taylor, 1911, p.1). Taylor believed that, in the case of a single individual, the greatest prosperity exists only when that individual has reached his highest state of efficiency; that is when he is producing his largest daily output.

The main principles of Taylorism are:

1. develop standardised methods through a systematic analysis of work through time and motion studies;
2. select and train employees rather than leaving them to train themselves;
3. tasks should be standardised and workers should be provided with detailed instructions;
4. the separation of 'planning', undertaken by managers using Scientific Management principles and 'doing' performed by workers (Littler, 1978; Pruijt, 2000).

In essence, the core of Taylorism is: i) the division of labour between managers and workers; and ii) that operations should be standardised and optimised scientifically using time and motion studies (Dankbaar, 1997). Taylor (1911) stressed the importance of training to enable individuals to work at maximum efficiency. Taylor sought a situation where a trained individual was working at his maximum potential to realise both individual and company needs.

Pruijt (2000) identified a number of limitations of Taylorism. It is relatively expensive because it creates non-value adding supervisors and other indirect workers. The reliance on semi-skilled workers and high levels of demarcation reduces flexibility. However, it increases numerical flexibility because new workers can be quickly integrated into the production process. Innovative capacity is constrained and it becomes inherently unattractive to work on the shop floor. It has been widely argued that Taylorism is anti-worker (Braverman, 1998).

1.5 Fordism

In 1913 Ford developed mass production, which incorporated elements of Taylorism. He mechanised the production of standard parts and introduced a continuously moving assembly line. Under this system, the pace of work was determined by the speed of line, which also

governed the overall volume of production. The combination of a Taylorist organisation of work, often using assembly lines, together with paternalistic control over a highly paid workforce has become known as 'Fordism' (Eldridge et al., 1991). Fordism achieved economies of scale through the division of labour. The focus was high volume production at lowest cost. Workers on the line were not responsible for quality; problems were fixed later by specialist repair workers. There was a very high division of labour with a strict separation of the planning and execution of work (Dankbaar, 1997).

1.6 Toyota production system

The Toyota Production System (TPS) is the best known example of a lean production system, developed by Taiichi Ohno. He had concluded that mass production could never work in Japan. After the World War II, Toyota was confronted by: i) a small domestic market, which demanded a wide range of vehicles; ii) a workforce that was unwilling to be treated as a variable cost, as the American occupation had passed laws that strengthened the position of workers; iii) the Japanese economy was starved of capital and foreign exchange, therefore companies were unable to purchase Western production technologies; and iv) overseas producers were keen to enter the Japanese market whilst defending their established markets (Womack et al., 1990). The buffers required to maintain high line capacity utilisation with line imbalances, quality problems and other sources of variability were too costly for Toyota. The solution was to operate with minimum inventory, whilst maintaining high resource utilisation (de Treville and Antonakis, 2005). The TPS is based upon two concepts: reduction of costs through the elimination of all forms of waste (those things that do not add value to the product) and the full utilisation of workers' capabilities (Sugimori et al., 1997).

TPS may be viewed as a set of tools for reducing waste or as a set of principles that led to the development of the tools (Lander and Liker, 2007). The 14 principles that constitute the Toyota Way can be categorised in four groups: i) long-term philosophy; ii) the right process will produce the right results; iii) add value to the organisation by developing people; and iv) continuously solving route problems drives organisational learning (Liker, 2004).

The tacit knowledge that underpins TPS (and the NPW) can be captured in four rules (Spear and Bowen, 1999). The first rule is in accordance with Taylor's principle of standardisation of methods. In the TPS all work is highly specified in terms of content, sequence, timing and outcome. Standardisation is important because all variation from the best process leads to lower productivity, inferior quality and higher costs. Moreover, it hinders learning and improvement since variations obscure the link between how the work is done and the results. Adler (1997) commented that reliance is placed on industrial engineering, time studies, and pre-determined standards to ensure maximum workloads. However, in the TPS the standardisation process is not restricted to specialists and imposed hierarchically on the workforce. The second rule dictates that every customer-supplier connection must be direct with unambiguous communication. The third rule is that every pathway for products and services must be simple and direct.

Taylorism seeks to maximise the efficiency of the individual, whereas TPS aims to maximise the efficiency of the system. All workers act as a team rather than individuals and performance is evaluated in terms of group rather than individual output (Forza, 1996). The final rule is that any improvement must be developed in accordance with a scientific method, which is a core feature of TPS (Spear and Bowen, 1999). The whole workforce is actively involved and share a common belief in continuous improvement (Forza, 1996). In contrast to Taylorism, shop floor workers collaborate with specialists in developing improvement programmes. Pruijt (2003) described the Japanese style of management as neo-Taylorism. It maintains the concept of standardisation of work through systematic analysis and addresses the problem of ‘systematic soldiering’.

The International Motor Vehicle Programme at the MIT coined the term ‘Lean Production’ to refer to the Japanese system of production, of which Toyotism represents the purist form (Womack et al., 1990). Forza (1996) commented that Lean Production adopted Ford’s desire to synchronise production flow.

1.7 Lean in the UK

The arrival of Japanese automotive companies in the UK in the 1980s and 90s highlighted the uncompetitive nature of UK automotive components suppliers (Anderson Consulting, 1993; Womack et al., 1991). Strategies were therefore developed to improve the product quality, cost and delivery (QCD) performance of UK companies. In 1996, the Society of Motor Manufacturers and Traders (SMMT) (SMMC, 2006) in collaboration with the Department of Trade and Industry, created the Industry Forum (Broome, 1996). This was supported by Honda, Nissan, Toyota, General Motors and Volkswagen. They provided ‘Master Engineers’ who were world experts in manufacturing process improvement (IF, 2006; Rich and Bateman, 2003). The Master Engineers trained a cadre of UK engineers in the use of best practice manufacturing tools and techniques. The Industry Forum created a number of programmes based around a ‘Common Approach Toolkit’ which comprises: i) ‘The building blocks’ (5C/5S (Waller, 2003), seven Wastes (Bicheno, 2000), standardised work and Visual Management); and ii) supporting tools (data analysis, problem solving, set-up improvement and line balance) (IF, 2006). These tools are explained in section 0. Industry Forum engineers transferred their skills, knowledge and delivery techniques into the companies with whom they worked through Master Classes (Bateman and David, 2002; Pullin, 1998). Master Classes are practical, shop floor based process improvement activities implemented with a ‘hands-on’ approach. The objective of the training is to enable companies to make significant improvements in quality, cost and delivery and to encourage the development of partnerships with their customers and suppliers. The Master Engineers have now returned to their respective companies and the training is now provided by Senior Industry Forum Engineers who carry on the high standard of work (IF, 2006).

The major Japanese car manufacturers have made substantial investments in supplier development teams (Sako, 2004). These teams train suppliers in manufacturing best practices, which has promoted the dissemination of Lean Manufacturing throughout the supply chain. In Japan, suppliers and customers often have interlocking business relationships and

shareholdings through the 'Keiretsu' system. This encourages suppliers to accept the support of their customer. In contrast, in the West, supplier development teams have to work in situations where the companies are independent and there is less loyalty (Lloyd et al., 1994). This can make supplier development much more difficult.

The superior performance of lean manufacturing systems has encouraged the idea of transferring lean manufacturing to non-Japanese and non-automotive situations. This is based upon the premise that manufacturing problems and solutions are universal. However, in practice, Western manufacturers are often able to emulate the structural parts of lean, but have found it difficult to adopt the required organisational culture and mindset. The impact is often localised and falls short of the desired improvements in the overall system (Hines et al., 2004).

1.8 Lean philosophy and strategies

The Toyota Production System (TPS) (Spear and Bowen, 1999) was developed in Japan by Ohno and Shingo and forms the basis of Lean Manufacturing (Spear and Bowen, 1999). Vollmann et al. (1992) considered the goal of Lean to be: zero inventories, zero defects, zero disturbances, zero set-up time, zero lead-time, zero transactions and routine operations that operate consistently day-to-day. Transactions consist of: i) *logistical transactions* - ordering, execution and confirmation of material movement; ii) *balancing transactions*: associated with planning that generates logistical transactions - production control, purchasing, scheduling; iii) *quality transactions*: specification and certification; and iv) *change transactions*: engineering changes etc.

Toyota could not afford the capital-intensive mass production systems used in the USA so instead focused upon minimising waste in all aspects of its operations. In lean manufacturing, waste may be considered to be any activity which consumes resources or creates cost without producing any form of offsetting value stream (Porter, 1991; Porter and van der Linde, 1995).

Ohno (1988) described seven general types of waste:

1. Making too many items or making items too early causes the waste of overproduction. This situation leads to excessive lead-times and storage times with increased inventory;
2. Any time that materials or components are not having value added to them is described as the waste of waiting;
3. The movement of materials within the factory adds cost but not value. This is known as the waste of transportation;
4. The use of a large expensive machine instead of several small ones leads to pressure to run the machine as much as possible rather than only when needed. This is known as the waste of inappropriate processing, which may lead to poor layout, extra transportation and poor communication;

5. Inventory tends to increase lead-times, reduces flexibility and prevents the rapid identification of problems. This is described as the waste of unnecessary inventory;
6. The waste of unnecessary motions relates to ergonomics. If operators have to bend and stretch it may lead to quality and productivity problems;
7. The cost of defects includes internal failure (scrap, rework and delay) as well as external failure (repairs, warranty cost and lost custom).

Waste may arise from individual processes or relationships between processes. Wastes 4 and 6 result from individual processes. Wastes 1, 2, 3 and 5 above arise from relationships between processes. Waste 7, defects, emanate from either individual processes or relationships between processes.

Bicheno (2000) identified 'new' wastes: the waste of untapped human potential; the waste of inappropriate systems that add cost without adding value; wasted energy and water; wasted materials; wasted customer time and the waste of defecting customers—it may cost many more times to acquire a customer than it does to retain one.

Lean comprises a philosophy, a way of thinking that focuses upon value. Often this is considered in terms of cost reduction. "This migration from a mere waste reduction focus to a customer value focus opens essentially a second avenue of value creation: Value is created if internal waste is reduced, as the wasteful activities and the associated costs are reduced, increasing the overall value proposition for the customer. Value is also increased, if additional features or services are offered, which are valued by the customer. This could entail a shorter delivery cycle or smaller delivery batches, which might not add additional cost, yet add customer value" (Hines et al., 2004). The other main emphasis is on continuous improvement that is usually based upon teamwork that is undertaken by empowered employees.

1.9 Lean tools

Toyota used many techniques and tools to reduce waste including Kaizen, Cellular Manufacturing, Synchronous Manufacturing, Poka-Yoke, standardised working and work place organisation (Bicheno, 2000). The outcomes included significantly reduced inventory and lead-times; improved delivery performance; better space and resource utilisation; and enhanced productivity and quality (Pavnaskar et al., 2003).

1.9.1 Gemba Kanri

The core of Lean is Gemba Kanri (workshop management), which is a system by which standards for running the day-to-day business are established, maintained controlled and improved. Gemba Kanri includes a number of methods:

1. 5Ss (Shitsuke, respect rules; Seiso, keeping the work area clean and tidy; Seiketsu, standardisation of operations, components and products; Seiri, putting tools away; Seiton, organising tools, materials and documentation).

2. *Skill control*, including the assessment of individuals capabilities, the identification of job requirements, the development of a comparison matrix and the identification of training needs;
3. *Kaizen* is a cost cutting approach that continuously makes small improvements to processes;
4. *Visual management*, the provision of notice boards for control information, stock, materials movement, health and safety and work methods.

1.9.2 Facility Layout

A common starting point for Lean implementations in manufacturing companies is to reorganise the layout of manufacturing facilities to simplify and reduce material movement. A well-designed manufacturing facility helps increase responsiveness and efficiency through minimising material transfer, work-in-progress and lead-times. It has been estimated that 30–75% of total manufacturing costs may be attributed to materials handling and layout (Chiang and Kouvelis, 1996). Good layouts facilitate the introduction of set-up time reduction techniques and the introduction of team working, which have a further impact upon manufacturing performance.

In traditional western manufacturing companies similar machines were placed close together. This is known as functional or process based layouts. This configuration was popular in the early 20th century when machines were powered by steam engines that fed large overhead shafts. Functional layout allows high levels of demarcation as workers performing a similar set of limited tasks are co-located. This configuration is also quite robust with respect to machine breakdown as work can be easily transferred to the next machine. However, materials travel very long distances with many direction changes. The alternative to this process based layout is to move towards a product focused layout where the (dissimilar) machines required to produce families of parts are located in manufacturing cells. Functional and Cellular layouts are illustrated in Figure 1 (the initials refer to the type of process; ‘T’ turning, CG cylindrical grinding, D drilling, M milling, SG, surface grinding).

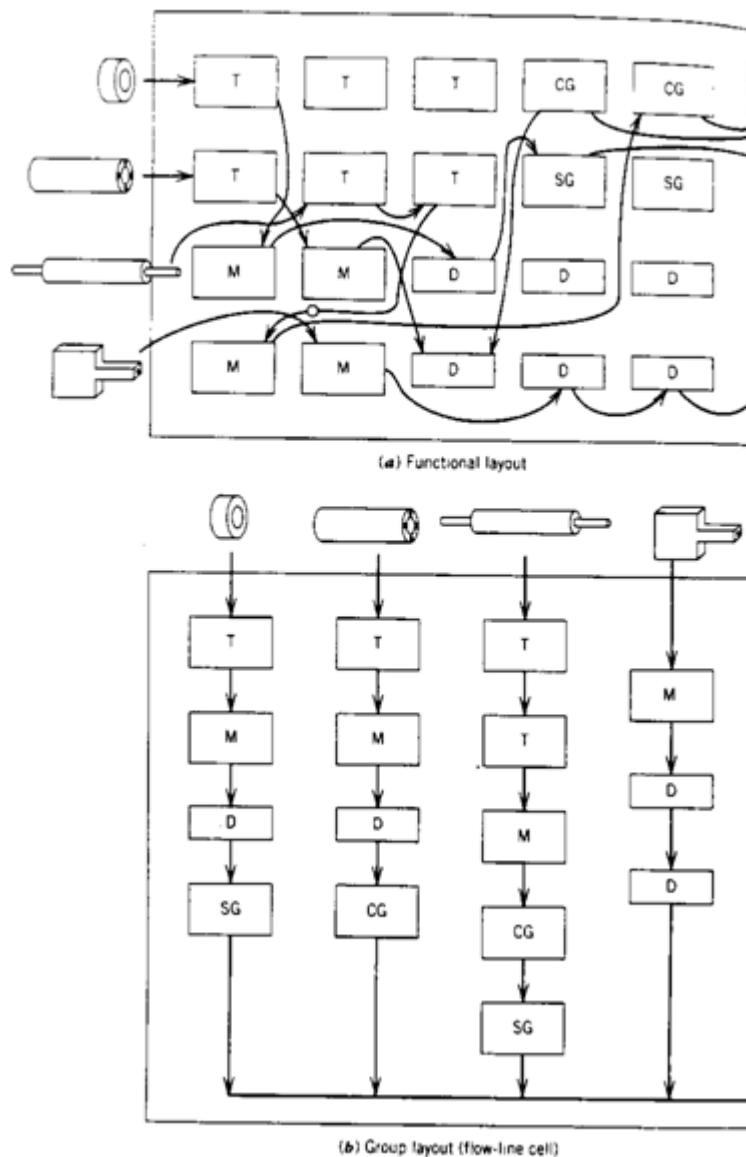


Figure 1 Functional and Group Layouts (Askin and Standridge, 1993)

Cellular Manufacturing is based upon Group Technology (GT). It is a philosophy that aims to exploit the similarities between parts in several ways: i) by performing like activities together; ii) by standardising similar tasks; iii) by storing and retrieving information about recurring problems. There are various application areas including design, process planning, sales, costs estimating, purchasing and manufacturing (Hyer and Wemmerlov, 1989). GT was first proposed by Flanders (1925) and was developed in Russia by Mitofanov (1966) and promoted in the United Kingdom by Burbidge (1971).

In white-collar areas, GT is linked with Business Process Reengineering (BPR), which transforms organizations from a functional to a process focus. Cellular manufacturing (CM) is an application of GT where a portion of a firm's manufacturing system has been converted to cells. Clusters of dissimilar machines are placed in close proximity and are dedicated to the manufacture of a family of parts (Wemmerlov and Hyer, 1989).

Manufacturing cells are designed through a number of stages including: i) job assignment, which selects machines for each operation; ii) cell-formation, which groups machines into cells; iii) the layout of cells within the plant; iv) the layout of machines within cells; and v) transportation system design (Dimopoulos and Zalzal, 2000; Wu, 1999). These approaches can be applied in other sectors.

1.9.3 Single Minute Exchange of Dies

To provide flexibility within Lean production systems it is very important to minimise the change over times. This is important because change over activities are wasteful and more importantly they lead to the use of large process batch sizes, which can dramatically increase lead-time and inventory, whilst simultaneously making the production system less responsive to customer demand.

Shingo (1985) developed a method called the Single minute exchange of dies (SMED), which was so named because it aimed to reduce all changeovers to less than ten minutes. SMED includes four steps:

1. Separating internal set-up from external set-up. (Internal set-up activities must have the machine turned off e.g. changing a cutter; whereas external activities can take place whilst the machine is still running e.g. collecting a tool from the stores);
2. Convert as many tasks as possible from being internal to external;
3. Eliminate adjustment processes within set-up, because adjustments are very slow and iterative;
4. Abolish set-up where feasible, perhaps by using duplicated machines (a car company may have a spray gun for each colour, which avoids the need for frequent cleaning)

The impact of SMED is illustrated in Figure 2.

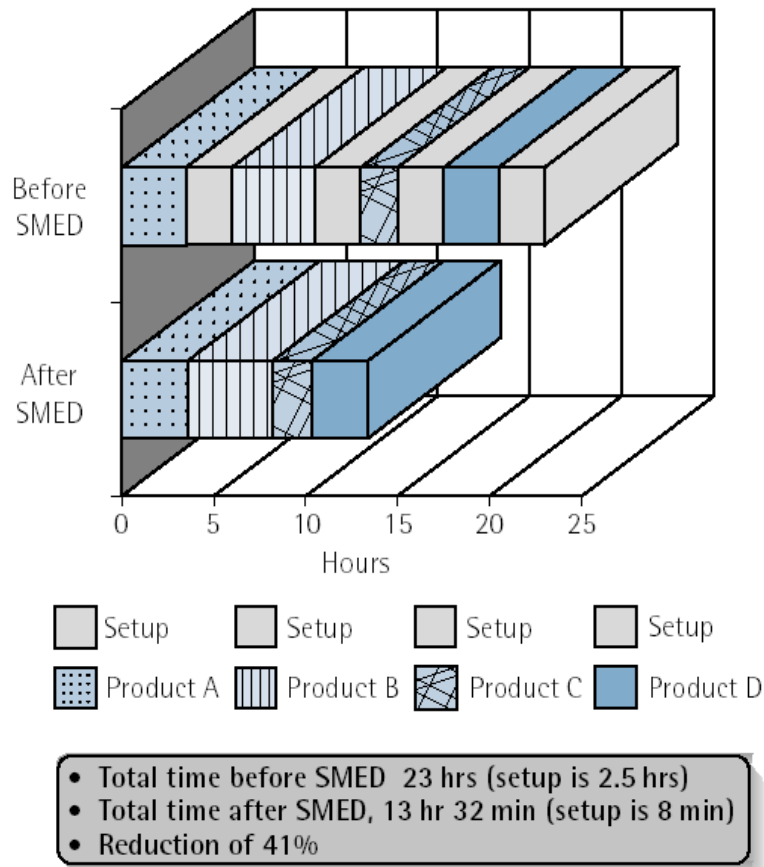


Figure 2 Single Minute Exchange of Dies (Waller, 2003)

1.9.4 Overall Equipment Effectiveness

Overall Equipment Effectiveness is a widely used tool for analysing processes and identifying opportunities for continuous improvement. OEE is a standard measure of machine performance that is adopted by world class companies. This measure accounts for output losses on a machine or process due to down-time losses (breakdowns, changeovers, maintenance, etc), performance rate losses (machine is running at a slower rate than its design speed due to stoppages, equipment failures, etc) and quality rate losses due to defects. An example is shown in Figure 3.

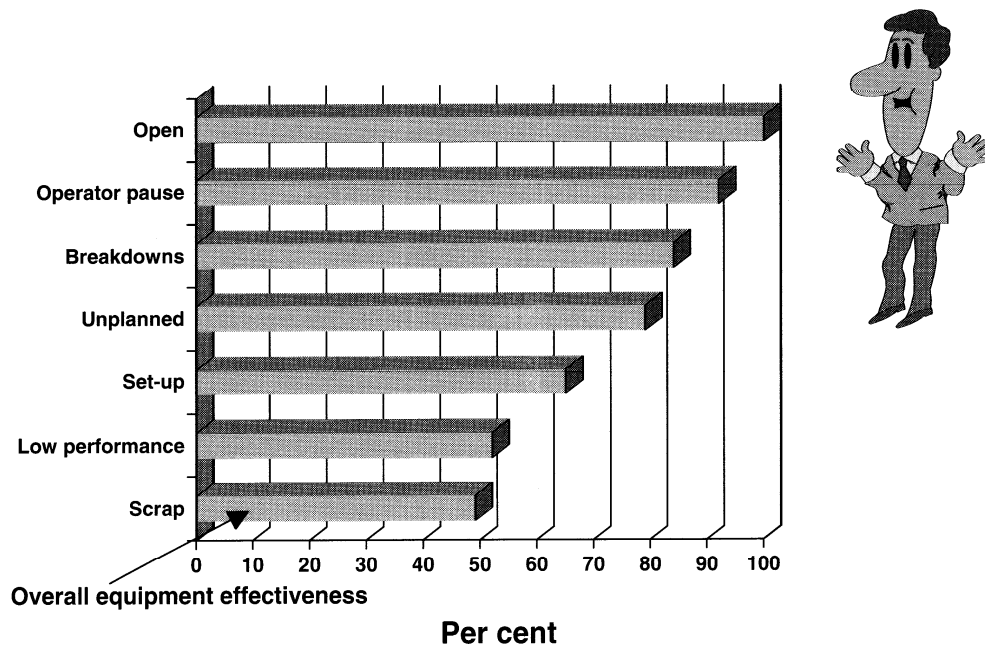


Figure 3 Overall Equipment Effectiveness (Waller, 2003)

1.9.5 Smallest Machine Concept

In the west, there has been a general tendency to use large technologically advanced high capacity machines. In Lean, the approach is to have more, simpler, lower capacity machines. This is illustrated in Figure 4. The large machine requires three changeovers to change production from green to purple to red. The small machine configuration has separate machines dedicated to each product, thus avoiding changeovers. Furthermore, it is usual for the total capacity of the small machines to exceed the capacity of the large machine. This makes the system more robust with respect to changes in demand in terms of volume and product mix.

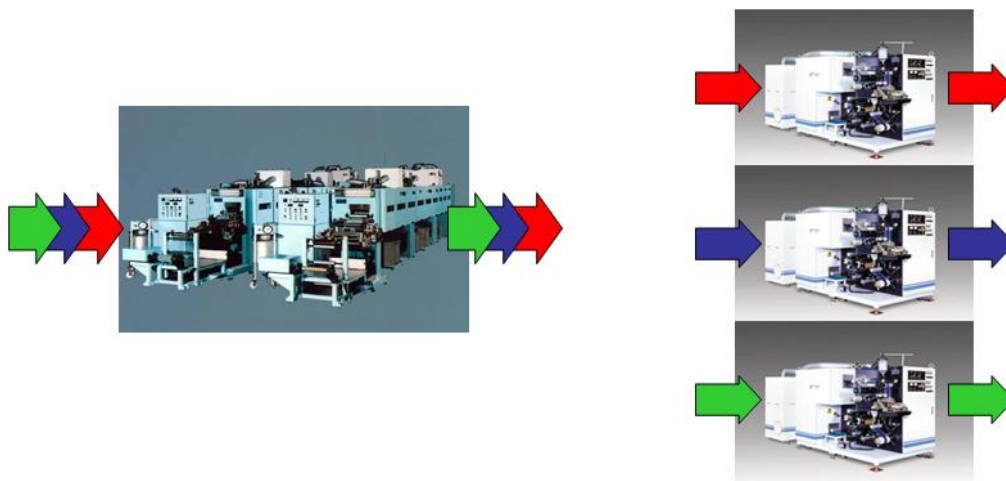


Figure 4 Smallest machine concept (Slack et al., 2004)

1.9.6 Material Control

A key element of Lean relates to material control. Indeed Lean evolved from the principles of Just-in-Time (JIT) manufacturing. “In the broad sense, an approach to achieving excellence in a manufacturing company based upon the continuing elimination of waste (waste being considered as those things which do not add value to the product). In the narrow sense, JIT refers to the movement of material at the necessary time. The implication is that each operation is closely synchronised with subsequent ones to make that possible” (APICS, 1998). The key to material control in Lean is the application of pull scheduling, which links the flow of materials to the requirements of the customer. This is illustrated in Figure 5.

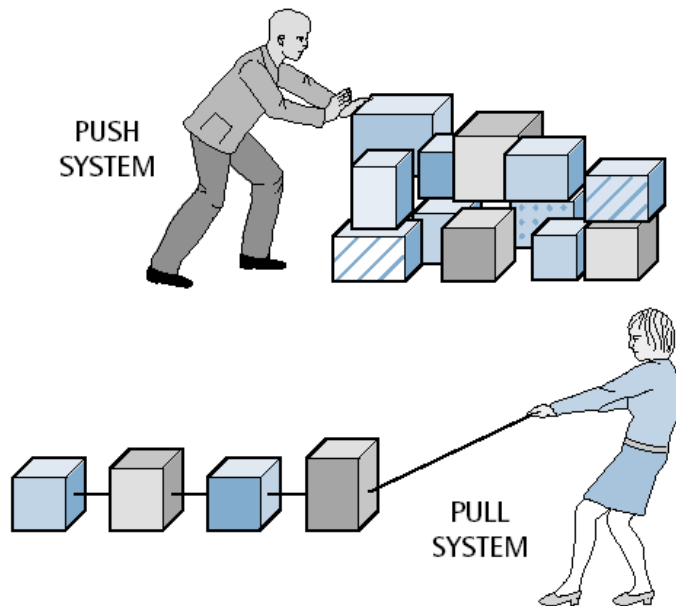


Figure 5 Push and pull systems (Waller, 2003)

There are a number of practical implementation methods used including card systems (1 and 2 card Kanban), visual systems e.g. chalk squares and audible systems e.g. operators speaking to each other. If there is a good layout with clear and obvious material flow it facilitates the use of the simplest pull systems. If the layout is more complicated (with resources remote from each other) it is necessary to use card or computer-based systems for communicating information on material requirements.

1.10 Implementation

Lillrank (1995), suggested that ideas emanating from Japan have to travel along an ‘idea line’. The ‘distance’ is not only geographical, but also due to differences in culture, society and history, as well as strategic paradigms. ‘Distance’ leads to misunderstandings, incomplete information and incorrect context. Figure 6 illustrates Lillrank’s model, which is based upon an analogy with the transmission of electrical power, where the power loss is a function of the voltage and distance travelled. Japanese concepts, tools and models are packaged and abstracted for the transfer process. At the receiving end, an application process interprets and applies the package through a learning process that suits local conditions. When

implementing Lean Manufacturing in western countries there are geographical, educational, cultural, societal and historic barriers, as well as mismatches in strategic thinking (Dyer and Nobeoka, 2000; Lloyd et al., 1994; Sako, 2004).

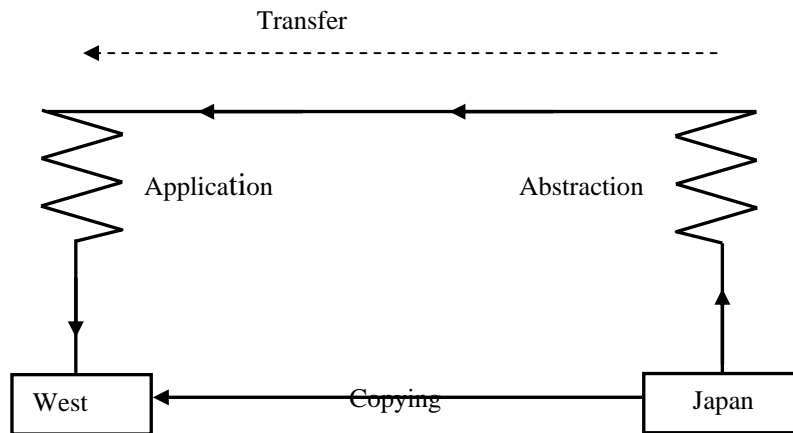


Figure 6. The transfer of management innovations from Japan (Lillrank, 1995).

The implementation of lean manufacturing techniques and philosophies requires the transfer of explicit and tacit knowledge (Polyani, 1966). The transfer of knowledge, particularly tacit knowledge, requires the abstraction and packaging of knowledge from a host. The application of the knowledge by a client involves an unpacking process (Lillrank, 1995). The Master Class (Pullin, 1998), which is a 15 day team event, is an example of this form of technology transfer. The abstraction and packing activities took place when the Industry Forum engineers were trained by the Master Engineers. The unpacking takes place through Master Classes run for recipients.

Lean tools, such as Statistical Process Control (SPC) (Montgomery, 1985), Failure Modes Effects Analysis (FMEA) (Dieter, 2000), Single Minute Exchange of Dies (SMED) (Shingo, 1985), Fool Proofing and Process Mapping (Hines and Rich, 1997) involve mainly explicit knowledge, which can be codified. These techniques are well documented and are relatively easy to learn from the literature. However, other tools such as Total Productive Maintenance (TPM), Kanban, 5S/5C, Standardised Working and Policy Deployment require mainly tacit knowledge (Polyani, 1966) to apply them, which makes them difficult to implement without support. The General Manager of International Purchasing for Toyota commented “(t)he ideas behind the Toyota Production System (TPS) have basically diffused and are understood by our competitors. But the know-how regarding how to implement it in specific factories and contexts has not. ... I think we are better at learning” (Dyer and Nobeoka, 2000, p345).

1.11 Hoshin Kanri (policy deployment)

Hoshin Kanri is sometimes known as “policy deployment, management by policy or policy control” (Tennant and Roberts, 2000). It was developed in Japan in the 1960s as a derivative of Management by Objectives. Hoshin Kanri is a framework for linking strategy with operations. The aim is to identify areas for improvement and the necessary actions required to bring about changes. Policy based objectives are translated into quality, cost, delivery and

education (QCDE) targets which are used as short term ‘ stretch’ measures at the operational and process levels to drive continuous improvement (Witcher and Butterworth, 2001). It is an implementation tool for deploying existing strategic plans throughout the organisation. It not a strategic planning tool. It ensures that local strategic actions are consistent with the long term strategy of the corporation. It is a means to focus and align operations and strategy (Witcher and Butterworth, 2001). Hoshin Kanri has four iterative phases; review, revision, deployment and implementation that correspond to the check-act-plan-do cycle phases of the improvement cycle (Wood and Munshi, 1991).

Figure 7 shows the Hoshin Kanri planning framework. The first step involves the formulation of the organisation’s vision and goals. This is followed by the development of a 3-5 year plan, which is disaggregated into annual objectives that defines what is necessary to realise the vision. The fourth stage relates to setting and agreeing targets and means at the departmental level. This is followed by implementation, monthly and annual review.

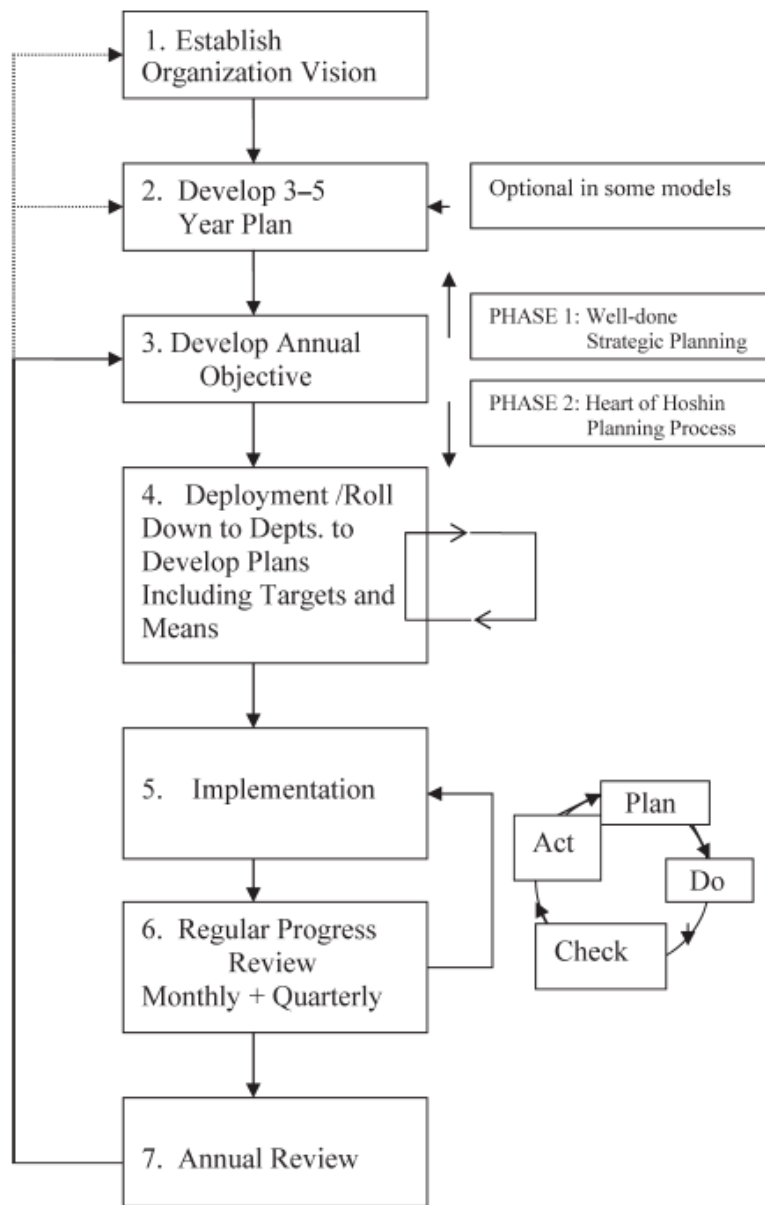


Figure 7 The seven steps of the Hoshin planning process (Jolayemi, 2008)

A key aspect of Hoshin Kanri is a consensus building process known as ‘Catchball’ that involves throwing ideas around from person to person. It is an iterative process of discussing plans and targets until a consensus is reached (Tennant and Roberts, 2003). This Japanese approach to organisational decision making is time consuming. The process of achieving consensus is known as nemawashi, which is an informal and intensive form of communication that takes place before open meetings and formal decisions (Witcher and Butterworth, 2001) . A major benefit of ‘Catchball’ is that it captures knowledge from employees at all levels of the organisation in order to improve processes.

Hoshin Kanri has several benefits when compared to traditional western strategic planning approaches: i) it integrates strategic objectives with day-to-day management; ii) it links vision to medium and short-term planning and control; iii) it applies the plan-do-check-act cycle to

business process management; iv) it generates consensus; v) it captures knowledge from the participants and motivates employees; vi) the process allows managers to exercise leadership; and vii) policy is not short-term (Lee and Dale, 1998).

1.12 Lean initiatives in the North East of England

In 2000, 18.2% of the population of the North East of England was employed in manufacturing, which was 20% higher than the UK national average of 15.1% (ABI, 2005). However, the level of productivity (measured in terms of gross value added i.e. the value of outputs minus the value of inputs) in the North East was 25% lower than the national average. Manufacturing employment in the North East is forecast to fall from around 175,000 in 2000 to 146,000 in 2010; a fall of 19% (ONS, 2006). This situation has made the support of manufacturing companies a major policy objective of One NorthEast (ONE), the Regional Development Agency (RDA). ONE has funded the North East Productivity Alliance (NEPA), which aims to improve the productivity of regional companies to make them globally competitive through the application of Lean manufacturing techniques.

NEPA developed a three step process for analysing companies' needs. The first step was Productivity Needs Analysis (PNA), which gave a manufacturing overview of each company, identified the key performance measures used and formed a basis for a detailed study of production efficiency. The second step was a Manufacturing Needs Analysis (MNA), which identified the plant processes and characteristics, as well as appropriate Lean tools and performance metrics (see Figure 8). The outcome of each MNA was an improvement plan for the first year. The third step was a Training Needs Analysis (TNA) that identified the operatives' knowledge of Lean tools and staff development requirements (Herron and Braiden, 2004; NAC, 2004). The TNA measured operatives' knowledge of Lean in terms of: i) understanding the concepts; ii) demonstrating understanding through training exercises; and iii) applying the knowledge in the workplace (see Figure 9). This allowed a structured training programme to be developed to meet individual company requirements. The methodology used was based upon a Quality Function Deployment (QFD) matrix with a scoring system to identify priorities (Herron and Braiden, 2004). A second tool evaluated the level of need and desire for change within the organisations (Herron and Braiden, 2004).

Fig:1		MNA Criteria				
Item	Level	1	2	3	4	5
5C/5S	1S Completion Sort (Seiri)	up to 20% of work areas have completed	up to 40% of work areas have completed	up to 60% of work areas have completed	up to 80% of work areas have completed	over 80% of work areas have completed
	2S Completion Straighten (Seiton)	up to 20% of work areas have completed	up to 40% of work areas have completed	up to 60% of work areas have completed	up to 80% of work areas have completed	over 80% of work areas have completed
	3S Completion Shine (Seiso)	up to 20% of work areas have completed	up to 40% of work areas have completed	up to 60% of work areas have completed	up to 80% of work areas have completed	over 80% of work areas have completed
	4S Completion Standardise (Seiketsu)	up to 20% of work areas have completed	up to 40% of work areas have completed	up to 60% of work areas have completed	up to 80% of work areas have completed	over 80% of work areas have completed
	5S Completion Sustain (Shitsuke)	up to 20% of work areas have completed	up to 40% of work areas have completed	up to 60% of work areas have completed	up to 80% of work areas have completed	over 80% of work areas have completed
Standard operations	The concept of Standard Operation is understood	By up to 20% of the direct Workforce	By up to 40% of the direct Workforce	By up to 60% of the direct Workforce	By up to 80% of the direct Workforce	By over 80% of the direct Workforce
	Standard Operations are Established	up to 20% of all operations have Standard Operations	up to 40% of all operations have Standard Operations	up to 60% of all operations have Standard Operations	up to 80% of all operations have Standard Operations	over 80% of all operations have Standard Operations
	Development of the Standard operation	Only OA/Engineering team members write Standard Operations	Level 1 plus some Supervisors can write Standard Operations	All Supervisors write the Standard Operations	Level 3 plus Team Leaders write the Standard Operations	Level 4 plus Operators have an input in developing the Standard Operation
	Maintenance of the Standard operation	up to 20% of Std Ops reviewed & maintained at least 6 monthly	up to 40% of Std Ops reviewed & maintained at least 6 monthly	up to 60% of Std Ops reviewed & maintained at least 6 monthly	up to 80% of Std Ops reviewed & maintained at least 6 monthly	over 80% of Std Ops reviewed & maintained at least 6 monthly
Skill Control	Personal capabilities of individuals assessed	up to 20% of all personal capabilities assessed	up to 40% of all personal capabilities assessed	up to 60% of all personal capabilities assessed	up to 80% of all personal capabilities assessed	over 80% of all personal capabilities assessed
	Job capabilities assessed	Job capabilities assessed in up to 20% of production areas	Job capabilities assessed in up to 40% of production areas	Job capabilities assessed in up to 60% of production areas	Job capabilities assessed in up to 80% of production areas	Job capabilities assessed in over 80% of production areas
	Skill Matrices deployed	Skill matrices using 4 levels or greater in up to 20% of production areas	Skill matrices using 4 levels or greater in up to 40% of production areas	Skill matrices using 4 levels or greater in up to 60% of production areas	Skill matrices using 4 levels or greater in up to 80% of production areas	Skill matrices using 4 levels or greater in over 80% of production areas
	Training using Skill Matrices	Training plans in place based on Skill Matrix requirements across up to 20% of workforce	Training plans in place based on Skill Matrix requirements across up to 40% of workforce	Training plans in place based on Skill Matrix requirements across up to 60% of workforce	Training plans in place based on Skill Matrix requirements across up to 80% of workforce	Training plans in place based on Skill Matrix requirements across over 80% of workforce
Kaizen	The need for PDCA	Understood across up to 20% of the Workforce	Understood across up to 40% of the Workforce	Understood across up to 60% of the Workforce	Understood across up to 80% of the Workforce	Understood across over 80% of the Workforce
	Cross functional improvement activity	Formal events using the 7 tools taken place across up to 20% of the site	Formal events using the 7 tools taken place across up to 40% of the site	Formal events using the 7 tools taken place across up to 60% of the site	Formal events using the 7 tools taken place across up to 80% of the site	Formal events using the 7 tools taken place across over 80% of the site
	Planning	Activities ad-hoc and unplanned	Sporadic events usually focussed on the latest quality issue	Events take place to a plan in some areas	Events take place to a plan in all areas	Activities planned and in line with company objectives
Visual Management	Breadth of application	Any visual management employed will probably be general information posted on a central notice board, no reference to Q, C, D, P or M	Visual management in some areas of the workplace pertaining to Q, C, D etc. but either not up to date or not relevant to the area posted	Visual Management up to date and relevant in most areas but not extending to controlling stock and materials	Some material controlled visually but not all of the 4 principles of stock control are evident	All types of visual management are used to control information, stock, materials movement, safety and work methods (standard operation)
	Concepts of JIT deployed	Understood across up to 20% of the Workforce	Understood across up to 40% of the Workforce	Understood across up to 60% of the Workforce	Understood across up to 80% of the Workforce	Understood across over 80% of the Workforce
Process flow	Lead time analysis	up to 20% of all product has accurate lead times	up to 40% of all product has accurate lead times	up to 60% of all product has accurate lead times	up to 80% of all product has accurate lead times	over 80% of all product has accurate lead times
	Waste elimination	Evidence of all of the 7 wastes in the production process	up to 40% of production areas practise waste reduction activities	up to 60% of production areas practise waste reduction activities	up to 80% of production areas practise waste reduction activities	Waste elimination programme has reduced most in process waste in over 80% of the shop floor
	Knowledge of problem solving techniques	up to 20% of workforce trained in problem solving techniques	up to 40% of workforce trained in problem solving techniques	up to 60% of workforce trained in problem solving techniques	up to 80% of workforce trained in problem solving techniques	over 80% of workforce trained in problem solving techniques
Problem Solving	Application of problem solving techniques	Currently only solving customer NCR	Level 1 plus monthly hit list of concerns	Level 2 plus measures for recurrence of previous problems	Level 3 plus trends plotted for all quality issues with corrective actions in place	Robust system for quick response with temporary countermeasure in place in 24 hours and permanent in place after 48 hours
	Quality improvement activities	up to 20% of all processes have Quality improvement activities running	up to 40% of all processes have Quality improvement activities running	up to 60% of all processes have Quality improvement activities running	up to 80% of all processes have Quality improvement activities running	over 80% of all processes have Quality improvement activities running
Achieving Quicker Changeovers	Application of techniques (concept of internal and external setup and improving takt)	The concepts of SMED are not currently employed to reduce stock or increase machine utilisation	SMED has been applied up to 20% of applicable processes to improve utilisation and reduce batch sizes with evidence to show the benefits	SMED has been applied up to 40% of applicable processes to improve utilisation and reduce batch sizes with evidence to show the benefits	SMED has been applied up to 60% of applicable processes to improve utilisation and reduce batch sizes with evidence to show the benefits	SMED has been applied up to 80% of applicable processes to improve utilisation and reduce batch sizes with evidence to show the benefits
PLM	Knowledge of PLM	up to 20% of workforce trained in PLM techniques	up to 40% of workforce trained in PLM techniques	up to 60% of workforce trained in PLM techniques	up to 80% of workforce trained in PLM techniques	over 80% of workforce trained in PLM techniques
	Equipment care	up to 20% of equipment has a daily clean and check system in place	up to 40% of equipment has a daily clean and check system in place	up to 60% of equipment has a daily clean and check system in place	up to 80% of equipment has a daily clean and check system in place	over 80% of equipment has a daily clean and check system in place
	Efficiency improvement	OEE performance measured and improvement strategies in place for up to 20% of equipment	OEE performance measured and improvement strategies in place for up to 40% of equipment	OEE performance measured and improvement strategies in place for up to 60% of equipment	OEE performance measured and improvement strategies in place for up to 80% of equipment	OEE performance measured and improvement strategies in place for over 80% of equipment
Work Measurement Techniques	Pace study analysis	Techniques used in the execution of kaizen activities only. Used only by Industrial Engineering function with production unable to gather data and analyse the data themselves. Not all techniques applied in all cases. 1 to 3 techniques utilised.	All techniques used where possible on all kaizen activities. Shop floor personnel use the techniques during kaizen events and also when validating their own process outside of kaizen activities. 3 to 5 techniques utilised.	Used when setting up new processes to optimise layout from SOP by cross functional team of IE, Prod Eng and Supervision		
	Walk pattern analysis					
	Man/Machine charting					
	Gantt Charting					
	Line balance activities					
Failure Mode and Effect Analysis (FMEA)	Depth of application	Top 20% by value of all components have FMEA studies with plans to reduce RPN numbers	Top 40% by value of all components have FMEA studies with plans to reduce RPN numbers	Top 60% by value of all components have FMEA studies with plans to reduce RPN numbers	Top 80% by value of all components have FMEA studies with plans to reduce RPN numbers	All components have FMEA studies with plans to reduce RPN numbers
	Application	Poka yoke not yet applied as a specific quality assurance technique	Poka yoke has been introduced in some areas to address specific quality issues but not controlled or logged as specific devices	Devices are identified on a quality layout or equivalent by their type. Will not accept, will not make, will not pass	Devices are identified in the workplace, also on the quality layout and are checked after each break using known bad part with results logged	Level 4 plus poka yoke devices are used to reduce RPNs from FMEA studies and as countermeasures to existing quality issues
Value Stream Mapping (VSM)	Knowledge of VSM	up to 20% of workforce understand VSM, typically Engineers	up to 40% of workforce understand VSM, Engineers and Supervisors	up to 60% of workforce understand VSM, Engineers, Supervisors and Team Leaders	up to 80% of workforce understand VSM, Engineers, Supervisors and Team Leaders	over 80% of workforce understand VSM and apply regularly
	Expansion of VSM	VSM is applied to top 20% of components by value	VSM is applied to top 40% of components by value	VSM is applied to top 60% of components by value	VSM is applied to top 80% of components by value	VSM is applied to all components
	Application of VSM	All VSM activities have a future state implementation plan	Level 1 plus assigned tasks and milestones	Level 2 plus balanced metrics to measure success	Level 3 plus linked to overall business objectives	Level 4 plus regular (monthly) review and walk of the process
Advanced Problem Solving Skills	7 new QC Tools knowledge	up to 20% of workforce understand 7 New QC tools	up to 40% of workforce understand 7 New QC tools	up to 60% of workforce understand 7 New QC tools	up to 80% of workforce understand 7 New QC tools	over 80% of workforce understand 7 New QC tools
	Application of the 7 new QC tools	New QC tools applied mainly by Engineers	New QC tools applied by Engineers and Supervisors	New QC tools applied by Engineers, Supervisors and Team Leaders	New QC tools applied by Engineers, Supervisors, Team Leaders and Operators	New QC tools applied by Direct and Indirect workforce
	SPC Knowledge	up to 20% of workforce trained in SPC	up to 40% of workforce trained in SPC	up to 60% of workforce trained in SPC	up to 80% of workforce trained in SPC	over 80% of workforce trained in SPC
	SPC application	SPC applied to up to 20% of processes	SPC applied to up to 40% of processes	SPC applied to up to 60% of processes	SPC applied to up to 80% of processes	SPC applied to all processes
	6 Sigma Knowledge	Management education programme complete	Some staff trained to green belt level	Some staff trained to black belt level	Some staff trained to master black belt level	Some staff trained to Champion level with projects running
	6 Sigma Application	6 Sigma applied to 20% of all processes	6 Sigma applied to 40% of all processes	6 Sigma applied to 60% of all processes	6 Sigma applied to 80% of all processes	6 Sigma applied to over 80% of all processes, direct and indirect
6 Sigma Success	Sigma Level 2 - 308,537 PPM	Sigma Level 3 - 66,807 PPM	Sigma Level 4 - 6,210 PPM	Sigma Level 5 - 233 PPM	Sigma Level 6 - 34 PPM	

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Figure 8 Manufacturing Needs Analysis (Hicks et al., 2007)

Training Needs Analysis (TNA)		Company XYZ			
Desired Level	Item	Understanding	Demonstration	Application	
<p>Workshop Management</p> <p>Minimum requirement to have greater than 80% of the direct workforce able to apply these techniques in the workplace.</p> <p>Enter into the boxes on the right the current proportion of the workforce able to understand, demonstrate, and apply the principles.</p> <p>The training need will be the gap between the current status and the desired level</p>	5C/5S	1S Completion Sort (Seiri)	10	0	0
		2S Completion Straighten (Seiton)	10	0	0
		3S Completion Shine (Seiso)	10	0	0
		4S Completion Standardise (Seiketsu)	10	0	0
		5S Completion Sustain (Shitsuke)	10	0	0
		Standard operations	The concept of Standard Operation is understood	15	10
	Standard Operations are Established		15	10	10
	Development of the Standard operation		15	10	10
	Maintenance of the Standard operation		15	10	10
	Skill Control	Personal capabilities of individuals assessed	30	10	10
		Job capabilities assessed	30	10	10
		Skill Matrices deployed	30	10	10
		Training using Skill Matrices	15	15	15
	Kaizen	The need for PDCA	10	10	10
		Cross functional improvement activity	10	10	10
		Ability to plan kaizen activities	30	30	30
	Visual Management	Application	30	30	30
	<p>Productivity</p> <p>The minimum productivity requirements will be to have 25% of the workforce competent at applying productivity principles. Most usually Team Leaders, Leading Hands or other types of Front Line Supervision. This will build upon the basic understanding and stability provided by the application of Workshop Management</p>	Process flow	Concepts of JIT deployed	0	0
Lead time analysis			0	0	0
Waste elimination			5	0	0
Problem Solving		Knowledge of problem solving techniques	2	2	2
		Application of problem solving techniques	10	10	10
		Quality improvement activities	15	15	15
Achieving Quicker Changeovers		Application of techniques (concept of internal and external setup and improving this)	10	10	10
PLM		Knowledge of PLM	10	10	10
		Equipment care	10	10	10
		Efficiency improvement	2	2	2
<p>Advanced Techniques</p> <p>The minimum requirements will be to have 15% of the workforce responsible for implementing change applying these techniques. Job roles will most likely include Supervisors, Section Leaders or Managers, Production Engineers etc. People responsible within the organisation for identifying, coordinating and planning productivity interventions</p>	Work Measurement Techniques	Pace study analysis	0	0	0
		Elemental analysis	0	0	0
		Walk pattern analysis	0	0	0
		Man/Machine charting	0	0	0
		Gantt Charting	0	0	0
		Line balance activities	0	0	0
	Failure Mode and Effect Analysis (FMEA)	FMEA Principles	0	0	0
		Application	0	0	0
	Value Stream Mapping (VSM)	VSM Principles	0	0	0
		7 new QC Tools	0	0	0
		SPC	0	0	0
		6 Sigma	0	0	0

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Figure 9 Training Needs Analysis (Hicks et al., 2007)

Fourteen Lean tools were included in MNA and TNA: i) 5C; ii) Standard Operations; iii) Skill Control; iv) Kaizen; v) Visual Management; vi) Process Flow; vii) Problem Solving; viii) Single Minute Exchange of Dies (SMED); ix) Production Led Maintenance (PLM); x) Work Measurement; xi) Failure Mode Effect Analysis (FMEA); xii) Poke Yoke (Error Proofing); xiii) Value Stream Mapping (VSM) and xiv) Advanced Problem Solving. The NEPA interventions concentrated on tools i) to viii), which were generally applied. The other tools were applied at the NEPA Engineers' discretion to satisfy particular manufacturing needs. The MNA and TNA were broken down into the constituent elements of the Lean tools; for example, each of the 5C tools was considered separately. The MNA evaluated performance in terms of five categories ranging from 1 (0-20%) to 5 (80-100%). The TNA measured understanding, demonstration and application as a percentage score.

The technology transfer process was based upon the Industry Forum approach (Bateman, 2006; Bateman and David, 2002). A 'Pre-diagnostic' visit was made to each company by an independent consultant. This involved the collection of data through the PNA, MNA and TNA to identify the objectives of the improvement activity. The personnel to be involved were also identified at this stage. The use of third-party consultants ensured that the requirement for NEPA support was independently verified. Two weeks later a three day diagnostic visit took place, which included: i) data collection and analysis; ii) the identification of the starting position from which performance improvements were benchmarked; and iii) identified all potential areas for improvement. A few days later a 'Check Day' checked that any actions, data or resources needed before the workshop were available. This was followed by a five day long Master Class workshop, which aimed to achieve the objectives and targets specified by the Pre-diagnostic and Diagnostic stages.

The hands-on workshops were led by Master Engineers, who ensured a structured approach to improvement based upon Deming's Plan, Do, Check, Act cycle (Deming, 2000). The team was responsible for proposing and making improvements. Progress and learning were assessed at the end of each day. At the end of the week, the team presented its work and a plan for future activity to management and other interested parties. At this stage management needed to commit resources to meet the plan (Bateman, 2006). The workshop was followed by three one-day follow ups, which took place at roughly one month intervals. The objective of these was to ensure that the continuous improvement process maintained its momentum. Corrective action was taken when necessary. During the Master Class process the responsibility for the change programme progressively shifted from the Master Engineer to a company's change agent and team.

The first step was to train the NEPA Engineers, who were initially seconded by local 'blue chip' companies. They participated in 12 assessed Master Classes. They were then responsible for running Master Classes to train company change agents in the tools identified by the PNA and MNA analysis. The NEPA initiative used the same core of lean tools as the IF Master Classes. However, the NEPA interventions included a number of additional tools including quality control, Single Minute Exchange of Dies, problem solving, process flow, Overall Equipment Effectiveness (OEE) and lead-time analysis.

Operators in the companies received a National Vocational Qualification (NVQ) in Business Improvement Techniques (IF, 2006) after successfully completing work-based training and assessment. The improvement in performance in each company was evaluated using seven DTI measures (floor space utilisation, value added per operator, stock turns, OEE, not-right-first-time, schedule achievement and the productivity of people) (DTI, 2005).

Before providing support to companies, NEPA conducted preliminary assessments of the companies using the PNA assessment tool to identify performance, manufacturing requirements and training needs. The companies that received support were assessed using the PNA tool on an annual basis. The initial PNA analysis is known as PNA1, the analysis after one year is PNA2 and a small number of PNA3 analyses after two years support have also been produced.

1.13 Performance measures

The North East Productivity Alliance measured the performance of each company using the seven Department of Trade and Industry (DTI) measures (floor space utilisation, value added per part, stock turns, OEE, not right first time, schedule achievement and operator productivity) (see: <http://www.berr.gov.uk/files/file21983.pdf>).

Stock turn ratio

$$\text{Stock Turn Ratio} = \frac{\text{Sales turnover (£)}}{\text{Raw material + work in progress + finished goods stock (£)}}$$

The stock turn ratio (sales turnover/(value of raw material + work in progress + finished goods stock)) is an important measure of the efficiency of a company. The value of stock turn ratio varies by sector. Typical batch manufacturing companies operating with functional layouts may have a low stock turn ration of 2 or less, whereas high volume automotive companies may achieve values of 50 or more. The stock turn ratio is a particular good indicator of the success of Lean interventions, as stock reduction is one of the key aims of Lean. Stock turn ratio is influenced by material flow, production planning and control and other issues such as reliability of resources.

Gross Value added per operator

$$\text{GVA per operator} = \frac{\text{Output value} - \text{Input value}}{\text{number of employees}}$$

Gross value added is explained by the Office of National Statistics on its website (<http://www.statistics.gov.uk/>). "GVA measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom. GVA is used in the estimation of Gross Domestic Product (GDP). GDP is a key indicator of the state of the whole economy. Three theoretical approaches are used to estimate GDP: 'production', 'income' and 'expenditure'. When using the production or income approaches, the contribution to the economy of each industry or sector is measured using GVA. The 'production' approach to estimating GDP looks at the contribution of each economic unit by estimating the value of an output (goods or services) less the value of inputs used in that

output's production process. The income approach to estimating GDP measures the incomes earned by individuals (e.g. wages) and corporations (e.g. profits) in the production of outputs (goods or services). The expenditure approach to estimating GDP measures total expenditure on finished or final goods and services produced in the domestic economy. All three approaches to estimating GDP are balanced annually using the Input-Output Supply and Use Tables accounting framework” (<http://www.statistics.gov.uk/>). At company level, GVA equals gross profit plus gross wages and salaries.

Overall Equipment Effectiveness (OEE)

OEE is a standard measure of machine performance that is adopted by world class companies.

$$\text{OEE} = \text{Availability (\%)} \times \text{Productivity (\%)} \times \text{Quality (\%)}$$

This measure accounts for output losses on a machine or process due to down-time losses (breakdowns, changeovers, maintenance, etc), performance rate losses (machine is running at a slower rate than its design speed due to stoppages, equipment failures, etc) and quality rate losses due to defects. However, in a recent survey only 69 out of 204 companies measured OEE (Hicks et al, 2007). There are also problems with interpreting this data because the OEE is only really significant for bottleneck processes. If companies do not have balanced production the optimum OEE for non-bottleneck resources would be less than 100%.

Floor Space Utilisation £/m²

$$\text{Floor space utilisation} = \frac{\text{Turnover of production area}}{\text{Square metres of production area}}$$

Interpreting this measure is difficult because the type of space and the amount of space required varies by sector. A recent survey of 204 companies in the North East of England revealed that 89 companies generated sales of less than £3,000 per square metre, 44 companies generated sales of £3,000 to less than £4,000 per square metre. Only 26 companies generated sales of more than £4,000 per square metre (Hicks et al, 2007). The key challenge is to increase the productivity of the companies.

Internal Schedule Achievement

An important measure of efficiency is internal schedule achievement. This shows how well management is managing the internal supply chain to ensure that materials and items are delivered to the respective business functions on time. This ultimately affects lead-time and the ability of the company to deliver to the customer on time. A failure to measure internal schedule achievement separately from external schedule achievement can lead to excessive finished goods stocks, which can give rise to high inventory levels, stock holding costs and low stock turn ratios.

External schedule achievement

To win orders and to achieve repeat business, companies need to meet customer requirements with respect to delivery dates. This measure indicates the percentage of planned deliveries that are completed on time.

Not right first time

This measures the number of defect parts per million. Reducing NRFT improves quality, cost and delivery and reduces waste. Many organisations consider quality in terms of statistical quality control (a Six Sigma process produces 3.4 defects per million)

A survey of companies in North East England revealed that only 134 out of the 204 companies measured not-right-first-time (NRFT). This would indicate that a large number of companies in the region do not recognise the importance of this measure, or have not established processes and procedures for ensuring that quality is in-built. The survey revealed that 99 of the companies that did measure NRFT experienced problems with 10% of their output. A further 17 companies experience problems with up to 20% of their production. Four companies indicated that they experience quality problems with all of their output. Implementing appropriate quality measures is an important first step to improving quality and reducing defects and waste.

1.14 Lean in healthcare

This subsection first reviews the literature in the context of public sector management theory more generally, and then focuses on Lean/TPS and systems thinking as applied to healthcare services. The emphasis throughout is on literature concerning the UK but there is also some discussion of material from Europe and the USA, particularly in regard to the Virginia Mason Production System.

1.14.1 Lean healthcare literature in the context of the public sector

The literature addressing the theory and implementation of Lean and TPS in the healthcare sector is part of a more general body of literature concerning Lean and other, related models of management such as Total Quality Management (TQM) and Business Process Reengineering (BPR) in public service organisations.

McNulty and Ferlie (2002) have argued that the UK's New Public Management (NPM) reforms which began in the early 1980s eventually resolved, by the mid 90s, into what they term 'NPM 4'. NPM 4 is characterised by a melange of private and public sector management ideas, emphasising a value-driven approach, concern with quality of service, and a continuing commitment to a distinctive public sector ethos of collective provision. While McNulty and Ferlie have reservations about the application of private sector models such as BPR to public sector settings (within the context of NPM 4), they conclude that the shift to a NPM model has made the public sector more receptive to ideas of process redesign. While Lean management/philosophy is not the same as BPR (and neither are the same as TQM), all are to a large extent focussed on process rather than product, and to this extent McNulty and Ferlie's observations are highly relevant. For example, they find that '*many public sector organisations are likely to encounter a tension between process and functional principles of organising*'. This is precisely the tension described by Seddon (2008) when criticising the arrangements made by local government organisations, over the last decade, in setting up 'front office/back office' call centres to process the various requests and demands from local citizens.

While BPR and TQM have certainly attracted considerable attention in the public sector – including health care (Patwardhan and Patwardhan, 2008) – there is evidence from recent literature that Lean management and the TPS are currently more in vogue in a variety of public service settings. For example, Hines and Lethbridge (2008) discuss and analyse a project to implement a Lean value system (Hines *et al*, 2004) in a university environment. The authors found a number of case studies relating to Lean initiatives in academic settings, and they are currently engaged in a 3-year initiative to embed Lean methods and thinking in a client university. Hines, Martins and Beale (2008) have explored the use of Lean methodology in the Portuguese and Welsh legal public sectors, particularly in the area of court services, and McQuade (2008) discusses the organisational transformation brought about by Lean thinking in a UK social housing group.

Lean in government has also received recent interest. In 1998 Erridge and Murray reported on the application of Lean principles to local government procurement processes, using the example of procurement contracts drawn up by Belfast City Council. The authors concluded that ‘lean supply’ was compatible with the best value approach to procurement, as long as those characteristics of Lean that are most closely aligned to manufacturing are adapted to fit better the culture of local government. More recently, Scorsone (2008) addresses examples of implementation of Lean strategy by the city government of Grand Rapids, Michigan, USA, in the face of fiscal restrictions and a dwindling workforce.

One of the most wide ranging documents in regard to Lean in the public sector – in terms of the scope of the research undertaken – is the report titled *Evaluation of the Lean Approach to Business Management and Its Use in the Public Sector* (Radnor *et al*, 2006), which attempts a comprehensive assessment of the success of Lean philosophy and tools in transforming a number of public sector organisations in Scotland. The report, commissioned by the Scottish Executive², covers 8 case studies and 3 pilot sites, including local authorities, health agencies, and a government (RAF) agency. It describes a range of levels of engagement with Lean, from ‘full implementation’ (acceptance of Lean thinking across all levels of an organisation, use of Lean tools and techniques, some likelihood of sustainable transformation) to light-touch Lean (adoption of a quick win, toolkit approach, usually based on Rapid Improvement Events). As later analysis has shown (Radnor and Walley, 2008), these case studies collectively warn against a Lean implementation approach that relies too heavily on the Lean/TPS ‘toolbox’ without a complementary commitment to Lean thinking at all levels of the organisation. The implication is that the tools of Lean/TPS (RPIWs, 5S, Kaizen blitz, etc) are less likely to have embedded, sustainable value if they are not part of a wider package of organisational reform. Furthermore, Radnor and Walley suggest that many public sector organisations suffer from a very basic lack of understanding of process management, such that Lean/TPS implementation, while initially gaining some quick wins, usually via RIEs (or RPIWs in VMPS parlance), is difficult to sustain in the long term. In a number of cases the authors point to a fundamental lack of alignment between the Lean/TPS measures and overall organisational strategy, which is to miss out on one of the key enabling conditions of any Lean programme.

² Now the Scottish Government, since the May 2007 elections

While over-reliance on the Lean/TPS toolbox can make it more difficult to embed acceptance of a move towards process-oriented thinking, Radnor *et al* (2006) also point out that in some cases the public sector does the opposite, i.e. resists specific, transformational, ‘quick win’ tools, believing these to be unwelcome imports from a manufacturing environment and inappropriate for use in public service. The message here is that balance is required. The case studies show that the success of Lean/TPS implementation is context-dependent, and relies to a large degree on a number of organisational and cultural factors. Where Lean has not been fully integrated with the strategy of a public sector organisation, there are serious doubts as to the long-term sustainability of the Lean initiative. Having a critical mass of people who are trained in Lean and accepting of it as a transformational agent is also essential.³

As a brief summary, Radnor *et al* (2006) identify the following critical success factors in Lean implementation in public service organisations (Table 1 below provides a list of success factors found by other authors):

- Organisational culture and development
- Organisational readiness
- Management commitment and capability
- External support from consultants (at least initially)
- Having a strategic approach to service improvement
- Team work and whole systems thinking
- Timing – setting realistic timescales and making effective use of staff commitment and enthusiasm
- Effective communication channels across the whole organisation.

The points above are reinforced by the range of papers in a recent issue of *Public Money & Management* (February 2008). These address the questions of whether Lean has a place in the public sector; what aspects of Lean thinking ‘fit’ best with public service organisations; how best to learn from Lean experience in other sectors; and to what extent Lean is a distraction or a panacea.

Although this issue of *Public Money & Management* contains research on Lean in universities, housing services, central government agencies, and the legal public sector, it is noteworthy that two of the four papers on Lean in healthcare take well developed examples of the application of Lean in a NHS setting and use these to draw lessons for the public sector in general. Papadopoulos, for example, uses the dynamics of Lean implementation in a UK hospital trust to examine the more general application of Lean mechanisms to public service

³ Unfortunately the report doesn’t attempt to quantify the critical mass in terms of ratios of those staff who are fully trained in Lean management, those who are acquainted with the principles involved, and those who are new to the idea. It would be a valuable exercise to research the ratios that best contribute to the success of Lean initiatives.

organisations. And Esain, Williams, and Massey (2008) develop a new model of change through examination of the use of 5S in a large NHS trust. The remaining two papers focus on the implementation of Lean techniques in the NHS (Proudlove, Moxham and Boaden 2008) and how Lean management was used to improve productivity in the particular area of radiology waiting times (Lodge and Bamford 2008).

1.14.2 Literature specific to Lean in healthcare

Although the literature review has shown that there is a groundswell of interest in Lean management and TPS principles in public sector organisations in general, and healthcare organisations in particular⁴, it remains the case that the literature in this field is by no means mature. Of the 73 references cited in the Scottish Executive report, for example, only around one-fifth are directly concerned with Lean in public service and/or healthcare. Studies that attempt a longitudinal evaluation of Lean in healthcare, in particular, are still rare. In part, of course, this is merely a reflection of the fact that Lean philosophy and tools have come relatively late to service organisations, and later still to the public sector, including health care.

A significant proportion of the literature concerning use of Lean in healthcare is found in reports and articles written, or commissioned, by the actors involved in Lean programmes and projects, including clinicians, health service managers, policy directors, and consultants. This body of evidence is variable in quality, and often concentrates on very particular and technical aspects of Lean implementation, but nonetheless has contributed some useful case study material. For example, 'Lean and healthy' (Scotchmer, n.d.) is a round-up of some recent NHS Lean programmes in the hospital sector together with a brief history of the Virginia Mason Production System and an overview of how culture change can be achieved. In general, the grey literature on Lean in healthcare tends to present success stories and often concentrates on the toolbox aspects of Lean – generally ignoring the application of more general principles and issues of culture change. In the same vein, comparative analyses are thin on the ground, no doubt because, despite recent interest, there are still relatively few examples of mature Lean programmes in the public sector, but also because (as indicated in the Radnor *et al* Scottish Executive report) the story of Lean in public service is not one of unbridled, guaranteed success.

Much of the literature on Lean in healthcare concentrates on the hospital environment. It is perhaps unsurprising that the acute sector, which has 'production' areas not dissimilar to manufacturing industry (and its own internal flows of suppliers and customers), should be the most receptive to TPS philosophy. A number of authors cite Spear (2005), who highlights a series of avoidable medical errors and patient safety issues in the US hospital sector, and advocates the use of the TPS to remove ambiguities in processes and to empower health care workers to solve problems as they arise, instead of opting for work-around solutions. Spear points out that '*No organisation has fully institutionalised to Toyota's level the ability to design work as experiments, improve work through experiments, share the resulting*

⁴ See, for example, the February 2008 issue of *Public Money & Management*, devoted to Lean in the public sector.

knowledge through collaborative experimentation, and develop people as experimentalists'. In answer to the question 'Can the Toyota Production System be applied in health care?' Spears' answer is an unequivocal 'yes'. Other researchers have reached the same conclusion in the European context. Ballé and Régnier (2007), for example, also concentrate on the Lean management methods that contributed to significant reductions in medication distribution errors, nosocomial infection rates, and catheter infections in a French hospital, although they argue that Spears underestimates the culture change barriers to standardisation of clinical and nursing practice. Fillingham (2007) also emphasises the role of the TPS in improving patient care in the UK hospital sector, but here the pinch point is seen as the combination of an essentially complex, risky environment with emerging fiscal pressures (the introduction of payment by results (PBR) and a forecast constraint in public spending on health care). Fillingham cites the example of Bolton Hospitals NHS Trust, where he is CEO, which began a comprehensive programme of adapting the TPS to reengineer a number of trauma-related processes, including patient flow through A&E and theatres, the work of the radiology department, and discharge procedures, and succeeded in bringing previously high mortality levels into line with the national average.

Other authors have worked on the application of particular and specific TPS-related concepts and Lean tools to the acute care environment. Antony *et al* (2007), for instance, analyse the use of Six Sigma business strategy to improve the operational performance of the NHS. Although the authors write generically of 'the NHS', in practice their examples and case studies are drawn only from the secondary care sector in US hospitals and clinics. Esain and Rich (n.d.) focus on operations management techniques that can achieve improvements in patient flow through hospitals and thus reduce waiting times.

Although a number of papers in the academic press are also concerned with highly technical issues, a good proportion present more balanced and holistic accounts of Lean programmes. The *Nursing Standard*, for example, ran a number of Lean management papers in 2007, including 'Drive for Success' (Green 2007) which examined the impact of Nissan's Lean programme at its Sunderland car plant on staff at a nearby hospital and looked at how the TPS principles could be applied to public sector organisations. In the same journal we also find 'Lean Thinking on the wards' (Castle 2007), wherein the author concentrates on Lean as a tool to reduce errors and defects in the hospital environment. In 'Think Lean' (Aherne 2007) the MD of Lean Healthcare Services addresses the use of Lean principles and methodologies for quality improvement in medical care, and the kind of training necessary to make a success of Lean implementation in this environment.

The literature appears to reveal next to no material concerned with the application of TPS/Lean principles in the public health arena, but the value of process analysis and systems thinking in primary care is occasionally written up. Boaden and Sokiewski (1998) conducted a process study of the non-clinical aspects of a UK general practice, with particular attention to the relationship between the patient and the managerial and administrative aspects of the organisation. Endsley *et al* (2006) did consider some of the process and flow issues involved in the some clinical aspects of family medical practice in the USA, but most of the commentary on reducing waste and understanding patient needs stems from examples and

analysis of administrative procedures. This may, indeed, be the most appropriate use of TPS and/or Lean thinking in primary care. Endsley *et al* make a good case that, from the patient’s perspective, many of the frustrations involved in accessing GP services arise not from direct contact with the physician, but from missing paperwork, unacceptably long waiting times, and poorly managed hand-offs between doctor, practice nurse, and receptionist.

Special mention should be made of the literature on the Virginia Mason Production System (VMPS). As certainly the best known healthcare organisation to have adopted Lean/TPS principles in the organisation of all aspects of healthcare, the Virginia Mason Medical Center is referenced by many authors and commentators (e.g Weber (2006) on improvements to logistics, productivity gains, cost and defect reduction; Furman and Caplan (2007) on a patient safety alert system; Nelson-Pieteron and Leppa (2007) on eliminating waste in nursing procedures; McCarthy (2006) on TPS as applied to healthcare; Bush (2007) on eliminating waste; Kowalski *et al* (2006) on nurse retention and leadership development; Pham *et al* (2007) on the redesign of care processes).

One theme stands out in the extant literature on Lean in healthcare: nearly all examples and case studies are drawn from the hospital sector. Some discussion of the Virginia Mason Medical Center does address Lean from a whole system perspective, but in general, whether writing about specific Lean tools (Weinstock 2007) or more general Lean principles (Shumaker 2007), the emphasis is relentlessly on the acute sector environment. Given the current need in the NHS to work collaboratively with partners across the whole spectrum of care and cure, and to aim for integrated care wherever possible, this is undoubtedly an area of research and reporting that needs to be further explored.

Our literature review on Lean in healthcare uncovered a number of critical success factors in implementing TPS/VMPS principles in public sector and health care organisations. These are summarised in Table 1 below:

Table 1: Critical success factors in TPS/Lean implementation

Critical success factors	Reference	Notes
Abandoning belief in the efficacy of arbitrarily set targets as the chief tool of management	Seddon (2008) Bagley and Lewis (2008)	Derived from private sector and manufacturing, but equally true (especially true?) of healthcare organisations.
Using experienced coaches/consultants	Proudlove <i>et al</i> (2008) Radnor <i>et al</i> (2006)	Literature suggests that experienced coaches/consultants are important for initial confidence building, but that it is also essential to internalise their expertise and produce the next generation

		of TPS/Lean advocates.
Consistent communication of the vision across the whole organisation	Lodge and Bamford (2008) Radnor <i>et al</i> (2006) Spear (2005)	
Applying (and understanding) the principles of systems thinking across the whole organisation	Ballé and Régnier (2007) Radnor <i>et al</i> (2006) Erridge and Murray (1998)	Piecemeal adoption of toolbox initiatives is unlikely to prove sustainable in the long run.
Recognising that process oriented management tools developed for manufacturing cannot be applied to health care without significant adaptation	Patwardhan and Patwardhan (2008) Fillingham (2007)	
Need for an iterative, incremental approach to adoption of Lean thinking	Esain <i>et al</i> (2006)	The <i>method</i> of introducing Lean thinking or Six Sigma to an organisation is key to success in creating sustainable change in culture
Avoiding sporadic application of highly developed Lean techniques in favour of systematic application of imperfect techniques	Ballé and Régnier (2007)	
Senior health care leaders must apply TPS to their own work	Spear (2005)	Support for pilot projects and application of TPS at lower levels of an organisation's hierarchy is not enough to embed a change in culture
Accepting that organising the flow of work is the essence of systems thinking	Seddon (2008)	
TPS/Lean implementation is a long term, dynamic process; not a quick fix	Hines and Lethbridge (2008) Radnor <i>et al</i> (2006)	Some organisations have "strategic structures" that are highly resistant to change, and are only open to incremental modification over many

		years.
An implementation approach that focuses solely on Lean tools is less likely to succeed	Radnor and Walley (2008)	
Clinician engagement and buy in is essential to TPS/Lean implementation in healthcare	Schwartz and Cohn (2002)	Managers in NHS and foundation trusts have to persuade senior doctors and nurses of the worth of TPS/Lean, since they are the link between strategy and implementation.
TPS/Lean metrics should be complemented by other measurement systems (e.g. patient satisfaction, referral management, target achievement)	Kollberg and Dahlgaard (2007)	
Need to have a structured methodology to guide the first steps in implementing TPS/Lean	Proudlove, Moxham, Boaden (2008)	
“Belief in the Vision”, “Consistency in the Message”	Lodge and Bamford (2008) Jones and Mitchell (2006)	

1.14.3 Lean resources for the NHS

A range of consultancy organisations run websites that offer training and resources in Lean management, TPS, Six Sigma, and other associated systems for management of processes in manufacturing and public service organisations. As interest in Lean in healthcare has grown, however, the NHS and the Department of Health have developed their own resource centres. The library of materials available to participants in the north east SHA’s NETS programme is one example. More centrally, the website www.networks.nhs.uk holds a number of documents that provide at least an introduction to Lean, including a basic guide, the *Going Lean in Healthcare* White Paper produced by the Institute for Healthcare Improvement, the NHS Lean Implementation Handbook, and a number of RIE case studies. The NHS Health Management Specialist Library (www.library.nhs.uk, managed by the King’s Fund) also carries a number of key texts, such as *Going lean in the NHS: how lean thinking will enable the NHS to get more out of the same resources* (2007) and *Going Lean: a guide to implementation* (2000).

The NHS Institute for Innovation and Improvement (www.institute.nhs.uk) has developed a comprehensive, web-based database of Lean materials which covers both the principles of Lean (in the broadest sense) and evidence-based case studies (e.g. the improvements to pathology and pharmacy services at Hereford Hospitals NHS Trust). This website also contains numerous links to some of the key texts in Lean thinking, from the classic *Lean Thinking* (Womack and Jones, 2003) to guides to Lean vocabulary, Lean tools, and effective planning of Lean projects.

Private sector organisations have recognised that Lean is increasingly seen as an important tool in NHS reconfiguration. Thus we can find training programmes on sites such as www.lean-healthcare.co.uk, offering the means to achieve the 18 week target, improvements to care pathway design, and the basis of continuous improvement. The Lean Enterprise Academy (www.leanuk.org) runs healthcare summits and produced the 2006 report *Lean Thinking for the NHS* for the NHS Confederation. This document is essentially a detailed introduction, which emphasises the long term, incremental aspect of Lean and concentrates on potential improvements to safety and quality.

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2 Stakeholder Interviews

The interviews were designed to capture the origins and early history of the NETS initiative, including the manner in which its three components – vision, compact and method (Toyota Production System tools) – were being implemented. The interviews were not intended to serve as an interim evaluation of the NETS initiative but rather to raise topics and issues which would assist in the formulation of a future evaluative agenda of the type expected to be supported by the NIHR SDO Programme call. As far as possible we were after facts and evidence about activities and achievements since the NETS team had begun work, through its training programme for Pathfinder sites, in collaboration with the VMMC in Seattle and with Amicus on the compact. The interviews provided a rich source of material on all aspects of the NETS initiative and its roll-out across the region via the Pathfinders

2.1 Methods

The Medical Director of the SHA informed potential interviewees of the status of the study in relation to research ethics approval (Appendix 1). A topic guide was prepared for the interviews which focused on the following areas (the full guide is presented in Appendix 2):

- the history of the NETS initiative
- understanding of the aim(s) of the initiative
- the kind of interventions that have taken place as a result of the NETS initiative
- the forward plans for the initiative
- the co-ordination of relevant activities in the Pathfinders
- degree of progress made so far
- success criteria of the initiative
- possible inhibitors or barriers to success that have been identified
- training and development initiatives envisaged
- background on personal career histories.

Interviewees were sent the interview topic guide in advance of the interviews. Usually, each interview was conducted by two researchers. Interviews were not recorded nor were verbatim notes taken. Summary notes were made and subsequently transcribed. The transcripts were then analysed to identify key – and recurring – themes and these are presented below.

The initial analysis was carried out by one of the research team and then validated by the other interviewers.

2.2 Results and analysis

The interviews were carried out between April and June 2008 and a total of 16 people – all from Pathfinder sites - were interviewed from a potential pool of 21. It proved impossible for various reasons to carry out any interviews in one of the Pathfinders. Those interviewed in the remaining six Pathfinders were all senior staff and included Chief Executives, Medical Directors, and other senior managers.

The key themes and highlights to emerge from an analysis of the interviews are as follows:

- patient safety is seen as the main ‘selling point’ for staff involved in the NETS initiative
- the enthusiasm and commitment of key individuals (‘product champions’) in establishing NETS and driving the vision, compact and method cannot be overestimated
- much of the push behind NETS was to change ‘hearts and minds’ across the region and across the whole health care community
- embedding NETS thinking was being done through ensuring that awareness of Lean principles was an important part of the recruitment process and a component in the assessment of NHS Trust CEOs and senior directors
- the approach adopted was deliberately long-term – ‘a journey and not a destination’ – with the SHA in it for the ‘long haul’
- despite the commitment to the long-term having some ‘quick wins’ was desirable to aid experiential learning
- there are issues about the transferability of the transformational changes being sought particularly issues around geographical distance and also distance in terms of cultures, history and so on which apply to adopting practices and techniques from the US as well as training methods borrowed from the US and Japan; there are also issues about the limits to transferability in respect of differences between the US and English healthcare systems
- though critical, the method and use of Lean tools were a means to an end and not an end in themselves – there should not be an over-emphasis on the toolkit
- NETS initiative not to be seen as SHA imposed
- failure should not be feared – it should be tolerated

- RPIWs are regarded as the main intervention tool but their sustainability is an issue for several reasons including moving on from a completed RPIW to the next ('eye off the ball' syndrome), possible loss of a particular 'champion' could prove detrimental
- much work remains to be done on establishing the requisite metrics and clarifying what these should be
- on the issue of appropriate metrics to measure performance improvement, there are issues over how far routine data collection is sufficient and how far additional data sets are needed
- the commitment to Virginia Mason is regarded as crucial with a considerable amount of emphasis on the initial training as instrumental in achieving 'conversion' among staff groups
- staff are experiencing mixed emotions ranging from a healthy scepticism to curiosity and interest
- some staff regard TPS and Lean thinking as a threat to clinical decision-making with standardisation being viewed as a form of 'dumbing down' but others regard the approach as empowering since it puts power in the hands of frontline staff
- the NETS initiative should not be oversold – its acceptance is best achieved by doing and by successful projects that will encourage staff to spread the word
- system-wide change is the aim, not confining change to individual units and/or hospitals – this gives NETS its unique selling point as a region-wide exercise
- general awareness training for staff is in place but will grow over the next couple of years or so with the aim being that 80% of staff will have been introduced to the key concepts and principles behind NETS.

We then grouped these issues into seven broad themes as follows:

- commitment and training
- transferability
- patient safety and 'selling' the concept
- culture change
- methods
- metrics
- implementation and sustainability

Each theme is considered separately below and starts with brief selected epigraphs drawn from the interview transcripts.

2.2.1 Commitment and training

- ...is now an enthusiastic advocate of the benefits of TPS...
- ...was previously sceptical of the benefits of TPS now a supporter...
- ...was not initially enthusiastic but now describesself as a convert...
- ...some were sceptical about the application of Lean in healthcare but when they see it working they are converts

The enthusiasm and commitment of key individuals – ‘product champions’ – in establishing NETS cannot be overestimated. Much of the push behind NETS was to change ‘hearts and minds’ across the region and the whole health care community. There was a high degree of scepticism before the training commenced. But, despite this, all our interviewees were enthusiastic advocates and convinced of the benefits. The NETS philosophy appears to have been passionately driven from the outset, especially in the commitment to developing a new compact with medical staff. This enthusiasm, coupled with a commitment to doing things the NETS way, was an important factor in the selection of Pathfinder sites. The commitment of each organisation’s leaders, particularly the Medical Directors, was viewed as essential to successful implementation. This was also demonstrated in the annual financial investments in implementation and training. Embedding NETS thinking is being done through ensuring that awareness of its principles is an important part of the recruitment process and a component in the assessment of CEOs and MDs.

The language used can evoke what amounts to a religious zeal; in fact, one interviewee remarked that one of the key VMMC trainers was ‘quasi-religious’. This commitment and enthusiasm appears to have permeated down to other clinical staff who, it was reported, are keen to receive the training. It is not clear, however, whether this can be delivered, through using internal leaders as coaches, with the same enthusiasm as the Japanese/VMMC trainers. In addition, interviewees in one of the Pathfinders took a different view of the training offered by VMMC. Notwithstanding these caveats, the commitment to VMMC in the initial phase was regarded as crucial to the success of the NETS. But conceivably a different approach might be adopted in future in order to cascade and embed Lean/TPS ideas and thinking. Finally, corporate induction programmes were seen to be a good vehicle for training.

2.2.2 Transferability

- ...Seattle course delivery very didactic and American
- ...found the cultural divide with Japan overwhelming
- ...found Japan very hierarchical...

Three main issues emerged relating to transferability. First, how well do Lean processes transfer from manufacturing industry to healthcare? It is seen as a challenge to transfer TPS from industry to healthcare. This is especially important as the set up at the VMHC is different to the rest of the US in the way, for example, that medical staff are contracted. Second, how well does TPS transfer from US healthcare, with its emphasis on financial management, to that of the UK where quality of care is now regarded as uppermost? Third, how applicable are the training methods, developed in Japan and the US, to the UK setting? The Japanese system is seen as hierarchical, jargon-ridden, and some of the terms used do not translate well. The VM training regime, described as didactic, was said to be alien to UK culture – ‘this way or no way’ – and not attuned to UK needs and sensibilities. While not an insurmountable problem, it needed to be taken into account when ‘selling’ NETS within the NHS North East organisations.

2.2.3 Patient safety and ‘selling’ the concept

- ...patient safety was one of the key drivers behind the programme ... objectives are not so much concerned with cost-benefit analysis, but as ‘the right thing to do’ ...
- ...patient safety is the main driver...although this can be hard to demonstrate at macro level...
- ...avoid ‘Lean’ as clinicians do not like the term ‘Lean’... Relationship building is the key to the success of the initiative especially getting buy in from all stakeholders.....
- ...the patient safety aim is assessed from the patient’s point of view with an emphasis on dealing with problems immediately (stop the line) and standardisation of processes...

‘Selling’ the concept is important on three levels. First, the SHA regards it as important in order to persuade Pathfinder organisations to ‘sign up’; second, the Pathfinder leaders see it as important in getting the support of their organisations; and third, the PCTs view it as important in order to engage GP practices. Although interviewees used the term ‘Lean’, the initiative is both best described and sold as something else. This is because the term ‘Lean’ is associated, by some staff, with cost-cutting and possible job losses. Alternative ‘badges’ are used, including ‘NETS’, ‘VMPS’, ‘Putting the Patient First’, the ‘North Tyne and Wear Way’, and ‘Do it once, do it right’.

Crucially, the NETS initiative should not be seen as SHA imposed. Engagement of the staff organisations was seen to be important in this respect. They were reported as having mixed feelings and although improvements in patient safety and quality care are to be welcomed, there is some scepticism about possible job losses down the road if efficiency is improved.

Effective selling needs to concentrate on the three legs that comprise the NETS – Vision, Compact, and Method. Although the compact, as the link between vision and operations, needs to be sold to all staff, it is largely directed towards, and especially important for, the medical consultants and GPs. There is a perceived threat to their assumed professional autonomy in clinical decision making which needs to be addressed. It seems to be generally accepted that the respective Medical Directors are the key drivers in securing clinical engagement, and acceptance of the compact.

Patient safety, although perhaps difficult to demonstrate at a macro level, is the main selling point with improvements in processes coming a close second. Early wins are important in gaining staff acceptance as is the elimination of jargon.

2.2.4 Culture change

- ...has concentrated on the compact agreement, from vision through to operational aspects. Previous initiatives have not got buy-in ... there was no vision. The compact is the link between the vision and operations
- ... emphasised that NETS will have different cultural and business ‘fit’ in different NHS organisations – definitely not ‘one size fits all’ ...
- ... a barrier to progress ...lack of organisational memory due to constant reorganisation...

NETS is seen as a long-term approach to change – the ‘long haul’ and a journey rather than a destination. This involves cultural change and the new culture needs to be aligned with the vision. These features are in addition to issues related to NHS reorganisation and mergers which may have led to a lack of ‘organisational memory’; conversely, however, this loss could have a beneficial impact as new cultures are required anyway which are not hindered by past thinking or practices.

NETS has a different cultural and business ‘fit’ in different organisation and there is not one single model. To achieve long term, and sustainable, culture change there needs to be a rigorous approach to implementing NETS. A benefit arising from doing the RPIWs is that the culture changes through being involved in a productive activity. However, it was suggested that resistance to culture change may be significant if any erosion of roles is perceived.

2.2.5 Methods

- ...Visual Management ... mention of the ‘wall-walk’, which includes not just the results of Rapid Improvement Events, but also the 30/60/90 day timelines and indication of metrics such as ‘did not attend’ and complaints ...
- ...the tools and techniques that will be used will be determined by the RPIWs...

Though critical, the method and use of Lean tools are seen as a means to an end and not an end in themselves – there should not be an over-emphasis on the toolkit. The main methods being used are Rapid Process Improvement Workshops (RPIWs), which incorporate 5S and

Visual Management techniques. RPIWs also often incorporated ‘Walk the Wall’ as a Visual Management technique, and the Plan-Do-Study-Act (PDSA) cycle to provide a framework.

RPIWs have been completed in several clinical and non-clinical areas with the clinical emphasis on patient pathway re-design to improve productivity and patient outcomes. Clinical issues addressed include: elective pathways, waiting times, ward rounds, drug rounds, theatre scheduling, and discharge processes. Non-clinical issues addressed include: HR processes (staff recruitment) and finance (travel costs). RPIWs have built-in reviews at 30, 60, and 90 days.

2.2.6 Metrics

- ...good candidates for measurement: untoward incidents’ hot spots for sickness, absence, recruitment; cancelled operations; HAIs; length of stay...
- ...use of an organisational ‘energy index’ which measures motivation and staff alignment with the organisation’s objectives
- ...data completeness and quality is an issue...
- ...more clarity on metrics is needed...
- ...metrics are not yet developed at the higher level...

It was reported that work remains to be done on establishing the requisite metrics and clarifying what these should be. There are also issues over how far routine data collection is sufficient and how far additional data sets are needed. Some interventions, especially those in the clinical areas, can make use of routinely gathered NHS data but others require additional metrics. Completeness, and quality, of this additional data may be an issue. Success is based on delivering metrics at strategic and organisational levels.

Metrics concerning the impact of NETS in terms of cultural change and behaviour are difficult to define and analyse. Annual staff appraisal information and staff satisfaction surveys are a starting point. Relevant metrics, as far as patient safety is concerned, are Serious Untoward Incidents (SUIs), hospital acquired infections, critical incidents, and near-misses. Data on length of hospital stay, and cancelled operations can also be useful.

2.2.7 Implementation and sustainability

- ...the tools and techniques will become part of normal working..... it needs to be built in how we can improve patient safety, quality, ... as part of the long-term strategy...
- ...should not be seen as a quick fix for organisations...
- ...sustaining the initiative...through integration with staff objectives, through recruitment practice, through changed leadership behaviours...
- ...sustainability after the RPIW is the main issue...

- ...the main challenge is sustaining the initiative.... This is based on the fact that the life of a chief executive is two to three years....
- ...important not to look just at short-term gains ...

All pathfinder organisations have a contract and are allocated funding for training. There is an annual review of funding, progress, and aims. The aims are to bring together a number of disparate initiatives. The aims need to be agreed with the relevant CEO, MD, and the individual directorates. It can take some time for the aims to filter through the hierarchy of an organisation. Implementation may be complicated because there are different cultures within each organisation, and sometimes within professional groups. NETS is not a quick fix and it is essential to have a long-term vision that is embedded within the organisation, is built into formal business plans, and is included in the assessment of all senior staff. The compact is seen to be the key to implementation, particularly with clinical staff.

The overall objective is to make NETS principles self-sustaining. This might be achieved through integration into staff objectives (via the recruitment process) and through changed leadership behaviours. The sustainability of changes brought about through individual RPIWs is an issue for several reasons, including moving on from one completed RPIW to the next or the possible loss of a particular 'champion' which could prove detrimental. However, some follow up on RPIWs after the 90 day reviews did show that changes were sustained.

Conclusion

This report has presented the fruits of a six month scoping study of the introduction of the NETS initiative. It has comprised a literature review and an analysis of interviews conducted with key stakeholders in NHS North East. The literature review embraces a wide body of published work around aspects of transformational change in complex systems. It is not exhaustive and nor is it a systematic review of the relevant literature. Its primary purpose has been to identify the key issues which underlie transformational change efforts and are central to their success. The analysis of interviews has sought to identify key issues and themes evident as NETS has begun to be introduced and implemented in the wave one Pathfinders. This is a fast-moving, dynamic state of affairs and it would not be appropriate to draw any definitive conclusions from an initial exploratory study. Its importance lies in helping to inform the design of a more formal evaluation that can proceed over several years and this report will be made available to the successful applicants for the formal evaluation study.

As mentioned at the start of the report, apart from capturing the early development of the NETS, the scoping study was principally seen as a ground-clearing exercise to prepare the way for a more extensive evaluation. Since completing work on the scoping study, the research team has been actively engaged on producing a proposal for submission to the NIHR SDO Programme in response to its call which appeared in the summer. The deadline for applications was early October and a decision is due on who the successful applicant will be before the end of the year. The hope is that the successful applicant will commence a full evaluation of the NETS in January 2009. This will be for a period of three years in the first instance and should begin to demonstrate whether the early enthusiasm and ambition which the scoping study has identified can be sustained and embedded over time. That is possibly the central challenge of the NETS.

Appendix 1

Letter sent to potential interviewees

Letter heading SHA

Date

Dear (individually named)

North East Transformation System in the NHS North East Pathfinder organisations: scoping study

The Strategic Health Authority has asked researchers from Newcastle and Durham Universities to develop an evaluation of the implementation of the North East Transformation System in its nominated pathfinder organisations.

As a preliminary stage to developing a full evaluation study, a scoping exercise is being carried out by researchers from both universities. This will involve speaking to key staff in each pathfinder organisation. They will be looking for factual, evidenced answers to some straightforward questions related to your organisation's role as a pathfinder site.

This scoping study will lead to the development of a detailed research study which will subsequently need to be approved by an NHS Research Ethics Committee, and by each pathfinder organisation's Research Governance Committee. In view of its preliminary nature, the scoping study has **not** been submitted for Ethical Review. I feel it is important that you are made aware of this.

The Universities will be directly contacting you giving you more detailed information.

Yours sincerely

Stephen Singleton

(Stephen's usual signature)

Appendix 2

NETS Scoping Study Pathfinder Organisation Interview Schedule

<p>1. What is the history of the NETS initiative, from your organisations point of view?</p>	<p>(a) Can you provide a factual account of the how the initiative started?</p> <p>(b) Who were the key players in getting the initiative off the ground?</p> <p>(a) What has the timeline been to date?</p> <p>Note: emphasise that we are referring to NETS throughout, although Lean or TPS may be the terms used locally.</p>
<p>2. What is your understanding of the aim(s) of the initiative?</p>	<p>(a) Have the aims and objectives experienced any 'course correction' as the project has progressed?</p> <p>(b) How were the aims decided upon?</p> <p>(c) Who was involved in setting the aims?</p> <p>(d) Is there a mechanism (formal or informal) for reviewing the aims/objectives?</p>
<p>3. Could you describe the kind of interventions that have taken place as a result of the NETS initiative?</p>	<p>(a) How has your organisation decided on the targets for intervention?</p> <p>(b) Were they clinical, or non-clinical? If the interventions were clinical, can you be specific as to which areas or conditions were addressed?</p>

	<p>(c) What metrics were/are in place to measure the effects of the interventions (i.e. what did/do you plan to measure, and how)?</p> <p>How do you know they are the appropriate metrics? For example, are they appropriate to trials or to established systems?</p>
<p>4. What are the forward plans for the initiative?</p>	<p>(a) Will the plans encompass a widening of participation in the in your organisation (more participants), or a deepening of the knowledge and skills of the existing participants, or a mix of both?</p> <p>(b) Who will monitor these plans?</p> <p>(c) Is there are timeline for the forward plans?</p>
<p>5. How are you coordinating relevant activities in your organisation?</p>	<ul style="list-style-type: none"> • Person/people responsible for coordination, with level in the organisation • Communication strategies • Feedback loops – do they exist? Are they formal or informal? • How do you find out about progress in other pathfinder organisations?
<p>6. How much progress has your organisation made so far?</p>	<p>(a) What activities have been undertaken?</p> <p>(b) Is there evidence of effectiveness of those activities?</p> <p>(c) Can you measure progress against expectations?</p>

<p>7. What are the criteria for success of the initiative, from your organisation's point of view?</p>	<p>(a) If such criteria exist, when were they drawn up, and by whom?</p> <p>(b) How will the degree of match between achievements and success criteria be assessed?</p>
<p>8. Have any possible inhibitors or barriers to success been identified?</p>	<p>(a) If such barriers have been identified, have they been shared among the pathfinder sites and with NETS?</p> <p>(b) Have knowledge of such barriers come from other sectors, experts in Lean implementation in health care, or from the direct experience of those people taking part in the NETS initiative?</p> <p>(c) Has the identification of barriers to success been incorporated in future plans for training or briefing?</p>
<p>9. What training and development opportunities are now envisaged?</p>	<p>(a) What has already been implemented, in terms of training and development?</p> <p>(b) What are the future plans?</p>
<p>10. Could you provide some background on your personal career history?</p>	<ul style="list-style-type: none"> • Educational background • Route into healthcare organisation • Experience of similar initiatives in other sectors?