

THE IMPACT OF PATH DEPENDENCIES ON LEAN IMPLEMENTATION WITHIN A CONSTRUCTION COMPANY

Nicola Morrey¹, Christine Pasquire², Andrew Dainty³

ABSTRACT

The effect path dependency has on a lean implementation is being investigated using a major UK construction company as a case study. This paper describes the nature of the issues arising from path dependency and presents the preliminary findings.

Path dependency refers to the idea that events and decisions that have taken place in the past continue to influence current decisions and ways of working. Concerning the implementation of lean, path dependencies would be in existence if a company's ability to improve processes, learn and innovate were constrained by policies, technologies, relationships and strategies from the past.

The case study Company has recently developed a number of tools (ways of working) that it is trying to standardise across the business. This is akin to the standardised work that might be seen in a lean production environment.

The assumption under consideration for this project is that path dependencies exist within the case study company that are influencing and constraining its ability to implement change. Following from this, it is proposed that understanding these path dependencies will enable them to be overcome, or capitalised upon, and that such an analysis of path dependencies is a useful diagnostic tool for lean implementation.

KEY WORDS

Path dependency, Lean, Standardised work, Lean implementation.

INTRODUCTION

The case study Company is a UK main contractor with an annual turnover of ~£300m, whose projects include schools and colleges, student accommodation, clinics and residential, mainly won through competitive tendering and some PFI. The average project value is £21m, and over 70% of the cost of each project is within the supply chain, with the Company having a small direct labour force.

The Company is currently implementing a change programme based on embedding lean principles such that it can continuously improve and meet business targets. This change programme is central to the Company's strategy. A recent stage of this implementation plan was to develop and implement a number of tools (ways of working) that could be standardised across the business to ensure that critical tasks are

¹ Nicola Morrey, Research Engineer, Department of Civil and Building Engineering, Loughborough University, Loughborough, Leicestershire, LE11 3TU, N.Morrey@lboro.ac.uk

² Dr. C. L Pasquire, Department of Civil and Building Engineering, Loughborough University, Loughborough, Leicestershire, LE11 3TU, Phone 01509 222895 C.L.Pasquire@lboro.ac.uk

³ Professor, A.R.J Dainty, Department of Civil and Building Engineering, Loughborough University, Loughborough, Leicestershire, LE11 3TU, Phone 01509 228742 A.R.J.Dainty@lboro.ac.uk

carried out consistently to the correct standard, thereby ensuring risks are mitigated and projects are delivered as planned, achieving the planned profit target.

The tools are the equivalent of standardised work, one of the core lean tools. If a method of working ensures delivery on time, to the correct quality and cost and safely, why not work that way every time? Documenting the set standard way of working ensures there is a standard to train people against. The set standard also provides the baseline for continuous improvement; if there is no baseline, then any improvement cannot be quantified or realised across the whole business, and any improvement will not be sustained. The tools are also aimed at eliminating waste, such as bad quality (reworking of tasks) and process waste, from the way these tasks are carried out. These tools will be fully embedded when every project team is using all the tools to the correct standard.

The development and implementation of the tools has so far taken nearly 12 months, and still all the tools have not yet become custom and practice on all projects. Prompted by the length of time taken to embed the tools, and feedback from those within the business regarding the way the tools have been developed and taught, it was decided to consider whether the business is locked into path dependencies that are constraining its ability to change.

Path dependency refers to the idea that events and decisions that have taken place in the past continue to influence current decisions and future ways of working. In other words, past decisions have locked the organisation into pathways that constrain future choices and ability to respond to change.

Since implementation of lean requires a change in thinking and practices, it will be of value to understand these path dependencies so that future lean implementation plans can either capitalise upon, or overcome these dependencies by enabling new paths to be generated.

Therefore the hypothesis under consideration is that path dependencies can influence the implementation of lean and the enactment of that strategy in practice. In the context of the case study Company, the hypothesis has been considered from the perspective that had a path dependency study been carried out prior to the start of their lean implementation strategy, the implementation plans could have accounted for and/or capitalised upon the existing path dependencies. It might therefore have been possible to generate new paths that would have realised the full extent of the lean strategy in practice and within the planned durations.

This paper discusses some potential path dependencies that have been identified from initial feedback received during the implementation of the tools across the business, and outlines some further work to be carried out that will aim to confirm these dependencies and propose how they might be addressed so that the strategy of lean implementation can be enacted fully in practice.

OVERVIEW OF LEAN IMPLEMENTATION TO DATE

In the last three years, the business has begun to adopt lean construction techniques, such as collaborative planning, to make improvements in terms of cost, quality and time. Recently two main events have served to drive the implementation of lean, and make it central to the Company strategy.

A recent poor result prompted a review by an Executive Board director of causes of project failure. A review of post project review documentation revealed that the

causes of loss making projects were due to lack of “basic” construction management activities, for example package management, design management.

At the same time, the business was also embarking on delivering two major learning programmes. These in house training programmes, aimed at first line managers (people putting tradesmen to work) and advanced managers, (senior managers of at least one project team) were to be delivered by Executive Board directors or directors within the organisation. The aim of the major programmes was to ensure all managers at each work level knew the activities critical to project delivery, how to carry them out, and where necessary, teach them to others. Development of the module material highlighted that there were no current, standard, best practices available within the business that could be taken and taught. In addition, delivery of the major programmes, particularly the advanced manager programme, further highlighted the lack of process and consistency when the individuals from each part of the business shared their ways of working. Not only were practices different across different operating divisions of the Company, but also across teams within these operating divisions. Coupled with the evident range of competencies and capabilities, this reinforced the need to develop and embed standard ways of working.

These two circumstances therefore directed what was called the “stabilisation stage” of the Company’s lean implementation plan. The aim of the stabilisation stage was to develop and implement, as standard across the business, 27 tools that would ensure tasks critical to successful project delivery were carried out to the correct standard on each project, every time, resulting in management of risk and therefore consistent project delivery. In this case, “tools” can be considered to be aids that define the way to carry out a task or step of a process, for example a template/proforma document such as a procurement schedule template or final price meeting agenda.

The identified tools were developed by twelve groups of approximately six people who represented the different company departments who had a stake in the tools they were developing. Each group had people of different levels of seniority, a sponsoring Executive Board director, a senior manager as a group leader and were facilitated by the improvement team. The aim of having groups made up of people from different areas of the business was to capture the current, best practices that had been found during the major programmes.

Following Executive Board sign off, implementation of the tools across all project teams and departments was carried out using a number of methods. Presentations delivered by an Executive Board director and the process improvement team were made to groups, by department or role, outlining the purpose of the tools, what they were, who should use them and why and how they had been developed. Interactive workshops sessions were facilitated by the process improvement team for groups of people by role type, supported by the company Managing Directors, to review each tool in detail and discuss how to implement it. Support was also given to each project team; the allocated process improvement champion for that project would work with the project team on site to coach and support them in the use of the tools as these activities took place. (See figure 1)

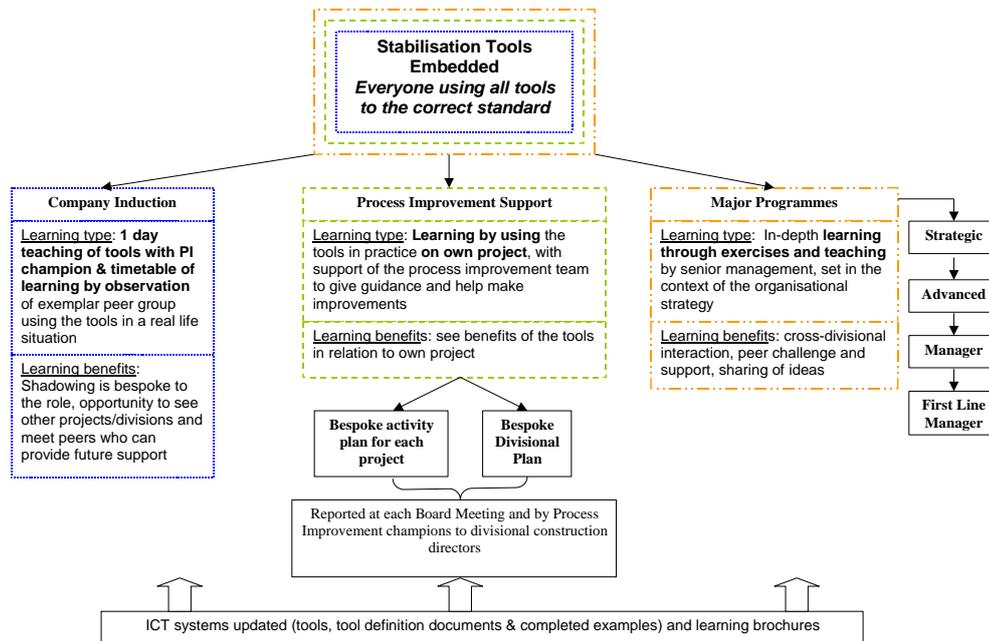


Figure 1: Embedding the tools through learning and support

The intent was to provide a set of standard tools that would ensure that critical activities are carried out consistently. In most cases, the completed tools were developments and amalgamations of current working practices, not totally new activities people were being expected to carry out. Four of the tools are management measures and checks. The purpose of these measures is to ensure managers are checking that their teams are using the tools to the correct standard and to identify areas for improvement and individual development. In the long term, the measures and checks will identify areas for continuous improvement in the tools themselves, the individuals and teams using them, and on the specific projects themselves. In addition, the standardisation of critical tasks should enable the teams to carry out these tasks easily and efficiently, therefore releasing potential time spent re-inventing the wheel on every project and defining ways of working with that team, meaning there is more time for innovation, improvement and delivering value.

However, a number of questions arise: to what extent is this strategic intent understood, and to what degree are the tools mutating as they are cascaded through the business and put to use? Have our path dependencies locked us into paths that inhibit us from enacting the strategy in practice and influenced this mutation of the use of the tools?

PATH DEPENDENCIES IN THE CASE STUDY COMPANY

Feedback from presentations, workshops and on site support has been captured, collated and reviewed by the improvement team. This feedback has been captured from verbal feedback, workshop feedback forms, and onto flipcharts in "what went well" sessions at the end of workshops and presentation sessions.

As stated by Cowan and Gunby (1996), the constraints concerning understanding path dependencies include the level of detail required to support empirical work, and how to understand which seemingly minor historical details might have had an impact in order to identify what might have been.

DEVELOPING AND DOCUMENTING PROCESSES

The assertion is that a firm's routines are specific to that firm, and are therefore its history, as these routines have been learned and reinforced over time (Teece, et al., 1997; Coombs & Hull, 1998). Therefore, if the routines are a firm's history, in order to understand these routines fully, you need to understand the history, the path dependencies, too. In terms of imitating a competitor therefore, you would need to have a very detailed understanding of that company's history and paths. Toyota have shared their way of working with supply chain and competitors, with their production system being documented in many books and papers e.g. *The Toyota Way* (Liker, 2004), perhaps because they understand that an entire company history and culture is not easily replicated.

There is empirical evidence that understanding routines, and the way routines are co-ordinated, is critical to process improvement, change and overcoming path dependencies; "an organisation cannot improve that which it does not understand" (Teece, et al., 1997, p.525.)

Historically the case study company's procedures and policies were controlled and managed by the Finance Director. Only those directly concerned with the policy or procedure, for example the manager of that department, updated them. Updated procedures and policies were sent out to senior managers for consultation and then circulated for implementation. It has not been common practice in the past to always involve people in the development of procedures/tools, therefore people are perhaps locked into the way they believe or perceive our tools are developed and implemented. People getting used to being involved will require new path generation, which might mean giving them the skills to follow this path.

A new document was developed to capture information and guidance for using the tools. Many people reported that they found this tool definition document too wordy, and many workshops sessions highlighted the fact that people had not taken the time to read any supporting information. Conversely though, those that took the time to read the documents did so diligently and returned with detailed comments, demonstrating the different learning styles of the people involved.

In terms of the tools themselves and their purpose, many people have commented that we are now asking to do even more than before. They see new forms and agendas and perceive something extra, rather than a structured, consistent way to many of the things they already did. This has been a particular issue for high performing individuals, who have taken some convincing that not all teams worked the way they did; many of the high performing individuals and teams took for granted the good practices that they had and had not considered that others might work differently. This highlights the project, rather than Company focussed, way of thinking. This might also help to explain the lack of sharing and lessons learned, as every team looks inwards, rather than considering the experience that other teams and areas of the business could bring to their projects; we are locked into a project based way of thinking, where asking for help and support is seen as a weakness.

ICT SYSTEMS

The issue of our ICT systems was a common point raised. The tools are located within an existing part of the current system, which to date had not been populated or needed to be accessed readily on a daily basis by all employees who might now need

to access that area due to the tools. In addition to some problems with system availability and speed on all sites, an individual's ability and willingness to use the ICT systems is a factor; this lack of willingness might be perpetuated by occasional unresponsiveness of the system. In other words, the business is locked into a path of not using ICT capability available due to previous experience and availability.

Another aspect of the concerns regarding ICT was regarding the way information was presented. Many requested the presentation of the tools be more visual and intuitive. However, what can be considered to be intuitive is open to further, individual interpretation. Never the less, the current presentation of the tools is constrained by our current systems.

LEARNING AND INNOVATION

The dynamic capabilities literature makes the link between a firm's routines and learning; "dynamic capabilities arise from learning; they constitute the firm's systematic methods for modifying operating routines" (Zollo & Winter, 2002, p.340.) Routines and learning appear to be inextricably linked, and are both shown to be path dependent (Garvin, 1988; Coombs & Hull, 1998; Cacciatoria & Jacobides, 2005.) There appears to be an interesting conflict however concerning whether operating routines can reinforce path dependencies, ultimately resulting in lock in, or whether it is possible for firms to adapt their knowledge and therefore their routines (Coombs & Hull, 1998.) If innovation is also considered to require a change in routines in order to introduce innovations, then the ability of a firm to innovate will also be path dependent (Coombs & Hull, 1998.)

Also identified as being important, and one of the limits to how an organisation is able to learn, and therefore adapt its routines, is the way in which routines are developed, captured and disseminated (Zollo & Winter, 2002.) They believe that the act of documenting a new process is a part of gaining an understanding of that process. They propose that organisations and individuals go through a learning cycle that reinforces routines. However they believe that at present "the literature does not contain any attempt at a straightforward answer to the question of how routines...are generated and evolve" (Zollo & Winter, 2002, p.341.)

Both the ICT comments and way the tools have been documented link closely with training, learning and communication. Various people requested different types of presentation of the tools, the ICT systems and the way learning was delivered. The success of these types of communication, and other communications used, (newsletters, e-mail, etc) can only be judged by those receiving the information. When learning styles and preferences vary from person to person, numerous paths would appear to be required.

The section later on path generation discusses how the case study Company has attempted to overcome some of these dependencies by involving people in developing, documenting and teaching the processes.

THE ROLE OF MANAGERS

In the main, senior managers have understood the need for consistency, as the advanced manager programme probably helped to give legitimacy to the need to define standard methods of working with that group. Has this had an impact on the embedding of the tools and breaking some of the locked in behaviours and ways of

working? However, they continually question and debate the extent to which the tools need to be adhered to, and how much they can be altered and adapted depending on project size and complexity.

There has also been much feedback about the implementation of measures and checks, both in terms of the numbers of checks and the reason for them. The reaction is that measures have been implemented to “catch people out,” rather than to identify areas for improvement and learning. Teams look for ways to fiddle the measures to ensure a green result against the red, amber, green status. Equally, managers themselves have taken some convincing that checking and coaching their teams is a key part of their role as managers.

Henderson and Clark (1990) outlined an example of a lithographic company that was unable to cope with a number of minor changes that caused their co-ordination routines to require major reconfiguration. Since managers co-ordinate activities within a business, and these methods of co-ordination are learned over time, it would therefore follow that the capabilities, learning and path dependencies of the management are also important in being able to embed change.

Some of those external to the business have seen evidence of “top down” delivery of the tools, i.e. a “telling” approach rather than one of listen and implement. This raises potential tensions between the necessity of a Company strategy developed by the Board (i.e. develop the tools) and that strategy being owned and implemented by everyone. People on workshops, who have received strong “must do” messages from their managers, whose intention was to show support and drive the strategy, have also experienced this “top down telling”. We are potentially locked into the expectation that change comes from the top down, and so any change is delivered and/or received as “tell” as we are locked into this way of thinking.

The evidence is therefore that the language we use to communicate is in itself path dependent. In other words, the language being used does not properly reflect the intention because we are locked in to communicating in a certain way. Also, people are conditioned to hear and interpret these messages in a certain way because of how they have been meant in the past. This lock in might extend to the type of people we recruit into certain roles. In other words, we recruit managers with certain management styles and skills or who have been developed in a certain way to follow a path, which their mentor also followed before them.

Over the course of the last three to five years, the business has seen at least three “initiatives” come and go. People have commented that this is the latest in a long line, and as such the locked in expectation is probably that this is the next fad, coming from the top down, and will die out just as the others did.

PATH GENERATION

Djelic and Quack (2007) presented two pairs of case studies concerning the transformation of national institutions. They use the term path generation to describe the development of new paths that overcome the path dependencies. Their case studies showed that the path transformations relied on a combination of different mechanisms, from power and policy, the ability to mobilise support from people involved, the ability of people to establish legitimacy for the change, and the establishment of institutions that would socialise the change. Further, they suggested that momentum for change is required both internally and externally to create a pincer

movement, and that the change can be gradual, rather than requiring a radical change to re-direct the path (Djelic & Quack, 2007.) Each of these case studies is based on observations of real events that have been documented over time. They show how a combination of events have facilitated change in a number of environments to overcome perceived path dependencies, although as before, there is scope for interpretation of where the path dependencies are, and therefore how difficult they might be to overcome.

Despite none of the examples being specifically concerned with lean transformation within a construction company, there are many aspects of how paths have been re-directed that could be applicable to the case study Company. For example themes of stakeholder engagement, creating social networks and using external sources to help facilitate change could all be useful, especially once the specific dependencies are understood.

The case study Company has arguably tried to create new paths in the methods by which the tools have been developed and taught.

Groups of people, taking current, best practice, worked together to develop the tools with the aim being that they would have more ownership. However, not everyone was consulted. Having Executive Directors and senior managers delivering learning was an attempt to ensure they are fully conversant with the tools themselves and to show their support for the strategy. However, perhaps this self fulfilled an existing path, reinforcing the top down approach. Many of those in the working group expressed disappointment that they had not been able to go out and teach the tools they had developed to their peer groups. In retrospect, this might have helped to overcome the lock in to top down thinking.

The approach to teaching and learning was also adapted as the implementation stage of the tools progressed, with various forms of learning being developed, as shown in figure 2, as it became apparent that certain methods alone had not resulted in the required level of knowledge.

Leeds University were also involved in the development and delivery of the learning programmes. Looking externally and building a network of external relationships has been shown to overcome path dependencies. For example, Coombs and Hull (1998) proposed that external professionals and groups have skills and access to academic publications, conferences, etc, that can prompt innovations and overcome path dependencies. The creation of social networks also played a part in breaking the Swedish construction industries path dependencies concerning use of concrete rather than timber; by engaging stakeholders in user groups and developing supply chain relationships they were able to overcome stakeholder perceptions and promote innovation and learning (Mahapatra & Gustavsson, 2008.) This would seem to reinforce the importance of developing and maintaining relationships with external bodies such as LCI UK, CIRIA, etc. There is potentially further scope to develop such networks, either with external parties, or by creating internal networks, where people can create legitimacy for change.

Feedback on the tools once the teams have used them has also been received, and much of this has been incorporated back into revised versions of the tools. Capturing feedback on the use of the tools and trying to use this to make amendments may help to carve new paths in that people see evidence of their input being considered and implemented.

The way processes (routines) are developed, tested, evaluated, documented and communicated appear to be important factors in being able to effectively transfer knowledge and allow new processes to be learned so that a business can overcome dependencies and change (Teece et al., 1997; Zollo & Winter, 2002.) This is why we put working groups together to develop the processes, and why the senior managers are delivering the major learning programmes. Doing these things will create new paths and accepted ways of working.

However, perhaps these new paths are not yet clear enough given the remaining dependencies that are still pulling people another way? Similarly, had we been aware of these dependencies prior to commencing this work, could they have been overcome?

FUTURE WORK

It is normal practice when implementing improvements to carry out a diagnostic/current state analysis, using data collection or current state mapping for example, to identify root causes prior to making changes. Carrying out the path dependency study first would have been the equivalent of such a diagnostic. The business will now undertake some future work to identify its path dependencies fully prior to the next stage of the lean implementation.

Case studies that have identified path dependencies in the context of an organisational transition (Lamberg, et al., 2008) and industry change (Cacciatoria & Jacobides, 2005; Mahapatra & Gustavsson, 2008) are extremely detailed and have obtained information from numerous sources such as interviews, published documentation such as news articles, industry data and annual reports in order to build up written history of events. However the ability to reconstruct history can be constrained by the ability of those interviewed to recall events accurately, their perception of those events and whether there are limits to obtaining access to data or individuals involved. In some cases the researchers have aimed to account for these potential limits by using numerous data sources and triangulating qualitative and quantitative data (Cacciatoria & Jacobides, 2005.)

Interviews and historic documentation will be used to construct a detailed timeline of historical events and decisions. This work can be considered to be akin to a 5 why or cause and affect analysis for the whole of the business. By understanding the root causes of decisions, and how the business has changed and performed over the years, we aim to understand where we have become locked into paths and why. Understanding this will allow new paths to be generated, or strengthened to support the business change.

CONCLUSION

A review of the path dependency literature has shown organisational processes to be firm specific and learned over time, with methods of developing, documenting and capturing these processes having an effect on how new processes are learned. Stakeholder involvement has also been shown to be critical to organisational change, with stakeholder relationships being path dependent.

Implementing change based on lean principles requires a deep change in mindset and organizational culture. This change in mindset can be driven by changes to

process/procedure, as doing something differently can drive a change in thinking and acceptance of new ways as results are achieved.

It therefore follows that if changes to process and organizational learning are critical to lean implementation, and both of these are path dependent, then understanding path dependencies is necessary to ensure lean strategies can be implemented in practice.

The work carried out to date in the case study Company has seen path dependencies showing themselves in the language, actions and responses to change. Furthermore, these path dependencies have influenced the extent of and approach to the lean implementation.

By understanding these path dependencies, it might be possible to ensure that communication plans, sequence of change and stakeholder involvement are improved to overcome these dependencies.

The further work outlined will be carried out to gain a more in depth understanding of the path dependencies, with the aim being to identify how new paths can be generated. The question will then turn to whether we will lock ourselves detrimentally into other paths, or whether we can identify paths that will provide advantages to enacting change too? This work will help the case study Company clarify what it knows about its business and ability to change, as opposed to what it thinks it knows about its business.

REFERENCES

- Cacciatori, E. and Jacobides, M.G., 2005. "The Dynamic Limits of Specialization: Vertical Integration Reconsidered." *Organization Studies* (01708406), 26 (12) 1851-1883.
- Coombs, R. and Hull, R., 1998. "Knowledge management practices' and path-dependency in innovation." *Research Policy*, 27 (3) 237-253.
- Cowan, R. and Gunby, P., 1996. "Sprayed to Death: Path Dependence, Lock-in and Pest Control Strategies." *Economic Journal*, 106 (436) 521-542.
- Djelic, M.L. and Quack, S., 2007. "Overcoming path dependency: path generation in open systems." *Theory and Society*, 36 (2) 161-186.
- Garvin, D.A., 1988. "Managing Quality: the strategic and competitive edge." 1 edn. New York: Free Press.
- Henderson, R.M. and Clark, K.B., 1990. Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly*, 35(1) 9-30.
- Lamberg, J.A., Pajunen, K., Parvinen, P. and Savage, G., T., 2008. "Stakeholder management and path dependence in organizational transitions." *Management Decision*, 46 (5-6) 846-863.
- Liker, J., K., 2004. "The Toyota Way." 1 edn. New York: McGraw Hill.
- Mahapatra, K. and Gustavsson, L., 2008. "Multi-storey timber buildings: breaking industry path dependency." *Building Research & Information*, 36 (6) 638-648.
- Teece, D.J., Pisano, G. and Shuen, A., 1997. "Dynamic Capabilities and Strategic Management." *Strategic Management Journal*, 18 (7) 509-533.
- Zollo, M. and Winter, S.G., 2002. "Deliberate Learning and the Evolution of Dynamic Capabilities." *Organization Science*, 13 (3) 339-351.