Lean Construction: The Contribution of Ethnography

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Introduction

I am a sociologist who taught management to construction managers and engineers in the School of Civil Engineering, University of Birmingham, for over 30 years. In the early nineties I met Glenn Ballard in Chile and I recognized affinities between his work and mine. That's how I became involved with Lean Construction.

Lean Construction (LC) is a philosophy and a set of practices which largely originated in the seminal work of Koskela and Ballard and Howell. In brief, it's about how to deliver optimum value to a customer by managing the transformation of materials into products through the multiple flows of activities which constitute a construction project, called 'TFV' (see Koskela 2000).

This paper will propose that there is still much misunderstanding of its implications even by those who wish to 'buy into' it. This is, in part, because of the deep-seated ideas that have developed, at least since the European Enlightenment, and are difficult to shed.

Lean Construction Challenges Conventional Wisdom

A notable feature of LC thinking is that it is 'counter-intuitive'; it seems to depart from conventional practice, from common sense even. It does depart in many important ways from conventional practice but *not* from common sense. Two examples:

Harmonizing versus Speed

Ballard and Howell (Ballard 2000) developed the brilliantly simple idea of the Last Planner®. They reasoned that standard planning practices had many defects. For example, there is no point in speeding up any given activity just because the bar chart is telling you that it is running behind schedule. A project consists of many interdependent activities. So, speeding up without taking into account the impact on other activities creates all kinds of waste and further uncertainty. What is required is that all activities be carefully integrated and coordinated. Ballard and Howell do this by focusing on the point of production – the Last Planner® – the person responsible for delivering actual work. If you increase the reliability of information about the work accomplished in all activities; that

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   -    paper is a revised version of the one presented at EGLC16, Valencia, May 2013.

it will be done on time to standard, then this provides a platform from which to, sort of, work backwards and upwards throughout the entire project. This challenges the conventional top-down practice of preparing plans, critical paths, bar charts and so on. Of course, for this planning and control system to work, people have to make commitments; to do what they say they will do.

Trust versus Contractual Enforcement

How can you get people to do what they say they will do? The conventional way is to threaten them with legal or financial penalties. So, the second counter-intuitive idea is that you have to trust them. Early formulations of the Last Planner® were fully aware of this. However, subsequent developments have helped us understand better how it works. Language Action theory (see for example Macomber and Howell 2003, Slivon *et al* 2010), owes a lot to ethnography. It sets out to understand how people communicate with each other; how they exchange meaning, how they manage the very foundations of social interaction and social life:

- "What do you want me to do?
- Can you do it?
- Sure!
- How are you getting on with it?
- Have you done it?
- Sure, come and have a look"

Ethnography aims to understand how these communication processes work, processes which sustain any kind of organization or social order. So, this is where ethnography comes in.

The challenge for anybody wishing to implement LC ideas and practices is to understand these processes. Given, as noted, that much of LC is counter-intuitive, it is important to understand the origin/nature of existing practice. Insofar as people find it difficult to accommodate new ways of thinking, it is useful to find out why.

Ethnography

What is Ethnography? It is a way of studying people in order to understand how they live their lives at the most basic taken-for-granted level – promising, making commitments, agreeing or disagreeing but then finding out what the disagreement consists of. And so on and so on. We all do it to the extent that we don't even notice what a remarkable and subtle process it is.

Ethnography is sometimes called Participant Observation. It aims to understand these processes in the same way that people, for whom it is just normal and common sense, learnt them. It originated in Anthropology in the 19th when scholars in Europe were keen to understand the ways of life of peoples who were being subjected to colonialism. These ways of life were, on the face of it, were very different from European cultures.

Ethnography may take several forms depending on the time and resources available and the extent of the access allowed. It usually involves semi-structured interviews and discussions with informants. A key principle is that it is important not to impose the researchers' ideas, assumptions, indeed their whole culture, on those they are studying.

They simply have to take at face value what they see and hear; not interfering, not making moral judgments. In short, they have to look, listen and learn if they are to understand anything.

A Common Reaction? So What!

For many people there is great skepticism about the value of such enquiry. This seems to be particularly true of engineers because they see it as just telling stories; that it lacks rigor, that it can't be objective, that there is no way of testing what is true and what is untrue; that it is just a bunch of opinions, partial, biased, etc.

The benchmark for this comparison and judgment is an idealized view of the natural sciences, particularly physics. Engineers take their cue from this view. They are not interested in what they tend to see as just opinions. What they want is tangible evidence about phenomena whose features can be unambiguously identified, the nature of their interaction quantified, calculated and so on. The origin of this viewpoint is a school of thought called 'Positivism'. It assumes that the world 'out there' can be objectively described and that any subjective influence on findings about it can be controlled or eliminated. This is simply a logical mistake. In order to understand a social process we must use our capability as participants in the social processes that constitute our own lives. Not to do so would be like denying ourselves the power of speech and then trying to talk to the people we research!

The primary concern of engineers, of course, is with the properties of material things – steel, concrete and so on. We don't need to talk to concrete columns and expect them to reply! Engineers have developed an extraordinary body of knowledge and understanding about how construction artifacts behave; how to design them so that they will meet functional requirements.

It is true that they have also recognized the importance of how people apply this knowledge in actually organizing the construction of these physical artifacts. However, in trying to understand it they have run into problems.

Fit the Research Methods to What is studied

Studying and understanding what and why people do what they do needs different methods from understanding how to design a building that will do what is required of it. But the majority of construction research is still conducted in a way appropriate to studying material things. The principal research tool is the questionnaire survey which is intended to establish objective facts. Findings are organized and analyzed in the terms, categories and concepts that the researcher supplies, as though they were studying the durability of concrete structures, *not* in the terms and concepts, ideas and beliefs which inform the lives of the people they are researching. This creates fundamental distortions in the truth of what the research reveals.

Producing Things or Production Flows: Substance and Process

In part, this owes to the failure to make a necessary distinction. Koskela and others (see, for example, Rooke *et al* 2007) argue that going back for thousands of years there has been a tendency to think of the world all around us either in terms of timeless substances or in terms of processes through time.

In simple terms, we can be concerned either with i) **substances** or ii) the series of events by which material substances come into being and continue to undergo change, that is, **processes.**

There are two major consequences of these two different ways of looking at the world. First, in the concern with **substances** there is a tendency to break them down into their constituent elements -analysis, or, in contrast, to find out, adopting a holistic viewpoint, how **processes** interact; how it all fits together – synthesis. At best, these two ways of seeing complement each other. But they often don't.

The second and even more radical consequence is that a concern with processes acknowledges and tries to understand the role of human or **social** involvement. People act in and on the material world. The following story may help to illustrate what I mean.

The Problem we were asked to research: How to achieve the required concrete cover in steel-reinforced structures

Many problems with the durability of concrete structures had been identified. In particular, cover to the steel reinforcement as specified in the design was not being achieved. The result, of course, was rapid deterioration of the structure. The study I supervised (Seymour *et al* 1997) involved a sample of walls and columns on 25 construction projects, all being undertaken by reputable, quality assured contractors. Using a cover meter, the study revealed that there was significant variation from the specified values in nearly all cases. In short, the build-quality was very poor.

Why was this happening? The conventional research approach is to ascribe defects to either the design or to what happens on site. This distinction reflects what is written into contractual arrangements where it is assumed that defects can be traced to the design office which has produced the designs and which are physically impossible to execute or to which subsequent structural failure can be traced. Construction defects includes all other defects, identified as the result of, for example, site inefficiency, poor workmanship, poor supervision, inadequate control, all of which contractually cannot be blamed on the designers.

The significance of this is that it does not address the realities of the construction process. It assumes that it is possible to make the distinction between design faults and construction faults in the first place. This is not possible because construction is an iterative, interactive process. It is only the occasion for assigning blame. It is a contractual distinction not a construction one.

In other words, if you looked at the problem from a purely engineering standpoint, use conventional categories (see for example Fraczek, 1979) and *impose* an explanatory

framework on it, you come to completely the wrong conclusions. If you look at it from an ethnographic point of view something closer to the truth emerges. We did this by talking to people and finding out their rationales, beliefs, ideas and their frustrations in the circumstances in which they worked, that is, we did an ethnographic study.

Our Findings

So, we spent a lot of time standing around watching and talking to people; design engineers, resident/supervising engineers, steel fixers, form-workers, form-work suppliers, concretors and so on. Amongst the many things that emerged from these discussions were:

First, that design drawings and specifications are regarded as describing things; finished products with little thought about how they are to be built. Within conventional contractual arrangements, that's the contractor's problem.

Thus, second, in setting up contractual arrangements the design and the implementation of the design are conceived of as two separate products rather than as iterative phases in the same process loop. This contributes to a conflict-prone interface between the two phases.

Third, design practice for specifying required cover is based on codes of practice which assume that there are consistent patterns in the variability of cover achieved in the finished product where the yet-to-be finished product on site provides the standards for assessing the functionality of the design, ignoring the processes by which the design is to be realized. This is a hazardous move because structural elements differ in type, shape, size, design complexity and location. Even where, according to the design, identical elements were being built, we found substantial variation in the processes involved.

Fourth, then, all the provisions for ensuring the required quality were wholly inadequate.

- Design was done in ignorance of local conditions. This was made worse by the fact that detailing was often subcontracted
- Some supervising engineers were prepared to depart from strict conformance to the specifications in light of circumstances. In doing so they risked being held contractually at fault.
- Other supervising engineers, the so-called 'spec wavers', insisted on strict conformance regardless of the practical difficulties, indeed, the impossibility of achieving them in the circumstances. So, ways had to be found for avoiding, bypassing them or getting into heated argument and consequent bad relations.
- Construction was carried out by separate firms of subcontractors; steelfixers, formwork carpenters, formwork suppliers and concretors, separately subcontracted, who rarely even met each other and, understandably, pursued their own interests.
- For reasons of access and visibility it was usually impossible to inspect the finished work or work in progress. It also put a strain on the availability of managers/engineers actually to do this checking.

End of Story?

I spent many frustrating hours in committee meetings with engineers who insisted on talking about the 'technical' characteristics of concrete structures. I said: 'You guys know all you need to know about what is required in a finished structure. What you are not thinking about is how to get it!' But then, what did I know? A mere sociologist!

Nonetheless, I recommended and explained the principles of Lean Construction (LC). The fact conferences such as IGLC and EGLC are taking place and the increasing application of LC practices suggests that I wasn't entirely wasting my time.

However, this is not quite the end of the story. Attending IGLC and EGLC conferences over the years, I am aware that despite the obvious attraction of LC and the desire amongst practitioners to implement it, there is, I think, still profound misunderstanding of the sophisticated philosophy which underlies it.

So, let's look at the Last Planner® again. I said that LC challenges conventional practice but, as with the distinction between 'substance' and 'process', it also challenges, in a much more radical sense, modes of thinking that go back for centuries. They are deeply engrained in ideas about what it means to achieve a rigorous, objective explanation and understanding about the world around us both physical/material and social. I have noted the distinction between 'substance' and 'process'. The point I now make is that the ways we use methods for describing/identifying social processes and substances are *also* social processes in two senses. First, words and any other mode of symbolic representation (formulae, flow charts, diagrams, etc.) are human inventions. We learn what they mean and how to use them through a process of enculturation or socialization. Second, these conventions are subject to change. They are themselves processes; they evolve through time. This is frequently overlooked for reasons we will now explore.

The Indexicality of Language Use

The Last Planner® uses a vocabulary which specifies the meaning and application of a set of terms, notably, amongst others, 'should', 'can', 'will'. We can easily understand what the words are intended to denote but we cannot know what they actually refer to without the experiential knowledge of the setting, the actual construction site, where they are being applied. Without this context-specific knowledge what they mean is quite literally unknowable

The Last Planner® also makes use of a technical vocabulary that refers to the material properties of what is being built – 'slump test', 'bending moment', etc. This vocabulary has been developed by a community of specialists -structural/civil engineers, who have learnt what the terms mean and are able to apply them consistently in order to communicate what is required in the built product.

Alfred Schutz (1962), incidentally, a successful German banker, provides a way of understanding the dynamics of these communication processes. For the most part, we take the external world for granted. He uses the phrase '*the natural attitude*'. It has two forms. In the '*common-sense*' attitude we expect the normal; what we are accustomed to. Only when something unusual or unexpected happens do we question: 'what is going on here?' And we try to make sense of it.

Within the natural attitude there is another; the 'theoretical' or *scientific attitude* which implies that for some specific reasons or purposes, doubt is cast on what is taken for granted; it questions what is *not* normally questioned. The reasons for this are various, ranging from the need to solve practical problems to the desire simply to know and understand. People, going back thousands of years, have been driven by this kind of curiosity. Most have also been driven by the need or desire to provide accounts of what they have found out, to share ideas with like-minded people, to debate the use of concepts and terminologies, the nature of evidence, method, proof and so on and so on. In short, there develops specialised vocabularies to capture the knowledge acquired– what we may call a *discourse* – whose proper application is owned and governed by the community of people who are properly licensed by the community in question (see Sharrock 1975, Rooke & Seymour 2002).

However, in developing these specialist discourses and adopting the scientific attitude we cannot and do not just abandon the common-sense attitude. After all, even physicists live in the everyday world. They are people as well as physicists. Thus, any specialist discourse or language like physics, jurisprudence or engineering has continual recourse to the ordinary language of the common-sense attitude. That is, specialists seek precise definitions; aim for an exact correspondence between words/concepts and things; aim to be able to represent or model reality by way of language or other abstract sets of symbols, e.g., formulae, flow charts, diagrams. However, these methods of knowing, understanding and communicating must always rely on common sense modes of knowing and understanding in order to interpret what they refer to; what they mean.

By way of illustration, I refer to the concrete-cover study described above. First, it was impossible to describe, by the exclusive use of the specialist engineering discourse/language, what was required to implement the design in practice. Second, it was impossible to describe, through contractual or legal provisions, exactly what was required of participants in the design-construction process. In both instances, there was reliance on common-sense, shared understandings.

Any uncertainties could be clarified by reference to the situation at hand. Even if this resulted in disagreement, at least people could find out what they were disagreeing about. This is referred to as 'indexicality'. It means that when we communicate with each other, we necessarily take for granted a mass of shared assumptions and understandings. If there is any uncertainty or the possibility of misunderstanding we can ask for clarification and use the situation at hand to ensure that mutual understanding has been achieved: *'Have you done it?. Sure, come and have a look.'* (See above)This is called 'remedying indexicality'.

Central to LC practice is the use of metrics and statistical techniques. However, it recognizes that if they are to be used effectively, their meaning or what they represent must be understood and shared by the people who use and/or are subject to them. This is very different from the frequent use of statistics where there is no such acceptance and agreement.

In sum, LC is a discipline that adopts the scientific attitude, as is appropriate (e.g., using statistics or strictly engineering terminology to communicate functional requirements), but it also recognizes the inevitable limitations of such formal or specialist languages. LC is alert to and incorporates the accuracy and precision that specialist

languages aspire to, again, as appropriate. For example, it is common for people trying to understand the application of LC to identify 'people' and 'processes' as two distinct entities (or things). In *doing* this they contribute to the perpetuation of a misunderstanding. Highlighting and rejecting such 'categorical errors' (Ryle 1963) is, I think, evidence of the sophistication, which, I have argued, underlies LC thinking.

Conventional practice and conventional research in construction (see Seymour and Rooke 1995) do not, for the most part, recognize these features. In the former, it results in trying to manage projects *imposing* inappropriate planning tools and concepts. In the latter, it results in imposing inappropriate criteria for judging 'proper', rigorous research as applied to social processes. As to research, there is another set of criteria for judging rigor. Insofar as its credibility is acknowledged, I think it would also contribute to improving practice.

Unique Adequacy

All scientific study begins with description; to achieve a clear and accurate account of the phenomena studied. However, there are two ways in which description can be done. The first, suitable for studying material phenomena, is to develop a specialized vocabulary which is developed and shared by a community of scholars; physicists, geologists, engineers, chemists and so on. Thus, provided with a vocabulary or discourse, they aim to understand what they research in the terms of this discourse. The truth or accuracy of descriptions and/or explanations is judged by the community of scholars to which the researcher belongs.

A second way recognizes that when we aim to understand social processes, description and explanation/understanding are both intrinsic to the same process. That is, people understand and act as required of them in any given setting; they act according to the common-sense attitude. They learn, as we all do, how to do this. No further explanation is required about what is happening. Unlike inanimate substances which have no opinions on the matter, we act in terms of our understanding of what is going on and at the same time are able to provide an explanation of what is going on. *This is what is going on here in these terms*. To supply other terms brought in, as it were, from outside and imposed by the researcher, is to destroy what the researcher aims to understand!

Here, the criterion for judging accuracy and displaying 'scientific' rigor is: do the descriptions/explanations make sense to the people that the descriptions are about? Quite simply: as a researcher, 'have I got this right about them? Does my description/explanation/understanding correspond with the reality of *their* life; *their* meanings, *their* understandings?' This is a key principle applied in a form of Ethnography called Ethnomethodology. The principle is called 'Unique Adequacy'. It means that the only real standard available by which to judge the truth or accuracy of a description is the people who are the subject of that description. It is they, and they only who are capable of making this judgment, An excellent account of Unique Adequacy and its importance in challenging conventional research methods, as applied to Built Environment Studies, is by Rooke and Rooke (2012).

Sadly, if there are any PhD students amongst you studying in a School of Civil Engineering, you will have difficulty in convincing your supervisors that the use of

ethnographic methods is appropriate. I have nearly forty years of experience to confirm that this is so. Still let's be optimistic. There are signs of change.

The chief culprit in the resistance is what we call 'reification', that is, treating social processes as though they were things. Engineers, in my experience, are mainly interested in things, not social processes.

Positivism or Ethnography

Finally, two contrasting studies which illustrate the points I have tried to make.

Example 1: ISO 9000: Is it a thing or a complex set of Processes?

Kale and Arditi (2006) did some research about the diffusion of ISO 9000, the Quality Assurance standard, in Turkey. They use a model developed by DiMaggio and Powell (1983) designed to understand how and why institutional practices like ISO 9000, indeed, like Lean Construction itself, spread from one country to another. This is an extremely important issue and becomes ever more so with increasing globalization. For example, is there a Portuguese interpretation of Lean Construction? A Dutch one? A Spanish one? How do they differ and why?

Kale and Arditi assume that there is a finite set of practices found in economically advanced countries which constitute the application of ISO 9000 and, note, not the prescriptions contained in the ISO 9000 documentation itself, that it is this THING that is being imitated from country to country. The reality is that there are a multitude of practices and processes which differ widely or subtly in time and place which pass as being quality assured under ISO 9000, despite the certification procedures applied.

So, what exactly is it that imitating firms are supposed to be imitating? Certainly not the construct – the reification - devised for the researcher's model, rather a range of practices and processes which can only be found out by a close study of those practices in the settings where they are employed.

Second, suppose they are imitating something, why are they imitating it? Kale and Arditi say there are three reasons and, note they provide these reasons, *a priori*, that is, before going out into the field to find out what the possibilities might be:

- Internal; in pursuit of rational efficiency and because other firms are doing it;
- External; influences from external agencies; government or client requirements
- Mixed; a combination of the above.

Thus, they impose an explanatory model and do not try to find out what people are actually doing and why they are doing it. It excludes the concerns and values and priorities of interest to *them*.

Example 2. So, Sorry, but it's more complicated than this

A study by Rottenburg (1996) of a commercial company in the Sudan directly addresses the distorting effects of trying to study institutional change, as in the study just described. An immensely complex picture emerges.

In a sense, the Sudanese company did copy Western practices. But it involved a mix of legitimacy and efficiency issues which are so thoroughly conflated in the West,

something that Max Weber (one of the founding fathers of sociology) pointed out many years ago. In other words, in the West, any course of action has long been justified depending on the circumstances. Efficiency, greater profitability or any of the indices by which a firm may be judged are some, but the implications of these are often so intrinsically unclear that another justification is simply that someone has the right to make this or that decision.

In the Sudanese company things were even more complicated. Increased efficiency was the usual justification for change and the adoption of some 'Western' practice. But, Rottenburg suggests, this was a kind of facade behind which any number of other legitimating frameworks were called upon as the situation required – obligations to religion, kinship, friendship, for example, all selectively invoked as appropriate to the situation.

Thus, he presents a picture where members of the Sudanese company tactically invoked competing legitimacy discourses, some provided locally and some from a global repertoire, depending on the particular setting and their purposes in it. All this is lost by imposing the explanatory model used by Kale and Arditi. It prevents us from understanding the dynamics of what is actually going on.

I said that what went on in the Sudanese company was complicated. If you try to model it as Kale and Arditi do, you come nowhere near an accurate representation. However, in another sense, it was all quite simple *as long as you understand it as the Sudanese do*. For them, it was all common-sense; *i*t was just what you do here.[2]

Summary and Conclusions

Ethnography is a way of studying social processes: looking, listening and learning. We have all inherited a powerful influence to analyze things rather than try to understand the processes by which these things come to be.

The evolution of arrangements for commissioning, designing and building construction artifacts has been heavily influenced by the attention to things rather than processes.

The story I told about the failure to achieve the necessary quality in concrete structures can be summarized by saying that arrangements were dominated by attention to things not processes. Complex interactive processes were broken down (design, steel fixing, formwork, concreting) with the intention of controlling them by contractual regulation. It failed. The categories used to manage the projects were dominated by contractual considerations - WHAT had to be delivered, not by construction considerations - HOW it was to be delivered.

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[2] This point is beautifully made by Barbara Kingsolver in her novel *The Poisonwood Bible, p512*. "She [a Congolese woman] has explained to me [an American woman]a dozen times, but it only sinks in as I come to see for myself what it is, this life. The Congolese are used to it and have developed a thousand shortcuts. They sum up prospects by studying each other's clothing and disposition and the bargaining process is well under way before they even open their mouths to speak. If you are deaf to this subtle conversation it comes as a shock [...] I've heard foreign visitors complain that the Congolese are greedy, naïve and inefficient. The [foreigners] have no idea. The Congolese are skilled at survival and perceptive beyond belief, or else you are dead at an early age."

This failure came to light because we applied an ethnographic research approach. We rejected conventional assumptions, categories and practices but, rather, learnt from the people who often, much to their discomfort, were imprisoned by them.

Lean Construction offers an alternative. In my view, its effectiveness lies in its grasp of some fundamental facts about how language or any mode of symbolic representation works. Much of the thinking that one encounters in the construction industry assumes that there can be an exact correspondence between words and things. The orthodoxy is that things can be objectively identified and unambiguously described.

But there is a paradox here. I know many highly intelligent engineers working in the industry who do not *act* according to this credo. In practice, I think, they would accept much of the argument I have offered here. They just won't endorse it publicly! Maybe it is too threatening to the engineering canon or maybe it's because they just don't like sociologists!

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