IN SEARCH OF LEAN SUPPLIERS – STRUCTURING A PREFERRED SUPPLIER PROGRAM

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ABSTRACT

The lean literature emphasizes that one should involve suppliers in early stage decision-making, work cross-functionally, and long-term. Simple principles but how does one put this into practice in more than 2000 construction projects in multiple countries and with 26,000 suppliers? This paper proposes a model for building a long-term preferred supplier program. The specific objectives of the paper are:

1. To describe a model for a preferred supplier program, for both goods and service suppliers, in development within an international construction firm.
2. To explain the theoretical foundations and design choices involved in the preferred supplier program.

The model is developed theoretically following the current state/future state methodology for process improvement.

Proactive management of supplier relations goes beyond simple 'buy for less' or 'select the best' strategies. Grounded in the realization that competition is increasingly between production systems (supply networks) rather than individual companies, an adequate preferred supplier program reduces costs by eliminating waste and increases capabilities by developing skills and processes. The model provided in this paper fills a critical gap in knowledge.

KEYWORDS

Lean, supplier, supply chain management, preferred supplier program

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INTRODUCTION

"While supply chain management may be practiced on a single project, its greatest benefits come when it (a) is practiced across all projects in a company, (b) involves multiple companies, and (c) is applied consistently over time. In today's marketplace, companies no longer compete one-on-one; their supply chains do." (Tommelein, et al., 2003)

This statement well expresses the thinking and practice in industry worldwide. The implication: to develop your firm's capability, you must develop the capability of the network of firms with which it works. Despite the prevalence of this view, and its origin in a work on construction, the construction management literature yields relatively little on supply chain management, less on preferred supplier programs, and less yet on preferred supplier programs for service providers[3]. Yet 70% or even more of the cost of a construction project is for purchased goods and services. There is clearly a need for preferred supplier programs in construction, especially for iterative buyers of construction services, for developers, and for service providers with continuing, stable workloads. In addition, e.g., in Finland, R&D expenditure for construction industry is about 0.4% percentage of revenue. Only energy and farming sectors are spending less. This means that the construction industry is very dependent on innovations from other industries, and how it captures and utilizes them becomes critical.

Despite this need, managing supplier relations in our industry is now typically done through arms-length transactions limited to a single project, relying on 'buy for less' and 'select the best' strategies. These strategies are not sufficient to develop network capabilities. Buying on least-price-to-purchase has been demonstrated time and again to fail as a strategy for minimizing project costs at completion (e.g., see Koskela & Howell, 2002). Further, to develop the capabilities of the network, it is not enough to select 'partners' based on their current performance capabilities. They must be selected based on their potential for learning and growth in a long-term, collaborative relationship.

In this paper, we describe a model for a preferred supplier program, for both goods and service suppliers, in development within an international construction firm, and explain the theoretical foundations and design choices involved. We first explain our methodology, followed in order by the theoretical framework, the current state, the future state, and conclusions.

METHODOLOGY

The preferred supplier program is developed theoretically and will be tested experimentally, following the current state/future state methodology for process improvement. The current state data has been collected through databases, interviews, workshops, and measurements. The future state is established with help of literature reviews, workshops and interviews. Centrally lead pilot projects will be used in three countries to test experimentally various pieces of the preferred supplier program (Figure 1).

[3] For exceptions, see O'Brien, et al., 2009.

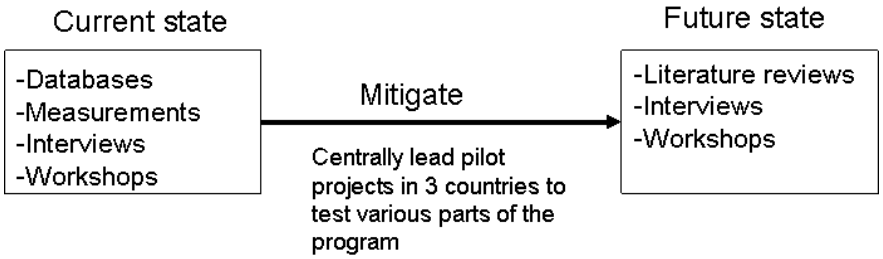

Figure 1. Research methodology

THEORY FRAMEWORKS

What is the appropriate theoretical framework for supply chain management and for preferred supplier (supplier development) programs? We look first at the general supply chain management literature, then at the literature specific to supply chain management in construction.

SUPPLY CHAIN MANAGEMENT LITERATURE

A framework for strategic alliances is offered in Simchi-Levi, et al. (2008), as an aid to firms deciding if a particular strategic alliance is appropriate for them:

- Will the alliance add value to our products?
- Will the alliance improve marketing?
- Will the alliance strengthen operations?
- Will the alliance add technological strength?
- Will the alliance enhance strategic growth?
- Will the alliance enhance organizational skills?
- Will the alliance build financial strength?

Clearly the authors regard alliances as a key means for developing the capabilities of the firms involved. However, the authors caution that not all alliances are equally beneficial. Some alliances may even be destructive; e.g., when the core competence of the firm is compromised. The willingness and ability of the supplier to share information and collaborate, to learn and develop is obviously an important consideration. Assessing supplier readiness is a critical issue.

Supply chain management is founded on systems optimization; optimizing the whole rather than the part, with the system understood to extend out through tiers of suppliers to providers of raw materials and services. Toyota is said to be just now working on its 4th tier suppliers supporting product development and manufacturing, and they've been developing their supply chain for fifty-plus years! (Simchi-Levi, et al., 2008).

There is still room within this orientation for more traditional arms-length transactions with specific suppliers, and a mix of 'make' and 'buy' is often encountered.

Supplier Development in Lean Manufacturing

An early account of supplier development in lean manufacturing is provided in *The Machine that Changed the World* (Womack, et al., 1990). The International Motor Vehicle research reported in the book found substantial differences between Japanese

and Western motor vehicle manufacturers' supply chain management. Consider these differences:

Table 1: Comparison of Suppliers

	Japan	**U.S.**	**European**
Eng by suppliers (% total hours)	51%	14%	35%
Black box parts	62%	16%	39%
No. suppliers per assembly plant	170	509	442

Suppliers to Japanese firms spent half the total engineering hours on product development projects, provided 62% of parts 'black box' (meaning the functionalities and interfaces are provided by the assembler, but the supplier develops their own solution), and had greater work scopes by a factor of three relative to their American and European counterparts.

SUPPLIER DEVELOPMENT IN CONSTRUCTION

One of the most comprehensive of the relevant texts is the *Construction Supply Chain Management Handbook* (O'Brien, et al., 2009). The book is composed of chapters by different writers, and understandably represents many, sometimes contradictory perspectives. For example, Andrew Cox (Cox, 2009) proposes that alliances are in principle infeasible, as the interests of buyers and sellers of goods and services are in opposition—buyers want to reduce costs and sellers want to increase profits. Kerry London (London, 2009) provides a partial echo in her stated concern for smaller firms involved in alliances (p. 10-9, in O'Brien, et al., 2009). Other contributors take a more optimistic view; e.g., see Tommelein, et al. (2009), who present the lean project delivery system, which is based on organizational integration. Overall, the authors tend to focus on single projects, as opposed to programs.

The concepts and practices of supply chain management were promoted in the construction industry by the influential Latham and Egan Reports in the U.K. (Akintoye, et al., 2000). Initial enthusiasm was followed by pessimistic assessments by industry scholars (Fernie and Thorpe 2007), and there are relatively few publications on the topic at all since the early 2000s.

Clearly, justification of the feasibility of supplier alliances is required. We return to this task after a brief description of the current state of affairs in construction.

CURRENT STATE – MANAGING SUPPLIERS

The firm that is developing a preferred supplier program has more than 2000 construction projects in multiple countries, with 26,000 suppliers. It operates both as a developer and as a constructor for others. Most of the purchasing is done by a central purchasing organization and project staff. Annually around €4,4 billion or $6 billion is purchased. About 30% of total spend is managed via framework agreements. The remainder is spot buying. Most of the suppliers are small and local (Figure 1). Supplier relations are not coordinated on the company level, but numerous informal "long-term" supplier relations exist at the project level, based on personal relationships. However, even if the firm works with numerous small suppliers, the

suppliers are not that dependent on the firm: 55% of suppliers have less than 10% of revenue coming from the firm.

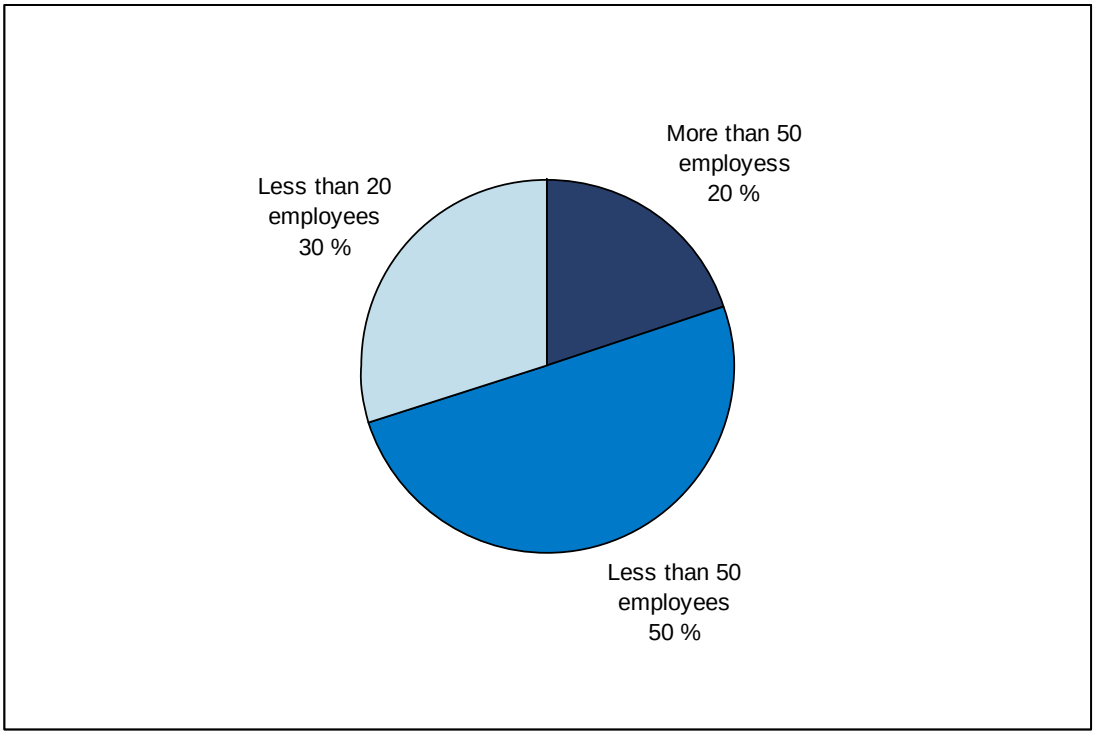

Figure 2: The share of small and local suppliers

Both for central procurement and procurement conducted by production professionals, the current way of managing supplier relations is very much based on individual skills rather than processes and performance measurements, in keeping with the construction industry tradition: the project manager is the captain of a ship at sea, with power 'to wed and to hang'. One reason has been that there is not a preferred supplier program in place, on the other hand, earlier attempts to establish such a program have failed (see Future state chapter).

A major problem is controlling the chain of subcontractors. Once a contract is awarded, it is difficult to maintain visibility of subsequent contracting. If a supplier is to be preferred, does that imply preference for the supply chain it heads? If so, how to make that judgment and how to extend development opportunities through each tier? Less ambitiously, but perhaps even more difficult, how to assure that every company involved in each of the supply chains operates legally?

As in the construction industry as a whole, buying for less remains the dominant mode of procuring goods and services, and the relationships that do exist tend to be limited to first tier suppliers. Supplier prequalification is generally limited to financial solvency, licenses, and safety records, with no formal consideration given to such characteristics as willingness and ability to collaborate and to innovate. Low bid price tends to be the trump card.

The authors argue that the way the company purchases and manages suppliers is one of the key issues why productivity is stagnant and the industry is lacking

innovations. On a project level typical problems that the above purchasing practices lead to are[4]:

- Suppliers are unwilling to share their knowledge. Instead of solving design errors proactively, suppliers charge for them through change orders.
- The same quality defects are repeated throughout projects.
- The focus is mostly on product cost instead of process cost and customer value.
- Capacity, time, and material are sub-optimized because standards and best practices are either missing or not shared.
- Because standards are missing, change becomes extremely challenging. The special needs of each of the 2000 projects have to be considered.

On the other hand, changing the way the company purchases and manages its supplier base could have a dramatic impact on its competitiveness. There have been numerous trials among the company and its competitors to set-up "preferred supplier programs" in order to fix the problem but so far there has not been a breakthrough. The attempts have failed because they have not addressed enough spend or the critical suppliers, the decentralized decision-making, compliance to the program, etc. However, perhaps most of all because, they have not truly aimed to build and develop supplier capabilities.

FUTURE STATE – PREFERRED SUPPLIER PROGRAM

The preferred supplier program concept is fairly simple (Figure 3): Based on performance (including supplier maturity) and strategic importance the degree of supplier interactions varies. The higher in the pyramid the more interaction there is between the buyer and seller in form of process improvement and value creation, e.g., in the approved section the supplier gets once a year feedback from projects, whereas in the preferred section common improvement areas are identified. In the top of the pyramid, there will be suppliers who generate business opportunities for the contractor and the relationship will more closely resemble a strategic alliance. Also, the contract type changes from transactional towards more relational with each higher location in the triangle (Macneil 1974). The program is founded on lean principles and goals (Koskela 2000), continuously reducing waste and increasing customer value. The ultimate success of the program will be measured on the capability of collaborative learning. The company's biggest obstacle to moving towards lean will likely be inability to systematically learn from mistakes (deviations in safety, quality, time, etc.). Basic lean tools such as 5 whys analysis (Shingo 1988) or A3 problem solving (Shook 2008) are not rigorously practiced throughout the company. These will be key tools to use collaboratively if the program is to be successful. The program aims to provide the following benefits for its members:

- Increased productivity (through better process & product quality)
- Improved safety performance
- Faster market capitalization of innovations

[4] For a more complete description see Elfving (2003)

The concept in itself is not the tricky part but how to make a reality of the concept is what matters. Until today, to the knowledge of the authors, a well-working preferred supplier program does not exist at a corporate level at any general contractor. With help of interviewing industry people and workshops, the authors have tried to identify why similar concepts have failed earlier. Based on these we established four principles for mitigating the transition from current to future state.

PRINCIPLE 1: ADDRESSING ENOUGH SPEND OR CRITICAL SUPPLIERS

Very often we start to work with the "best suppliers" and pay less attention to the "everyday" or problem suppliers, and program impact becomes weak or meaningless. We will build the preferred supplier program from bottom-up (Figure 2). First we define the lowest "filter", the minimum criteria in order to become an approved supplier. This criteria needs to be low enough so that we do not run out of suppliers, particularly service suppliers. In the Scandinavian market, there is often only one dependable supplier in many product groups or trades operating in a specific location.

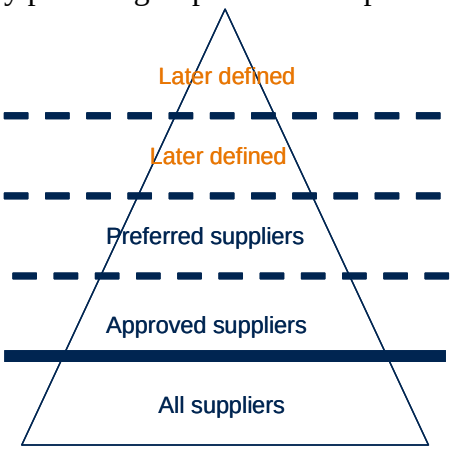

Figure 3. Preferred supplier hierarchy

The next filter differentiates suppliers that only meet minimum criteria from preferred suppliers. This filter is fairly tight and criteria are based on strategic focus areas, such as safety, green, and operational efficiency. There will be different tracks for material and service suppliers, which tend to have different levels of capability and maturity to work upstream in project processes. Also, the skills and strengths of the same suppliers, particularly those providing services, may vary widely depending on the areas in which they work; i.e., service suppliers tend to be relatively local, and few have developed a characteristic and reliable way of working that is relatively independent of the individual workers (3). The subsequent filters or segments will be defined later as the program and mutual learning evolve.

PRINCIPLE 2: CENTRALLY LEAD DECISION-MAKING

The program will be local but centrally coordinated. We want take advantage of the informal supplier relations that project staff already have and build on them. The projects have to have the freedom to choose their suppliers from a common pool of suppliers, because collaboration and mutual trust is required both on corporate and

project level. Projects will be able to suggest local suppliers that they would like to work with. The supplier relationship management is done centrally. Strategic decisions such as criteria for the different filters are taken together with procurement and production professionals.

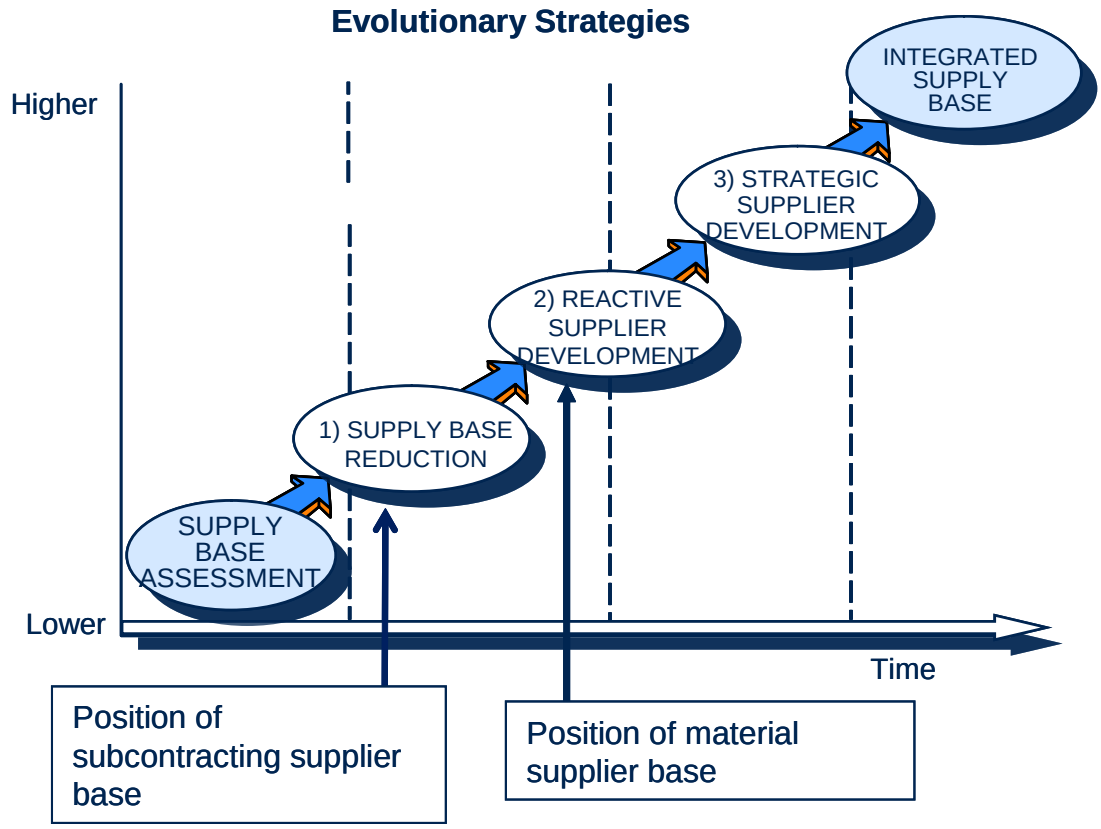

Figure 4. Principle 2: "Different tracks for material and service suppliers" (the concept is from: Krause and Handfield 1999)

PRINCIPLE 3: COMPLIANCE TO THE PROGRAM

Poor compliance is often a result of not aligning interests[5]. Where stakeholders have not been part of the decision-making process, they may feel that there is not enough value for them, and lack understanding and knowledge. Stakeholder involvement in decision-making and lack of understanding and knowledge go hand in hand. The more one gets involved in the decision-making the more the understanding around issues grow. It is more a technical process to "remember" to involve stakeholders. However, generating value to the projects and the suppliers is trickier, particularly short-term. If projects' production reliability is on average between 50-60% (Ballard 2000) and suppliers about the same (Arbulu and Ballard 2004.), there is a lot of day-to-day problems that have to be solved and reduced prior to some high-level corporate targets. Therefore the bottom-up and local approach will be essential so that projects will as soon as possible feel that they get value from the program. The program has to solve problems that projects are not able to handle themselves or are repeated.

[5] As an example, see the Toyota Way principle to build consensus slowly and execute quickly in Liker 2004.

PRINCIPLE 4: COLLABORATIVE LEARNING

If one ends up solving the same mistakes and deviations from project to project there is no learning, and the program is malfunctioning. Therefore, measurement of collaborative learning is of the highest priority. During the first part of establishing the program, different measurements for collaborative learning will be tested. These include, but are not limited to: the number of repeated defects, number of 5 whys analyses, number of improvement ideas, number of team problem solving events, and supplier reliability.

CONCLUSIONS AND NEXT STEPS

Lean theory advocates selecting and developing suppliers that have a capability to learn. Selection strategies such as "buy for less' and 'select the best' will not be enough in building a preferred supplier program. Just by looking at how other "lean industries" have reshaped their way of managing their supplier base and how little it has happened in the construction industry, it is readily apparent that the opportunity is enormous. However, the construction industry has had a bad track record with similar programs. Therefore, it is important to understand pitfalls from the past. This time we will try to build the program locally, bottom-up, have different tracks for service and material suppliers, and anchor it both with procurement and production staff. The next step will be to test the criteria for both material and service suppliers—to be reported in future papers.

REFERENCES

Akintola, A., McIntosh, G., and Fitzgerald, E. (2000). "A survey of supply chain collaboration and management in the UK construction industry". *European Journal of Purchasing and Supply Management*, 6 (2000), pp. 159-168.

Arbulu, R. and Ballard, G. (2004). "Lean Supply Systems in Construction" *Proc. 12th Conference of the International Group for Lean Construction* (IGLC12), 3-5 August 2004, Copenhagen, Denmark, 12 pages.

Azambuja, M. and O'Brien, W.J. (2009). "Production and Operations Analysis Construction Supply Chain Modeling: Issues and Perspectives". Edited by O'Brien, W.J., Formoso, C.T., Vrijhoef, R., and London, K. *Construction Supply Chain Management Handbook*, CRC Press, Boca Raton, Florida.

Ballard, G. (2000). The Last Planner System of Production Control. Ph.D. Dissertation, Faculty of Engineering, Univ. of Birmingham, Birmingham, UK.

Cox, A. (2009). "Strategic Management of Construction Procurement", Ch. 12 in O'Brien, et al., 2009.

Elfving, J.A. (2003). *Exploration of Opportunities to Reduce Lead Times for Engineered-To-Ordered Products*. Ph.D. Dissertation, Constr. Engrg. and Project Mgmt. Program, UC Berkeley, Berkeley, CA. 322 pp.

Fernie, S. and Thorpe, A. (2007) "Exploring change in construction: supply chain management", Engineering, Construction and Architectural Management, Vol. 14 Iss: 4, pp.319 – 333

Formoso, C.T. and Isatto, E.L. (2009). "Production Planning and Control and the Coordination of Project Supply Chains". Edited by O'Brien, W.J., Formoso, C.T.,

Vrijhoef, R., and London, K. *Construction Supply Chain Management Handbook*, CRC Press, Boca Raton, Florida.

Koskela, L. (2000). An Exploration Towards a Production Theory and its Application to Construction. Ph.D. Dissert., *VTT Publications 408*, Espoo, Finland, 296 pp.

Koskela, L. and Howell, G. (2002). "The underlying theory of project management is obsolete", in Proceedings of the PMI Research Conference, Project Management Institute, 2002, 16 p.

Liker, J.K. (2004) *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*, McGraw-Hill, New York, NY

Liker, J.K. and Meier, D. (2006). *Toyota Way Fieldbook.* The McGraw-Hill Company, New York, NY, pp.476.

London, K. (2009) "Industrial Organization Object-Oriented Project Model of the Façade Supply Chain Cluster", chapter 13 in O'Brien, et al (2009)

Macneil, I.R. (1974). "The Many Futures of Contracts". *Southern California Law Review* 47 (May), 691-816.

O'Brien, W.J., Formoso, C.T., Vrijhoef, R., and London, K. (2009). Construction Supply Chain Management Handbook, CRC Press, Boca Raton, Florida.

Shingo, S. (1988). *Non-Stock Production*. Productivity Press, Cambridge, MA, USA, 454 pp.

Shook, J. (2008) *Managing to Learn: Using the A3 management process to solve problems, gain agreement, mentor, and lead*, Lean Enterprise Institute, Cambridge, MA

Simchi-Levi, D., Kaminsky, P., and Simchi-Levi, E. (2008). *Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies, 3rd edition.* McGraw-Hill Irwin, New York, NY.

Tommelein, I.D., Ballard, G. and Kaminsky, P. (2009). "Supply Chain Management for Lean Project Delivery", Ch. 12 in O'Brien, et al., 2009.

Tommelein, I.D., Walsh, K.D., and Herschauer, J.C. (2003). *Improving Capital Projects Supply Chain Performance.* Research Report PT171-11, Construction Industry Institute, Austin, TX, 241 pp.

Womack, J.P., Jones, D.T., and Roos, D. (1991). *The Machine That Changed the World: The Story of Lean Production.* Harper Perennial, New York, NY.