

PRINCIPLES AS A BRIDGE BETWEEN THEORY AND PRACTICE

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ABSTRACT

Principles can carry the intent from the theory they represent. Military strategy has a long history of being presented through principles of war. In Lean Construction, principles like "flow," "pull," "remove waste" are used with ease. However, have they been correctly treated and understood? Supported by a literature review, we follow the use of principles through the history and the standing and character they have gained. The work is grounded in the important position of principles between theory and practice, and methodologically proceeds through philosophical conceptualisation. We recognise the guiding, dynamic, adjustable, durable, action-oriented, prescriptive and descriptive capabilities of principles, and emphasise their important capacity to facilitate abductive reasoning. We call for reflection upon the power of principles to strengthen the theoretical conceptualisation of Lean as well as upon their power to support improvement in practice.

KEYWORDS

Theory, Lean Construction, process, principles, concepts

INTRODUCTION

Koskela (2000) sees principles as a link between concepts and methodologies. Koskela and Kagioglou (2005) use this in their discussion of the metaphysical assumptions forming theory and practice. They illustrate their reasoning in a pyramid that shows the relationship between "understanding of the world" at the top of the pyramid down to "acting on the world" at the bottom (Figure 1). This figure is a point of departure for further examination of what principles are, what characteristics they have and how they can bridge between theories and theoretical concepts on the one hand and methods, tools and practices on the other. The paper is part of a broader research agenda, including a PhD research project, where the aim is to expand our understanding and use of principles under the label "Lean theory and practice". The research involves but is not limited to,

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topics like strategy, leadership, production planning and control and continuous improvement.

METHOD AND APPROACH

The primary method in this paper is to elaborate on the philosophical conceptualisation of principles as a bridge between theory and practice (Finger 1994, Duffy 2008). We ground our conceptual approach on the work of Koskela and Kagioglou (2005), who perceive a differentiation between ontology, concepts/theories⁵, principles and methods/practices. We work on understanding what principles are, how they function and why principles can be both practical and theoretical useful (Corley and Gioia 2011). Our discussion follows both a descriptive and a prescriptive path, linked through theoretical reasoning. The descriptive path consists of a literature review (Grant and Booth 2009), in which we search for principles use and form in a historical view. Our topic is principles as a bridge between theory on the one hand and practice on the other.

For this reason, our philosophical stance is dualistic. On the one hand, we take the position that principles, when functioning in the actual world, are hardly true or false, but rather useful or not useful, that is working or not working in as intended. On the other hand, principles underpin theories that obviously can be true or false, consistent or inconsistent, relevant or irrelevant, comprehensive or partial. It is reasonable to believe that the theory's properties can affect the properties of an associated principle.

The paper consists of two main parts: first, a presentation of the essential characteristics of principles, followed by a discussion of these characteristics and some consequences thereof.

WHAT ARE PRINCIPLES?

BASIC DEFINITION AND STARTING POINT

There are several meanings of the term principle (Oxford Advanced Learner's Dictionary 1995). In this paper, we define a principle as *a guiding rule for action*, not detailed instructions (von Clausewitz and von Scherff 1883). A principle functions as a facilitator for alignment with and consistency to the concept it represents (Greene 2010), herein lies the guiding capabilities. Some examples of generally formulated principles are "Simplify" (Koskela 1997, Fowler et al. 2001), "Use pull" (Liker 2004), "Remove waste" (Koskela 1997, Gothelf 2013) and "Make it visual" (Liker 2004).

Koskela and Kagioglou (2005) place principles in a hierarchical pyramid with four layers; the top of the pyramid, expresses how we understand the world, the bottom of the pyramid how we should act in the world. As we move down through the layers, we gradually move from just "understanding" to "acting" based on this understanding. Principles are, on the one hand, more concrete and action-oriented than metaphysical assumptions and theories. On the other, they are more general and abstract than practices. Principles establish a connecting bridge between the practices on the one hand and the theories on which they are based on the other.

They describe "the pathway to transform existing reality through the basic idea set by a concept" (Santos 1999).

⁵ The distinction between theory and theoretical concepts, or between methods, tools and practices is not clear and is not of importance for the reasoning in this paper. To simplify, we further use the terms theory on the one side and practice or practices on the other.

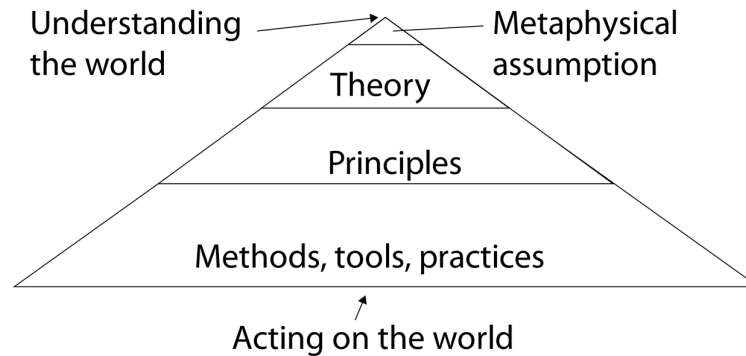


Figure 1: The relationship between theory, principles and methods. Based on a similar figure by Koskela and Kagioglou (2005)

Principles can function as valuable guidance, without claiming to be universal laws, rules or formulas (Buzzell et al. 1987). Holding this guiding ability, principles are prescriptive, they take a stand regarding what one should (or should not) do. Principles are further tightly connected with their underlying theories and metaphysical assumptions. Therefore, a principle also has a descriptive component, even though this needs not to be explicit in the wording of the principle.

Practices are always contextual. They can be more or less useful in different situations, and their relevance will change over time. Because principles are more general than practices, they are less contextual. They will have different practical implications in different situations and contexts and can be kept more constant over time.

All theories have contextual boundaries regarding validity. Accordingly, we cannot presuppose that principles and practices based on theory will be relevant outside their specific domain. This domain can be equal to that of the underlying theory, but it can also be more limited. If a broad theory is to be applied on a more limited context, this can be facilitated through principles specially tailored for this domain. In this case the domain of the principles will be smaller and more specific than the domain of the theory on which they are based. As we will see later in the paper, there are, however, also examples of principles being generalised beyond their original domain (e.g. from warfare to business or from manufacturing to processes in general). When formulating and using principles, it is therefore essential to reflect on what domain(s) the principles are valid within. If one for example within the domain of car manufacturing formulates “Lean” principles, these principles might, but need not, be relevant for construction.

Translation is necessary when a principle is applied to specific situations and contexts (Røvik 2007). A theory is general in the sense that parts of the specific context are abstracted away; it is decontextualised. In order to turn this abstract knowledge into actionable knowledge (Argyris 1996), it will have to be placed back into a context (recontextualised) through a translation (Røvik 2007). The same principle can in different contexts result in different practices. By being something in between general and specific and in between descriptive and prescriptive, sound principles call for reflection. Principles are action-oriented and describe in general and guiding terms what one should do. The ambition to change and improve the existing situation is therefore embedded in the concept of principles.

Since a principle is actionable and open for contextual interpretation, there is, of course, a risk that the interpretation can be wrong and lead to unwanted actions considering the initial perspective and intention behind the principle. Principles are

dependent on reflection, dialogue and communication to create coherent understanding and desirable action. Principles should be phrased so they give guidance for action. As a guiding role a principle should therefore be formulated positively, addressing what to do, instead of negatively, addressing what not to do.⁶

HISTORY OF PRINCIPLES AND THE JOURNEY TOWARDS LEAN

The art of war has a long history of expressing core beliefs through principles or sentences of the essence. The ancient sources date back to Chinese warlords and philosophers (Griffith 1963). Principles are still in active use in modern warfare. The way Antoine-Henri Jomini (Jomini, Mendell et al. 2007) and Carl von Clausewitz (von Clausewitz and von Scherff 1883) differ in the way they interpret strategy are still of interest (Bassford 1993) both for warfare and business. Where Jomini was static and simplistic, von Clausewitz was dynamic and recommended principles as a guide to be used wisely in the context (Bassford 1993). The resemblance to the substance view and the process view as described by (Koskela and Kagioglou 2005) is evident.

Henri Fayol, known for taking strategy to business (Parker and Ritson 2005), introduces principles for management (Fayol 1916). Fayol was inspired by military strategy, but was clear about the difference between the domains of warfare and business (Peaucelle 2015). Fayol advocated the general capacity of the principles in public and private affairs: “All undertakings require planning, organisation, command, coordination and control and in order to function properly, all must observe the same general principles.” Principles of Tzu, Clausewitz and Jomini are still prevailing both in war and business strategy (Dimovski, Maric et al. 2012) and even though this might support that principles can be robust over time and relevant across context, “principles of war” evidently are not the same as “production principles”.

In 1911, Taylor published his book *The Principles of Scientific Management* (Taylor 1911). Taylor based his conclusions on systematic observation and study and advocated enforced standardisation of methods, enforced adoption of the best implements and working conditions, and enforced cooperation. He believed in transferring control from workers to management with detailed planning and specification of how the work is to be done (op cit.).

In contemporary history, several important contributions to production theory have conceptualised their message through principles (Schonberger 2008, Simchi-Levi 2010, Hopp and Spearman 2011). In his seminal book *Out of the Crisis*, Deming (1982) formulated 14 points that should be the basis for the transformation of American industry. We interpret these 14 points as principles. Toyota won “the Deming Prize” already in 1965 and 1970, and Deming’s work allegedly influenced the conceptualisation of the Toyota Production System (TPS).

Krafcik (1988) first introduced the term “Lean”, that today is an established term. Within many different domains Lean principles have been presented; like general management (Liker 2004, Liker and Convis 2012), manufacturing (Womack and Jones, 1997), software development (Fowler et al., 2001), and construction (Ballard et al., 2009). Given that the mentioned principles originate from the framework of Toyota Production

⁶ An example of a negative principle is “Never trust somebody who says ‘trust me’”. There can also be combinations of positive and negative formulations in one principle. When working as a process facilitator one of the authors tries to follow the following principle: “Ask more, tell less”.

System (Koskela 2004), “lean principles” are still modified and rephrased to fit their context.

WHAT IS NOT A PRINCIPLE?

Scientific laws are not principles. We make the distinction that a scientific law is a statement on observations of the outcome, and a principle is a statement on what one should do. Absolute rules are also not principles. The word “rule” can be conceived as more prescriptive and less descriptive than the word “principle”, so when using the word “rule” in the definition of principle, we pinpoint “guiding” as an adjusting word.

Methods and tools should be aligned with the guiding principles but are not to be confused as being principles themselves.

Holweg and his co-authors (2018) address principles of operation management in the book, “Process theory”. An example of a principle these authors address is “Variation is inherent in all process inputs, tasks and outputs” (op cit.: 83). This is a central knowledge statement, but it is not action-oriented, and then somewhat different from our understanding of principles.

THEORY-BASED PRINCIPLES

Theory-based principles are deduced from theory, anchored in logical reasoning (e.g. principles on creating flow and continuous improvement). The Factory Physics by Hopp and Spearman (1996) deduces principles from factory physics laws, supported by mathematical logic or reasoning. Koskela (2000) conceptualises and synthesises the theoretical framework of Transformation, Flow and Value generation, along with associated principles.

PRACTICE-BASED PRINCIPLES

Principles can also be induced from the empirical world, based on a judgement of that the principle is likely to have a wanted effect on action and outcome (e.g. principles like start with a pull from the customer and use visual controls). Proverbs follow the logic mentioned above; as an example, the law-like proverb “A chain is only as strong as its weakest link” or the more as a principle phrased proverb “Always put your best foot forward”. The same logic goes for the principles presented by Schonberger (1987), with principles like “Do not put in equipment simply to displace labor” and Simchi-Levi (2010) with principles like “Speed in sensing and responding”. The use of practice-based principle is quite common in the subject of Lean, since much of the writing is induced from a western interpretation of Toyota’s work. Liker’s (2004) 14 management principles are a prime example of this. The same goes for Womack and Jones (1997) in their bold attempt to capture “Lean Thinking” in 5 principles alone.

PILLARS IN THEORY AND PRACTICE

All principles have to be underpinned by a combination of theory and practice. When the knowledge is theory-based, the principles must reflect that theory, and if the wanted outcome is not triggered, they must be adjusted or contextually rephrased. Thus, in the formulation of a principle, two considerations need to be taken into account: 1. Is it in compliance with the theory? and 2. Will it lead to action and wanted outcome? The first question is about logic; the second is about judgement and rhetoric. On the other hand, if the available knowledge is empirical, induction from practice to principles (and further to theory) is possible (David and Hatchuel 2007). Indeed, this approach is essential for supporting Lean, due to its industrial origin (Krafcik 1988 p. 458).

VALUE-BASED PRINCIPLES

Value-based principles can reflect values and ethical evaluations (e.g. principles regarding respect for people and involvement). Such value-based principles can also be rooted in an expected effect on the outcome. Toyota's reasoning for involving people and to have a stable workforce need not necessarily be based on altruism and ethics but might also be motivated by positive effects on production (Vidal 2007).

USE OF PRINCIPLES IN ETHICAL AND RELIGIOUS THINKING

Principles are also widely used in ethical and religious thinking. Examples of this are provided by the ten commandments from the Bible and the golden rule⁷, common to humanism and all world religions (Ellis 2017). Without going further into this topic, we observe that the use of principles in ethical and religious thinking is similar to the one described in this paper: to give guidance for reflection and action by bridging between the fundamental concepts on the one hand and specific actions in given contexts on the other.

DISCUSSION OF THE POTENTIAL OF PRINCIPLES

USE OF MULTIPLE PRINCIPLES – A QUESTION OF DYNAMICS, BALANCE AND FIT

A strategy is characterised by the fit and dynamic between the elements it is composed of (Porter 1996). The same goes for principles. Much of the dynamics in how principles will be interpreted and work lays in how they fit and are combined. We stress that the balance between the principles is essential for how both they, and the theories they are based upon, are understood, reflected and expressed in methods (and tools). Several principles can be operationalised in one unifying method, but one principle can also result in several different methods. As an example “Reversed phase scheduling” (Kalsaas, Grindheim et al. 2014), a component in Last Planner System (Ballard 2000), coheres with several principles like “begin with the end in mind” (Covey 2014), “create pull” (Hopp and Spearman 2004), “visualise” (Liker 2004), “create flow” (Koskela 1992) and “involve and have respect for people” (Sugimori et al. 1977).

We argue that as there is a delicate fit among the principles to represent or “bridge” a concept (Marlin, Hoffman et al. 1994, Porter 1996). Principles can sometimes compete against each other on how to be applied. As an example: “Banish waste” (Womack and Jones 1997) vs “give new ideas a chance” (Macomber 2017) might seem contradictory in some cases, especially in a short term perspective.

Not only a fit, but a predefined sequence of how to use the principles is argued by some authors (Ferdows and De Meyer 1990, Womack and Jones, 1997, Womack, et al. 2007). A predefined sequence might make the principles easier to use, if the order does not need to be considered, but often limits some of the potential in combining them. We argue that a sequence could be a part of the knowledge that supports the use of the principles, but should not be predefined, since the flexibility in combining the principles is part of the power they possess. A sequence can be argued to be closer to a method, like Goldratt (Goldratt and Cox 1984) arranges their “five focusing steps”.

⁷ “Treat others as you would like others to treat you.” The golden rule has been expressed in many different wordings, both positive and negative. A negative example is “Do not do to others what you do not want others to do to you.”

The principle itself can show a prioritisation or timing without losing flexibility, like “begin with the end in mind” (Covey 2014) or “Strike while the iron is hot” (Schulz, Steinhoff et al. 2017). “Strike while the iron is hot” is phrased for a specific context, but functions as a metaphor and is applicable and guiding for many other contexts, due to the previously mentioned need for reasoning when applied.

PRINCIPLES AS A BRIDGE –CAN WE CROSS BOTH WAYS?

An important merit of a principle is to act as a bridge between a theory on the one hand and practice on the other. Referring to Figure 1, one obvious direction of this bridge is top-down. The principles take the theory as a point of departure, connect it to practice and make it actionable. Can then a principle also bridge the other way, can it connect practice back to the theory in a way that might influence the theory? We think the answer is yes.

As pointed out by Koskela and Kagioglou (2005, 2006), lean is based on Aristotelian ontology. The world influences what we see, and what we see influences what we think and do. On the other hand, what we think and do influences what we see. This movement, back and forth, has no specific starting point and no specific end. Therefore, we should expect that principles formulated as generalisations of practical experiences might contribute to theoretical reasoning. This reasoning, back from practice to theory, could go like this:

1. We are doing this and that, but are we thereby following some sort of principle?
2. Yes, what we do is according to the following principle(s): ...
3. Well. We are acting according to this principle, and we are experiencing that this works well. Is there then an underlying theory that can explain why it is working?

The following two classic examples of principles within the domain of lean and Lean Construction can act as examples of this crossing back from practice to theory. First, Glenn Ballard developed the Last Planner System (LPS) before the year 2000 (Ballard 2000). The development of LPS was based partly on theory, partly on experienced problems. Ten years later, in 2009, Ballard et al. presented the principles on which LPS is based (Ballard et al. 2009).

Second, one of the main contributions of Shigeo Shingo is the distinction between what he (in English translation) calls processes and operations (Shingo 1989). Shingo’s statement that processes should have priority before operations is a principle. Shingo offers no explicit theoretical argument for the principle and thereby leaves the impression that it is based on experience rather than theory.

PRINCIPLES: SOMETHING MORE OR SOMETHING LESS?

Principles are not identical with the theory and cannot necessarily be deduced by pure logic. Does this make them something more or something less than the theory in question?

This question can be answered both ways. In order to bridge the theory to practice, the principles should enrich. This enrichment comes from something outside the theory itself. This “something” can be other theories, or it can be elements from the actual world (context) to which it is connecting. In this sense, the principle can add up to be something more than the underlying theory. An example: Respect for people (Emiliani 2008) and sustainability (Vieira and Cachadinha 2011, Khodeir and Othman 2018) have become an essential part of many companies’ values (Mackey and Sisodia 2013). The TFV model only implicitly contains reasoning on people and sustainability through value generation. Adding principles addressing these perspectives explicitly might enhance the TFV model

and generate more dynamics in these respects. Hence adding a principle inducted from practice, might expand and enrich the core theory.

Lewin's (1951) quote "There is nothing as practical as a good theory" might be right. However, despite this quote, the theory might get lost in the translation towards practice (Argyris 1996), and when the theory is hard to translate principles can function as an essential bridge. In such a case, there might be a need to simplify. This simplification can be done through principles that subtract the elements of the theory less relevant to the context in question. In this sense, the principles can be seen as something less than the theory they are based upon. When applied to specific domains, there might be a need to narrow it down to the new context. Principles can help consolidate and tailor the essence of the theory down to the specifics of the new domain. Methods, tools and practices should always be challenged and inspired by the principles they represent, and this might be the essence of spurring continuous improvement (Skaar 2019).

GENERIC OR CONTEXTUAL PRINCIPLES?

von Clausewitz' evident attitude towards the flexibility in principles, in contrast to absolute laws and rules (Bassford 1993), is one of the early sources of empowerment and the ability to adapt to context. von Clausewitz divides his principles into the strategic, tactical and operational level. Levels of principles support tailoring principles even down to the shop floor (Skaar 2019).

There are fundamental differences between industries, trades, companies and also between production and design (Huovila and Koskela 1998). Fundamental differences can make it necessary or fruitful to custom fit principles to a specific domain. An example of this can be the formulation of different principles for different domains, like car manufacturing (Liker 2004) ("lean") and software development (Fowler et al. 2001, Gothelf 2013) ("agile"). There are however also examples where the generalisation of principles from one domain to another can create new understanding (Lillrank 1995). In his book "The Lean Startup," Ries (2011) describes principles for starting up businesses within the domain of information technology. The principles presented do, however, seem to be applicable far beyond this original domain.

Culture, be it within a team, a company, an industry or a country is an essential part of the context and domain within which principles are interpreted and applied. Thus, the cultural background is one of the variables that will affect how principles are understood and translated into action by individuals and groups. "Respect for people" is a principle requiring a great deal of cultural interpretation and will be understood in very different ways in the Nordic countries compared to Japan or the USA (Doeringer and Piore 1985; Lipietz 1997).

CAN GENERIC LEAN PRINCIPLES REPRESENT A LEAN THEORY?

What is "Lean" and what is "Lean Construction"? It has been said that Lean Construction is the application of lean principles to construction. For this answer to make reason, it must be possible to explain what these "lean principles" are. Does such a comprehensive and agreed list of lean principles exist? If no, can such a list be worked out and agreed upon? Can a list of Lean Construction principles be worked out?

Our ambition in this paper is to raise and shed light on the importance of the subject, but not to answer these questions. Krafcik (1988) introduced "Lean" as a term reflecting observations done at Toyota, and it can today be called a paradigm. It is, however, a paradigm to which no single contributor can claim the main parenthood or the rights to

royalties. It is, therefore, also a paradigm with somewhat unprecise and debatable content. The positive side of this is that it is non-proprietary, adaptable and in continuous development. The negative side is that it can be both used and misused, sold and oversold and lead to misunderstood consensus.

Liker (2004) presents 14 “key principles (that) drive the techniques and tools of the Toyota Production System”. Liker is, however, explicit that the 14 principles are not a comprehensive and generic set of lean principles. “Lean is not about imitating the tools used by Toyota in a particular manufacturing process. Lean is about developing principles that are right for your organisation”. “Toyota’s principles are a great starting point”.

Several authors (Čiarnienė and Vienažindienė 2012) claim there are five principles (Womack and Jones 1997, Womack et al. 2007) that makes the basis of lean thinking, though criticised by others for lack of both academic and practical support (Koskela 2004).

Koskela and Kagioglou (2005) see the process view and the substance view as two fundamentally different metaphysics. A verb instead of a noun, dynamic instead of static, action as a response instead of plan realisation and process instead of product and outcome are signs that separate the process view and the substance view. They argue that a foundation of Lean is the process view. One should, at least in theory, presume that this underlying metaphysical stand will affect the phrasing of alleged lean principles and what they target. We, therefore, expect lean principles to reflect a process viewpoint and be dynamic and actionable, not static and absolute.

We claim that comprehensive and generic “lean principles” are yet to be phrased and given practical and academic support. A further examination and eventual determination or codification of Lean principles lie beyond the limitations of this paper. Further research effort should proceed in two directions (as mentioned above): 1. From theory to principle and further to actionable knowledge and practice and 2. From practice to principle and further to theory (David and Hatchuel 2007).

CONCLUSION

We have discussed principles as guiding rules for action and how they can bridge between theories on the one hand and practices on the other. As such, they are based on both the core contents of the theories on which they are founded and on a judgement of their potential to lead to action and further to a wanted outcome.

Principles can have both expanding and narrowing capabilities on theories. Principles can expand the core theories through deductive (and abductive) reasoning on the way to context, and by inductive (and abductive) reasoning make theories more specialised. The last can be the case when there is a need to adopt a theory to a specific domain, context or setting.

Principles are often formulated in general terms or even metaphorically; this broadens their contextual coverage and can make them more durable. This durability allows time to create a more consolidated meaning on how to interpret and use the principles. Principles are guidelines, not detailed instructions. Principles call for reflection. Principles encourage people to reason out what to do, not just to follow instructions or rules they do not necessarily understand. Principles’ ability to be non-conclusive and still guiding is a central part of what makes them powerful.

REFERENCES

Argyris, C. 1996. “Actionable knowledge: Design causality in the service of consequential theory.” *The Journal of applied behavioral science* 32(4): 390-406.

- Ballard, G 2000. "The Last Planner System of Production Control.", *Ph.D. dissertation*, Univ. of Birmingham, Birmingham, U.K.
- Ballard, G., J. Hammond and R. Nickerson 2009. "Production Control Principles". *17th Annual Conference of the International Group for Lean Construction*, Taipei, Taiwan.
- Bassford, C. 1993. "Jomini and Clausewitz: their interaction". *An edited version of a paper presented to the 23rd Meeting of the Consortium on Revolutionary Europe at Georgia State University*. accessed at <https://www.clausewitz.com/readings/Bassford/Jomini/JOMINIX.htm>.
- Fowler, M., and Highsmith, J. 2001. *The agile manifesto*. Software Development, 9(8), 28-35.
- Buzzell, R. D., B. T. Gale and B. T. Gale (1987). *Te PIMS principles: Linking strategy to performance*, Free Press, New York.
- Čiarnienė, R. and M. Vienažindienė 2012. *Lean manufacturing: theory and practice*. Economics and management 17(2): 726-732.
- Corley, K. G. and D. A. Gioia 2011. *Building Theory about Theory Building: What Constitutes a Theoretical Contribution?* Academy of Management Review 36(1): 12-32.
- Covey, S. R. 2014. *The 7 habits of highly effective families*, St. Martin's Press, New York City.
- David, A. and A. Hatchuel 2007. *From actionable knowledge to universal theory in management research*. Handbook of collaborative management research: 33-47.
- Deming, W. E. (1982). *Out of Crisis* Mass. Institute of Technology, Center for Advanced Educational Services, USA.
- Dimovski, V., M. Maric, M. Uhan, N. Durica and M. Ferjan 2012. *Sun Tzu's "The Art of War" and Implications for Leadership: Theoretical Discussion*. Organizacija 45(4): 151.
- Doeringer, P. B., and Piore, M. J. 1985. *Internal labor markets and manpower analysis*. ME Sharpe. Armonk, New York.
- Duffy, F. 2008. *Forum Linking theory back to practice*. Building Research and Information 36(6): 655-658.
- Ellis, R. J. K. 2017. "The Golden Rule." Rural Theology 15(1): 52-53.
- Emiliani, B. 2008. "The equally important "Respect for people" principle." *Real lean: The keys to sustaining lean management* 3: 167-184.
- Fayol, H. 1916. "General principles of management." *Classics of organisation theory* 2(15): 57-69.
- Finger, M. 1994. "From Knowledge to Action? Exploring the Relationships Between Environmental Experiences, Learning, and Behavior." *Journal of Social Issues* 50(3): 141-160.
- Goldratt, E. M. and J. Cox 1984. *The goal: excellence in manufacturing*, North River Press, Great Barrington, MA.
- Gothelf, J. 2013. *Lean UX: applying lean principles to improve user experience*. O'Reilly Media. Sebastapool, CA.
- Grant, M. J. and A. Booth 2009. "A typology of reviews: an analysis of 14 review types and associated methodologies." *Health Information & Libraries Journal* 26(2): 91-108.
- Greene, R. J. 2010. *Rewarding performance: Guiding principles; custom strategies*, Routledge. New York.
- Griffith, S. B. 1963. *Sun Tzu: The art of war*, Oxford University Press, London.

- Holweg, M., de Meyer, A., Lawson, B., Schmenner, R.W. 2018. *Process theory : the principles of operations management*, Oxford : Oxford University Press.
- Hopp, W. J., and Spearman, M. L. 2004. To pull or not to pull: what is the question?. *Manufacturing and service operations management*, 6(2), 133-148.
- Hopp, W. J. and Spearman, M.L. 2011. *Factory physics*, Waveland Press Long Grove, Illinois.
- Huovila, P. and L. Koskela 1998. Contribution of the Principles of Lean Construction to Meet the Challenges of Sustainable Development. *6th Annual Conference of the International Group for Lean Construction*, Guarujá, Brazil.
- Jomini, A.-H., G. H. Mendell and W. P. Craighill 2007. *The art of war*, Rockville, MD : Arc Manor, Maryland.
- Kalsaas, B. T., I. Grindheim and N. Læknes 2014. “Integrated Planning vs. Last Planner System”. *22nd Annual Conference of the International Group for Lean Construction*, Oslo, Norway.
- Khodeir, L. M. and R. Othman 2018. “Examining the interaction between lean and sustainability principles in the management process of AEC industry.” *Ain Shams Engineering Journal* 9(4): 1627-1634.
- Koskela, L. 1992. *Application of the new production philosophy to construction*, Stanford university, Stanford.
- Koskela, L. 1997. “Lean production in construction.” *In: Lean Construction*. Edited by L. Alarcón. A.A. Balkema, Rotterdam, The Netherlands.
- Koskela, L. 1999. “Management of Production in Construction: A Theoretical View.” *7th Annual Conference of the International Group for Lean Construction*, Berkeley, USA.
- Koskela, L. 2000. “An exploration towards a production theory and its application to construction”, *Dr.thesis*, VTT Technical Research Centre of Finland.
- Koskela, L. and M. Kagioglou 2005. “On the Metaphysics of Production.” *13th Annual Conference of the International Group for Lean Construction*, Sydney, Australia.
- Koskela, L. and M. Kagioglou 2006. “On the Metaphysics of Management”. *14th Annual Conference of the International Group for Lean Construction*, Santiago, Chile.
- Koskela, L., J. Rooke, S. Bertelsen and G. Henrich 2007. “The TFV theory of production: New developments.” *Lean Construction: A New Paradigm for Managing Capital Projects - 15th IGLC Conference*: 2-12.
- Krafçik, J. F. 1988. “Triumph of the lean production system.” *MIT Sloan Management Review* 30(1): 41.
- Lewin, K. 1951. “*Field theory in social science: selected theoretical papers*” (edited by Dorwin Cartwright.). Harper and Brothers. New York.
- Liepitz. A. 1997 *Warp, woof and regulation*. In G. Benko and U. Strohmayer (Eds.), *Space and social theory: Interpreting modernity and postmodernity* (pp. 250-284). Wiley. London.
- Liker, J. K. 2004. *The Toyota way : 14 management principles from the world’s greatest manufacturer*, New York : McGraw-Hill.
- Liker, J. K. and G. L. Convis 2012. *The Toyota way to lean leadership : achieving and sustaining excellence through leadership development*, Maidenhead : McGraw-Hill Professional.
- Lillrank, P. 1995. “The Transfer of Management Innovations from Japan.” *Organisation Studies* 16: 971-989.
- Mackey, J. and R. Sisodia 2013. *Conscious Capitalism: Liberating the Heroic Spirit of Business*. Cambridge, MA: Harvard Business School Press.

- Macomber, H. and D., Calayde 2017. *The Pocket Sensei: Mastering Lean Leadership*. United States, Pemi River Media.
- Marlin, D., J. J. Hoffman and B. T. Lamont 1994. "Porter's generic strategies, dynamic environments, and performance: A profile deviation fit perspective." *International Journal of Organizational Analysis* 2(2): 155.
- Parker, L. D. and P. A. Ritson 2005. "Revisiting Fayol: Anticipating Contemporary Management." *British Journal of Management* 16(3): 175-194.
- Peaucelle, J.-L. 2015. *Henri Fayol, the manager*, Routledge, New York.
- Porter, M. E. 1996. "What is strategy?" *Harvard Business Review* 74(6): 61-78.
- Ries, E. 2011. *The lean startup : how today's entrepreneurs use continuous innovation to create radically successful businesses*. New York, Crown Business.
- Røvik, K. A. 2007. *Trender og translasjoner: ideer som former det 21. århundrets organisasjon* (Trends and translations: Ideas that shape the 21st century organization), Universitetsforlaget, Oslo
- Schonberger, R. 1987. *World class manufacturing casebook: Implementing JIT and TQC*, Simon and Schuster Free Press. New York.
- Schonberger, R. J. 2008. *World class manufacturing*, Simon and Schuster. Free Press. New York.
- Schulz, J., F. Steinhoff and K. Jepsen 2017. *Strike While the Iron Is Hot: User Centricity Adapted to the Agile Innovation Development Process*. Strategy and Communication for Innovation, Springer: 349-365.
- Shingō, S. 1989. *Non-stock Production: The Shingo System for Continuous Improvement. A Guide for Group Study*. Productivity Press. Cambridge, MA.
- Simchi-Levi, D. 2010. *Operations rules: delivering customer value through flexible operations*, MIT Press. Massachusetts i USA
- Skaar, J. 2019. "The Power of Lean Principles". *Proc. 27th Annual Conference of the International Group for Lean Construction (IGLC)*, Dublin, Ireland.
- Spearman, M. L. and W. J. Hopp 1996. *Factory Physics: Foundations of Manufacturing Management*. Irwin, Chicago, IL 439.
- Sugimori, Y., K. Kusunoki, F. Cho and S. Uchikawa 1977. "Toyota production system and kanban system materialisation of just-in-time and respect-for-human system." *The international journal of production research* 15(6): 553-564.
- Vieira, A. R. and N. Cachadinha 2011. "Lean Construction and Sustainability - Complementary Paradigms? A Case Study." *19th Annual Conference of the International Group for Lean Construction*, Lima, Peru.
- von Clausewitz, C. and W. von Scherff 1883. *Vom Kriege: Hinterlassenes Werk des Generals Carl von Clausewitz* (On War. The work left by the general Carl von Clausewitz), Richard Wilhelmi. Berlin.
- Taylor Winslow, F. 1911. *The principles of scientific management*, Harper and Brothers, New York, London.
- Womack, J. P. and D. T. Jones 1997. "Lean thinking—banish waste and create wealth in your corporation." *Journal of the Operational Research Society* 48(11): 1148-1148.
- Womack, J. P., Jones, D. T., and Roos, D. 2007. *The machine that changed the world: The story of lean production--Toyota's secret weapon in the global car wars that is now revolutionizing world industry*. Simon and Schuster, London.