

# FILMMAKING AND CONSTRUCTION: TWO PROJECT PRODUCTION SYSTEMS

Glenn Ballard<sup>1</sup>, Christin Egebjerg<sup>2</sup>, Trond Bølviken<sup>3</sup>, Sigve Endresen<sup>4</sup>, and Brittany Ballard<sup>5</sup>

## ABSTRACT

Both filmmaking and construction are project production systems, along with shipbuilding (air and sea), new product development, software engineering, performing arts productions (theater, dance, etc.), and more. Because they are similar in fundamental ways, there is potential for learning one from another, and for further developing the principles and methods peculiar to the project production systems through which all artifacts are created.

This paper is the first product of design science research underway to improve both filmmaking and construction. Based on a review of the literature and the experience of the authors as practitioners in construction and filmmaking, the paper offers a comparison of the two project production systems, in an effort to understand key similarities and differences. From that comparison, a hypothesis has emerged; namely, that the future state proposed by advocates of lean construction already exists in filmmaking. Hypothesis testing and transfer of knowledge from filmmaking to construction will be reported in future publications.

## KEYWORDS

Culture, filmmaking, lean construction, production system design, relational contracts

## INTRODUCTION

All project production systems share certain characteristics. All design and make goods or services through temporary organizations with time-limited objectives. All move through time in phases: all define their projects, build their teams, design their products and processes, make or buy the elements of which their products are composed, and assemble those elements into their products. However, they produce different types of products, under different framework conditions, and have developed independently one from another, so also have dissimilarities as well as similarities. How projects arise, how project teams are formed, and how projects are managed – all these may differ in filmmaking as compared to construction.

The opportunity to transfer knowledge between different types of project production system has been too little exploited. However, Christin Egebjerg's "...and ACTION!" (Egebjerg 2012) is a notable exception. After an intensive study of filmmaking and construction, Egebjerg reports that production management in filmmaking handles challenges at least as difficult as those faced on most construction projects. She has also proposed a

---

<sup>1</sup> *Research Director, Project Production Systems Laboratory, University of California, Berkeley. ballard@ce.berkeley.edu; +1 4157105531. Corresponding author.*

<sup>2</sup> Assistant Professor, KEA Build, Copenhagen School of Design and Technology, christinegebjerg@gmail.com

<sup>3</sup> Director of Strategy, HR and HSE, Veidekke Entreprenør, Oslo, [trond.bolviken@veidekke.no](mailto:trond.bolviken@veidekke.no)

<sup>4</sup> Sigve Endresen, Producer and Chairman of the Board, Motlys AS, [sigve@motlys.com](mailto:sigve@motlys.com)

<sup>5</sup> Brittany Ballard, Independent Filmmaker, [brittany.ballard@gmail.com](mailto:brittany.ballard@gmail.com)

transfer of knowledge in the form of a software tool that adapts filmmaking's production coordination to the parallel activities characteristic of construction (Egebjerg 2013).

Our research is a continuation of Egebjerg's, but with an expanded scope. Our study is limited to large construction projects and large feature film projects, but within that scope we will examine all aspects of filmmaking and construction in search of knowledge transfers in both directions. We differentiate between traditional management, which is still the dominant form of project delivery in construction, and lean management of construction projects. As for filmmaking, we consider only the dominant form of delivery; namely, the so-called Hollywood system (Persse 2008).

This paper reports our first steps. Its objective is to make a plausible argument for a hypothesis: *the future state proposed by advocates of lean construction already exists in filmmaking*. This hypothesis, if true, suggests that knowledge may be transferred from filmmaking to construction to help accelerate realization of the future state construction project delivery. Hypothesis testing and knowledge transfer will occur in later research.

After this introduction, the paper is divided into sections devoted to a review of the literature, design science research methodology, arguments for the hypothesis, conclusions, and references.

## LITERATURE REVIEW

The relevant literature for this paper includes publications on project management, lean management of construction projects, and the management of film projects. Given the hypothesis--*the future state proposed by advocates of lean construction already exists in filmmaking*--selections have been made from the large number of publications on these topics. The Project Management Institute's PMBOK Guide (Rose 2013) represents traditional, mainstream project management. *Managing Integrated Project Delivery* (Thomsen et al. 2009), *The Underlying Theory of Project Management is Obsolete* (Koskela and Howell 2002), and *Lean management methods for complex projects* (Ballard and Tommelein 2012) represent lean management of construction projects. *Paradox in Project-Based Enterprise: The Case of Film Making* (De Filippi and Arthur 1998), *Hollywood secrets of project management success* (Persse 2008), *Expecting the unexpected? How SWAT officers and film crews handle surprises* (Bechky and Okhuysen 2011), and Egebjerg's "and...ACTION!" (2012), represent the management of film projects.

An earlier version of the PMBOK Guide was critiqued by Koskela and Howell (2002) at a Project Management Institute conference. That critique is summarized in the section below titled *Arguments for the Hypothesis*. The current version of the PMBOK Guide says explicitly that production management lies outside project management. This exclusion is challenged by lean theorists (Koskela and Ballard (2006).

The model used to compare the management of construction and the management of film projects was developed from Thomsen, et al. (2002). Description of the future state vision of lean adherents for construction project management is drawn from Ballard & Tommelein (2012).

The publications on the management of film projects all stress the high level of uncertainty and complexity routinely met on those projects, and also the high degree of effectiveness in project delivery. Of special importance is Egebjerg's ethnomethodological observations of film projects, key findings from which are the intense identification of team members with project objectives, and the combination of push and pull methods of managing.

Egebjerg (2012) and Persse (2008) have a similar approach. They both perceive that filmmaking is performing better than respectively construction and software development, and want to examine what the two industries can learn from filmmaking. The approach of

Egebjerg (2012) is to "observe the production management of filmmaking through the optics of the construction site". The perception that "professional movie productions far better meet their goals for time, budget and quality than construction productions do" (p. 2) is supported by industry reports and by interviews of top managers, researchers, business organizations and other professionals in both industries in Denmark and the United States. The method of the thesis is ethnographical observations on Danish and USA large studio movie sets and Danish construction sites, as well as qualitative interviews and literature studies. She finds that planning in the production (shooting) phase of filmmaking is done through a very detailed, and yet flexible planning system. She further finds that film crews are very focused on the overall quality goals of the project and that, even though they are experts with different tasks and responsibilities, they work together in a flexible and focused way that ensures the overall flow and quality of the shooting process. She concludes by recommending that construction apply a detailed yet flexible planning and control approach similar to that of filmmaking.

Persse's approach to learning from filmmaking is to go through four of the five phases of the project model of filmmaking (development, preproduction, production, post-production), looking for similarities between filmmaking and software development and identifying takeaways for software development. The book is relevant for the present paper because it also attempts to learn from filmmaking and because it gives a good introduction to the Hollywood system and filmmaking in general.

## **DESIGN SCIENCE RESEARCH METHODOLOGY**

The term "design science" originated with Herbert Simon's *The Sciences of the Artificial* (Simon, 1969). The origin of design science research can be traced to the paper by Kasanen, et al. (1993) in which the authors propose to focus management accounting research on the design of more effective accounting systems. In this, they followed Johnson and Kaplan's (1987) claim that management accounting had become increasingly irrelevant to practice. The methodology was subsequently applied by Van Aken (2004) more broadly to management as such, proposing that management research be regarded as a design science alongside medicine and engineering, as distinct from an exclusively explanatory science like physics and chemistry.

The difference between design science and design science research is that the latter must not only solve a practical problem but also make a contribution to theoretical knowledge. The practical problem to be solved in this research is improving the performance of both filmmaking and construction projects by transferring knowledge between them. One contribution to knowledge is the proposed hypothesis; namely, that the future state proposed by advocates of lean construction already exists in filmmaking.

## **ARGUMENTS FOR THE HYPOTHESIS**

In this section, we present comparisons of selected aspects of filmmaking and construction in support of our hypothesis. A comprehensive comparison of filmmaking and construction is deferred to future publications.

### **A FRAMEWORK FOR COMPARING**

In this paper, filmmaking and construction are compared using the three elements shown in Figure 1: commercial terms/contracting, organizational structure & culture, and operating system. Commercial terms are agreements between participating organizations or individuals regarding who will do what work for what compensation and with what risk. This element also includes the criteria for contract award. Organization includes both structure and culture.

The operating system consists of the fundamental principles and methods by which the project will be managed.

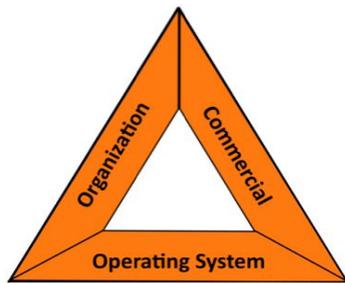


Figure 1: The Basic Elements in Projects (adapted from Thomsen, et al. 2009).

Comparisons of filmmaking, traditional construction, and lean construction regarding these three elements is shown in Table I.

Table 1: Comparison of Filmmaking with Traditional and Lean Construction

|                         | <b>Filmmaking</b>  | <b>Traditional Construction</b>   | <b>Lean Construction</b>   |
|-------------------------|--|---|--|
| <b>Contracting</b>      | Select by qualifications, pay negotiated rates, risk is borne by the entities best able to both manage and mitigate the risk | Select by low bid, pay fixed price for fixed work scope, risk borne primarily by the performers | Select by qualifications, pay negotiated rates, risk is borne by the entities best able to both manage and mitigate the risk |
| <b>Project Culture</b>  | Collaborative but not consensus decision making, high team identification with project objectives                            | Command and control, low team identification with project objectives                            | Collaborative but not consensus decision making, high team identification with project objectives                            |
| <b>Operating System</b> | Management by Means and Results  | Management by Results   | Management by Means and Results  |

### LEAN CONSTRUCTION'S FUTURE STATE VISION FOR ITS PROJECTS

All projects can be located on a continuum ranging between simple/certain and complex/uncertain. Traditional commercial terms in construction depend on a fixed relationship between work scope and compensation--deliver specific scope of work X in exchange for Y amount of money. As projects become more complex and uncertain, that fixed relationship is increasingly difficult to maintain, and eventually becomes an obstacle to project success because it discourages the cross-discipline/cross-trade innovations needed to meet the challenges of complex and uncertain projects.

Contracts can also be located on a continuum, in this case between the fully transactional and the fully relational. Although all contracts are some blend of both (MacNeil 1980), traditional construction's reliance on fixity of work scope results in largely transactional

contracts, which reduce the agreement to an exchange of this for that. More complex and uncertain projects need contracts that are largely relational; contracts that engage a team of professionals to help deliver a challenging project. The future state vision for lean construction projects is shown in Figure 2.

Construction projects have traditionally formed their teams by inviting designers and negotiating their compensation, and by competitively bidding for general contractors, who in turn competitively bid for subcontractors. Everyone has their own financial situation to protect, so opportunities for improving project performance by shifting scope and revenues across organizational and contractual boundaries is usually resisted.

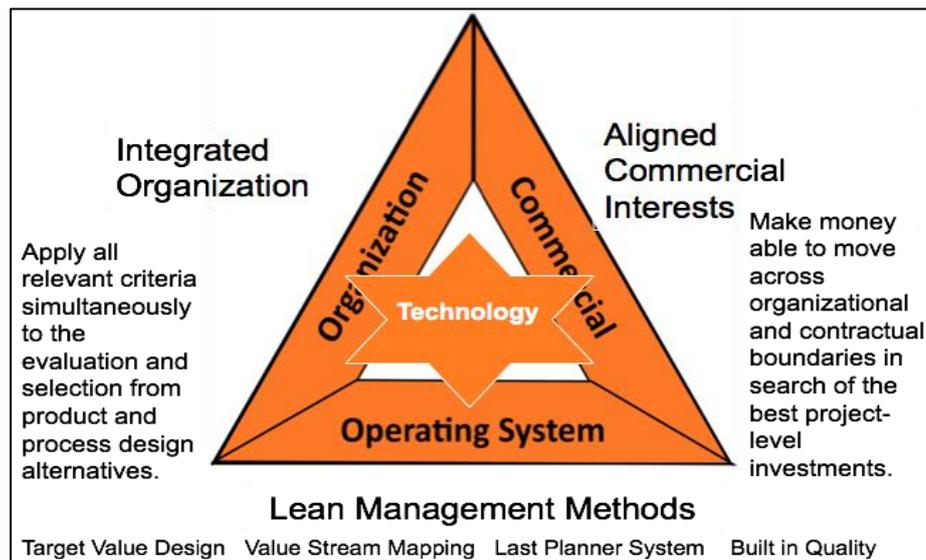


Figure 2: Integrated Lean Project Delivery

Lean construction, like filmmaking, awards contracts based on qualifications and does not try to achieve cost certainty by pushing cost risk onto providers. Indeed, in the various project delivery processes that go by the name of “integrated project delivery”, risks are shared, but consistent with the principle that risk should be borne by the entity best able to both manage and mitigate the risk, and also best able to absorb risk events should they occur.

Turning now to project organization, traditional forms of organizing construction projects might be called ‘sequential processing’; i.e., each player is brought onto the project only when they are to perform their specific scope of work. The design of the building limits alternatives for construction methods, but the constructors do not participate in the design phase of the project, and designers do not get feedback about the buildability of their designs because they are not present in the construction phase.

This engagement of specialists only when their specific work scope is to be performed, together with traditional contracting practices, results in a command and control approach to project governance, which tends to stifle collaboration and innovation. Filmmaking and lean construction differ from traditional construction in this dimension of organizational culture (less so in structure). Project organizations require hierarchies that allocate decision-making power, but that power can be misused. A better use of power is to seek input before declaring a decision, and to recognize when taking the lead in a problematic situation may better be done by someone other than the person in charge (Weick and Sutcliffe 2011).

Let’s now consider the management system for construction projects. Koskela and Howell (2002) argue that the traditional system is obsolete. They criticize decomposition of

tasks, management focused on push as opposed to pull, restriction of execution to dispatching, and the thermostat model of controlling.

Decomposition of tasks rests on the assumption that the various scopes of work to be performed are independent of one another except as regards sequencing. Risk shifting makes proactive management of production impossible. From these two premises, it follows that project management is understood as the management of contracts, as distinct from the management of production (designing and making things).

Pushing tasks into execution in accordance with the project schedule is counterposed to management by means; i.e., creating and maintaining the conditions for successful execution, which includes adapting plans to emergent circumstances.

Given these first two, it naturally follows that execution is understood as directing that specific tasks be done, with no consideration to the conditions required for successful execution of those tasks (dispatching).

And finally, the concept of control in traditional construction project management is exclusively reactive, and excludes proactive control. Project controls have the job of determining if the project is on course to meeting its objectives for safety, quality, time and cost. In traditional construction project management, doing what is needed to cause the project to meet its objectives is considered to be outside the realm of project management, which may bring pressure to bear on those executing the work (e.g., by threatening to exclude them from future projects), but does not otherwise get involved in production planning or execution.

The management system for Integrated Lean Project Delivery includes project controls, but also management by means. Its primary methods are target value design, value stream mapping, the Last Planner system, and Built in Quality. These apply to the entire project, consistent with organizational integration and aligned commercial interests. Target value design drives the project to deliver customer value within customer constraints for cost, time, and other conditions of satisfaction. Value stream mapping is used to improve the flow of information and materials through processes. The Last Planner system improves workflow reliability, which stabilizes the entire project. Built in Quality includes detecting deviations as close as possible to the source, taking corrective action to enable production to resume, and analyzing deviations in the search for countermeasures to prevent reoccurrence.

Developments in information technology, including Building Information Modelling (BIM) are changing the design process into a virtual assembling of components and systems. This assembly process requires the collaboration of design and construction specialists; collaboration that is inconsistent with the sequential processing of traditional construction.

Relatively recently, lean management methods have been coupled with selection of project team members based on qualifications, the assumption of cost risk by Buyers or Design-Builders, organizational integration, bringing downstream players into upstream processes, and upstream players into downstream processes (Thomsen, et al. 2009). This combination, which resembles the normal situation in filmmaking, has proven successful in motivating attention to reputation and promoting collaboration, including moving money across contractual boundaries in search of the best project-level investment (Thomsen, et al. 2009; Conwell 2012).

## **HOW FILM PROJECTS COMPARE**

In this section, arguments will be made in support of the following claims:

- Film projects are highly uncertain and complex
- Film projects align commercial interests of participants in a way that facilitates collaboration and invention

- Film projects involve key players across multiple project phases; i.e., integrate organizationally
- The culture of film projects is collaborative but intensely driven to achieve project objectives

Film projects tend to be highly uncertain and complex. They require coordination of many elements, with a high degree of probability that something unexpected will occur. This complexity is evident in the Pre-production phase, which includes organizing cinematography, electricians, scenography, make-up, costume, sound departments, casting companies, location scouts, props, stuntmen, special effects, animal trainers, gardeners, and much, much more.

Film projects form their teams largely by inviting the key players and negotiating their compensation. On the large feature film projects studied in this research, cost risk is borne directly by the company responsible for producing the film. Selection of team members is based on qualifications and reputation, which puts a premium on creating and maintaining those credentials. That, coupled with the absence of cost risk, creates conditions that promote collaboration between ‘investors’ and ‘creators’.

In film projects, key players participate in multiple project phases, thereby achieving the organizational integration needed both to promote learning and to provide constancy of purpose. Such key players include the producer(s), director, production manager(s), cinematographer, and others, depending on the project. The presence of these key players through all phases bridges between designing and making--but also bridges across hierarchy between the different professional groups. Note that, just as in construction, other specialists than these ‘key players’ may participate in the project only when their specific tasks are to be performed; e.g., actors coming and going to the set, stuntmen, extras, etc.

The culture of film projects is highly collaborative yet intensely driven to achieve project objectives. Once filming starts, the process is re-designed on a daily basis in an agile coordination with inevitable changes like weather conditions, illness in the main cast, accidents, etc.; but only inside the overall budget and schedule.

## CONCLUSIONS

This section consists of a summary of findings from the arguments above, limitations of this research, and recommendations for future research.

Arguments for the following eleven statements have been made in previous sections of this paper. The statements describe both the lean vision for construction project management and current filmmaking practice, and thus support the hypothesis: *the future state proposed by advocates of lean construction already exists in filmmaking.*

1. The entire team is aligned to the project goals.
2. Risk is borne by the parties best able to mitigate occurrence of risk events and best able to bear the burden if risk events should occur.
3. Participants in the team are assigned based on skills, relations and previous work.
4. Resources (time and money) can be reallocated between tasks in order to increase value and flow (keeping the budget and end date constant)
5. Downstream players are involved upstream and upstream players downstream.
6. Top management are present, visible and actively involved.
7. The project is managed both through contracts and through direct management of production.

8. Continuous update of project status and forecast are integral parts of the planning concept.
9. Plans get more detailed the closer one gets to executing planned tasks.
10. As the plan gets more detailed, preconditions are established and constraints removed in an on-going dialogue.
11. The plans are detailed, and still have a level of agility.

## LIMITATIONS OF THIS RESEARCH

The objective of this paper is to provide a plausible argument for the hypothesis: *the future state proposed by advocates of lean construction already exists in filmmaking*. The authors relied upon previously published descriptions and their own experience in the construction or filmmaking industries. No new descriptive research is presented. More testing of the hypothesis is required, including further examination of differences between the two project production systems, in addition to the similarities stressed in this paper.

## RECOMMENDATIONS FOR FUTURE RESEARCH

One very interesting characteristic of filmmaking is the high degree of commitment by project team members to achieving project objectives. That appears to be in part the result of selecting team members based on qualifications, not low price. While advanced lean construction practice also involves qualification-based selection, it is not yet clear what will happen industry-wide as lean construction is taken up more broadly. Filmmaking may offer a way to see lean construction's future.

The interplay of cost risk and risk of damaging reputation is one strong thread in this future research. Another is the choice of negative vs. positive incentives in the design of commercial terms. The differences between construction and filmmaking also need to be further explored; e.g., differences in business contexts.

We invite other scholars and practitioners to join us in this research.

## REFERENCES

- Ballard, G. and Tommelein, I. D. (2012). "Lean management methods for complex projects." *Engineering Project Organization Journal*, 2(1-2), 85-96.
- Bechky, B. A. and Okhuysen, G. A. (2011). "Expecting the unexpected? How SWAT officers and film crews handle surprises." *Academy of Management Journal*, 54(2), 239-261.
- Conwell, D. (2012). "Sutter Health's Lean Integrated Project Delivery Model." A report to the P2SL Workshop *Owner Strategies for Project/Program Delivery*, August 28, 2012. Available at [p2sl.berkeley.edu](http://p2sl.berkeley.edu).
- Egebjerg, C. (2012). "... and ACTION!" Filmprojektets produktionsledelse observeret gennem byggepladsens optik. Fra multidimensional planlægning over konsensus baseret styring til motiverede arbejdsflow. Department of Management Engineering, Technical University of Denmark. English title: "...and ACTION!" Movie Production observed through the lens of Construction Management. Zooming in, from multidimensional planning through consensus based hierarchies towards motivated workflows.
- Egebjerg, C. (2013). "Learning from movie-sets coordination." In *29th Annual ARCOM conference*.
- DeFillippi, R. J. and Arthur, M. B. (1998). "Paradox in Project-Based Enterprise: The Case of Film Making." *California Management Review*, 40(2), Winter 1998, 125-139. DOI: 10.2307/41165936

- Johnson, H. T. and Kaplan, R. S., (1987). *The Rise and Fall of Management Accounting*. Harvard Business School Press.
- Kasanen, E., Lukha, K., and Siitonen, A., (1993). *Journal of Management Accounting Research*. Sarasota: Fall 1993, Vol. 5, 243.
- Koskela, L. J. and Ballard, G. (2006). "Should project management be based on theories of economics or production?" *Building Research & Information*, 34(2), 154-163.
- Koskela, L. J., and Howell, G. (2002). "The underlying theory of project management is obsolete." In *Proceedings of the PMI Research Conference* (pp. 293-302). PMI.
- Macneil, I. R. (1980). *The new social contract: An inquiry into modern contractual relations*. Yale University Press.
- Persse, J. R. (2008). *Hollywood secrets of project management success*. Microsoft Press.
- Rose, K. H. (2013). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Fifth Edition*. Project Management Journal, 44(3), e1-e1.
- Simon, H.A. (1969). *The sciences of the artificial*. Cambridge, MA.
- Thomsen, C., Darrington, J., Dunne, D., and Lichtig, W. (2009). *Managing integrated project delivery*. Construction Management Association of America (CMAA), McLean, VA, 105p.
- Van Aken, J. E. (2004). "Management Research Based on the Paradigm of the Design Sciences: The Quest for Field-Tested and Grounded Technological Rules." *Journal of Management Studies*, 41(2), 219-246.
- Weick, K. E., & Sutcliffe, K. M. (2011). *Managing the unexpected: Resilient performance in an age of uncertainty* (Vol. 8). John Wiley & Sons.