

# APPLICATION OF PRODUCT DEVELOPMENT PROCESSES IN THE EARLY PHASES OF REAL ESTATE DEVELOPMENT: A FEASIBILITY STUDY

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## ABSTRACT

The standardization of processes in the construction and real estate industry is one of the basic requirements for a secure implementation of lean principles in practice. An important element for real estate development is to realize building projects efficiently and successfully. Among other things the task of a project developer is to organize, coordinate and control the interdisciplinary collaboration between internal and external stakeholders. The project developer has in consequence a special role by crosslinking the functional value chain processes in the real estate project.

This paper aims to provide an outline of a general approach to improve the quality of real estate development processes. By applying management methods of the product development processes (PDP) to the real estate development process, the possibility of errors should be reduced and interfaces should be optimized. The applicability of this product development processes in the early stages of real estate development will be demonstrated by way of example.

## KEYWORDS

Process, product development, real estate development, kaizen

## INTRODUCTION

The real estate development is a dynamic, time-limited process that begins with forming a concept and ends with selling of a completed and let real estate. In the early phases of real estate development strategic decisions are in the foreground, while in the later phases operational decisions are more important. But especially at the beginning of real estate development appropriate information are often missed to be able to decide whether a project is to pursue further or to quit (e.g. Schelkle, 2005).

Today there is hardly a company that has not implemented the successful elements of the Toyota Production System (TPS) (e.g. Koskela, 2001). The convincing results pioneer a transfer of these principles not only to the building construction but also to the real estate development. In this context, the question

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arises whether the real estate development is to be equated with product development of the manufacturing industry.

Unnecessary errors in the real estate development must be avoided. Starting with the project initiation, the errors proceed with a lack of demand analysis, faulty evaluation of economic efficiency, inadequate feasibility studies or not buildable constructions. This leads to unnecessary loops, rising development costs, delayed completion in real estate development and thus leading to a subsequent sale. The unpredictable duration of individual activities in the development process makes the synchronization of all activities and the elimination of waiting times difficult. Developments take place just in project form and thus are characterized in contrast to most processes in the manufacturing production with a degree of uniqueness. In addition, the complexity and the division of labor in an interdisciplinary real estate development process is added. On the other hand, developers work usually on multiple projects simultaneously and can fill waiting times in a project meaningful.

While the product and process design can be standardized for standard products, it is necessary to standardize the design and project controlling for non-standard products, such as real estate. In other words, it is necessary to map out standard methods for planning and management of real estate development (e.g. Ballard and Howell, 1998).

The aim of this paper should be to apply the product development process of the manufacturing industry with its methods to the real estate development process in order to reduce potential errors and to optimize interfaces. The process should be set up with the necessary project phases and participants.

## **PRODUCT DEVELOPMENT PROCESS**

Product development is a series of activities that begins with the perception of market opportunities of a product and ends with the production, sale and delivery of this product (e.g. Ulrich and Eppinger, 2000). Smith and Morrow (1999) and Hale (1993) define the product development as a process in which an idea is created due to market and customer requirements in a product or technical system. In addition, the product development is usually a complex process, because of the scope of technical problems that must be controlled and also because of the diversity of stakeholders and organizational structures that are employed during the development of the product (e.g. Smith and Morrow, 1999).

The analysis of the product development process in research and practice began in the 60s with a formal approach of the NASA (e.g. Cooper, 1994). From the 80s first best-practice studies were published on success factors for product development, for example by Griffin (1997) and Cooper and Kleinschmidt (1998). After a long time predominant focus on cost reduction and restructuring efforts, the importance of product development grew in the 90s. A long-term survival of a company can only be secured through new products (e.g. Spath, Matt and Riedmiller, 1998). From the comparison of different definitions, a process can generally be understood as a logically connected sequence of activities which are limited by a defined input and output. The essential feature is that processes and activities are not isolated but connected to each other (Buchholz 1996). The advanced universal design theory of Grabowski and Lossack (1999) assumes that there is a universal product development process that is applicable to the interdisciplinary development of any products and

thus also on real estate. A specific part includes all domain-specific extensions. An objective oriented product development is possible if all the requirements of different domains are defined completely and correctly (e.g. Grabowski and Lossack 1999).

Generic phase models have the goal to look at the product development process as general as possible regardless of industry or company specifics to allow a universal use. They are based on the hypothesis that common process structures exist (e.g. Brokemper and Gleich, 1999). A basic process model for the product development process comes from Cooper (1994). It is the so-called stage gate approach of the first generation. The second generation is a still in the industry commonly encountered model of a product development process. The features of this second generation are trans-sectoral phases and gates (marketing, production, sales, etc.), an increased focus on activities before the actual development process (feasibility studies, market studies, product definitions, etc.), increased market orientation and accurate decision points above the progress of the project with clear criteria.

## **REAL ESTATE DEVELOPMENT PROCESS**

Concerning substantive description and conceptualization of real estate development process a number of models exist in the Anglo-American literature. Healey (1990) has systematized these models and has identified three basic approaches to the description of real estate development:

- equilibrium models
- agency models
- event-sequence models

Event-sequence models describe a pragmatic way to characterize the real estate development process. In general, there are descriptive models that divide the processes occurring in the real world of real estate development in individual idealized phases. Though they come quite close to the traditional flow charts of production and service processes in which the production of a product or the creation of a service takes place in several successive steps. At the beginning of the real estate development process are the three factors location, project idea and capital; in the end is the ready for use real estate (e.g. Bone-Winkel, 1994).

Event-sequence models are very well suited to capture the complexity and dynamics of the real estate development process. The development projects run through a "development pipeline" at varying speeds, depending on location, design factors and the capabilities or objectives of the project participants. In practice, the project schedule usually is represented by network plans. In the specific project procedure overlaps, parallel processes and feedback effects also appear.

The real estate development process includes all activities that are needed to develop a project from initiation to building completion and handover to use. The event-sequence model of the real estate development process by Bone-Winkel (1994) distinguishes five phases and is based on the phase model of the School for Advanced Urban Studies, University of Bristol (SAUS) (e.g. Barrett, et al., 1978). The goal-oriented strategy based real estate development process is divided into: project initiation, project conception, project substantiation, project management and project marketing (e.g. Bone-Winkel, 1994).

## **APPLICATION**

### **REQUIREMENT**

A scientific debate for process management in the real estate industry and especially in the real estate development was carried out inadequately or not at all, although the optimization of organization and processes, and thus the process management is becoming increasingly important (e.g. Held, 2010).

Significant improvements to the development process of real estate are only being achieved through a holistic approach to the conception, design and execution process. This applies particularly to the area of inter-company collaboration. The organization of cooperation by the client from plan to control up to executive functions, presents itself as a major challenge. The traditional real estate development has to be complemented by a standardized process management in which clear rules exist in the form of assigned tasks, competencies and responsibilities. This makes a reconfiguration of the conventional to an organizational structure necessary based on object orientated design. It requires a process-oriented organizational structure. The ability to cross-link the functional performance processes is already a competitive advantage that will enhance in future yet (e.g. Kaiser and Khodawani, 2008).

### **FEASIBILITY**

The challenges in the development of real estate are versatile. To be mentioned in this context are the organization and coordination of interdisciplinary activities with internal and external stakeholders. In addition, controlling of the design process and managing approvals are important tasks. Looking at the product development of the manufacturing production, it has analogous requirements to a product development process as the real estate development and is faced with similar circumstances. Already in the conception and design phase a variety of stakeholders, such as project managers, architects, engineers and consultants have to be coordinated. Thus, the development process plays both in the manufacturing industry and in the construction and real estate industry a special role. Especially in the large and highly integrated networks of stakeholders in both areas, it is very important to realize optimization potentials and errors as early as possible in the process in order to avoid error propagation (e.g. Kaiser and Khodawani, 2008).

Still many real estate projects fail, because the related product development processes are not performed tight enough. Although various best practice studies show (e.g. Griffin, 1997): Successful companies have product development processes with decision points, called gates. Thus, according to a study by Cooper the existence of hard decision points on the resume or cancel of projects strongly correlate to the profitability of new product developments (e.g. Cooper, 1998).

Long-term studies of success factors in new product development draw a relatively homogeneous picture of what distinguishes successful companies. As shown by various benchmarking studies the existence of an excellent product development process is the most important factor of success (e.g., Griffin, 1997; Cooper, 1998). However, the sole mapping and modeling of this process is insufficient. Other success factors are associated with the company and product strategy, as well as a link to the tools of quality and project management. Among

them is the existence of hard project break off criteria at each phase end (e.g. Cooper, 1998).

In order to create a process with higher productivity and a more reliable workflow, the Last Planner System™ is an appropriate production planning and control instrument that especially realizes the pull-principle in building and holding all project participants to active cooperation (e.g. Ballard, Hammond and Nickerson, 2009). The most important key element of the Last Planner System™ is the Last Planner meetings in which the Last Planners of different sections jointly plan the course, by making decisions and commitments. Therefore, the participants at the meetings must be skilled to make decisions and be empowered to be able to make decisions. Depending on the project phase monthly, weekly or daily meetings are held, in which commitments are analyzed and reasons for non-compliance with commitments are recorded. Elements of the Last Planner System™ could be cogitable for a more efficient design of the real estate development process.

### **REAL ESTATE DEVELOPMENT PROCESS MAPPING**

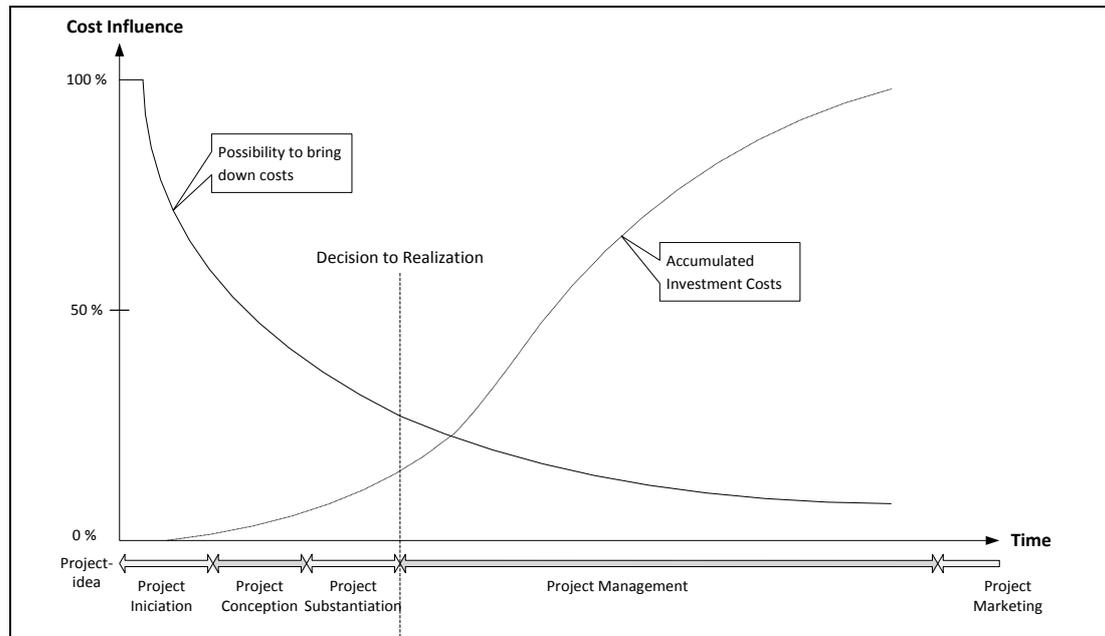
Another method inside of Lean Construction for the continuous optimization of processes and thereby to increase project efficiency is the process-oriented assignment and execution management (AEM) (e.g., Kaiser and Khodawani, 2008). This method is following applied as a proposal for solution to the real estate development process.

A lean AEM systematic must meet clearly defined goals. The principal goal in this context can be mentioned is the improvement of stability and efficiency by mastering the complexity during real estate development. In order to realize this following sub-goals have to be achieved:

- Definition of standardized processes
- Clear assignment of tasks, competencies and responsibilities within the project organization
- Demand-supply of qualified resources and application of methods and tools in the project phases
- Composition of process-oriented team-organizations
- Use of a standardized reporting to measure process quality with short-term decision escalation

A basic principle within the AEM systematic to optimize product development is frontloading. Frontloading means to invest a lot more intensity of labor to identify optimization potentials in the early phases of the project to avoid a disproportionate use of staff resources in later phases of the project. In the early phases of real estate development it is possible through the use of optimization potentials to reduce costs disproportionately, as shown in Figure 1. A possible extension of the design phase is compensated by increasing design efficiency. Transferred to the real estate development, this means the provision and timely use of qualified resources and the application of the necessary processes and methods along the project execution. This produces always objective transparency according to project sequence and status in the project organization. In the early stages of a project development thus future planning and construction costs can be greatly affected. A user-oriented project development, in which any necessary specialists are involved at an early stage, can

lead to considerable cost savings during the utilization phase. If the relevant professionals involved too late in the planning process, it requires frequent downstream planning changes when critical aspects have been forgotten (negative iteration). Also the testing of scenarios and alternatives regarding the economy and the needs-based planning is iterative. According to Ballard (2000) negative iteration, which is not an increase in value, should be avoided in the project development process.



*Figure 1: Qualitative illustration – Frontloading generates efficiency improvements throughout the real estate project development (Figure 3 in Kaiser and Khodawani, 2008)*

The product development process (PDP) systematic from the manufacturing industry integrates the sum of all the activities that have to be performed for a successful start of production. The transfer of the PDP systematic on the real estate development is carried out in form of the AEM systematic with quality gate approach. This system consists of the following three tools:

- The process map, as a standardized and multi-stage process definition of the required activities, methods and tools along the real estate development,
- The interdisciplinary project teams with the necessary qualifications and defined tasks, competencies and responsibilities, which work through the process map and define the status of the project regularly,
- The standardized reporting system for showing transparently the project status in terms of quality, costs and schedules.

The process map, as shown in Figure 2, forms the basis of the systematic real estate development process. It is divided into three levels: project phases, quality gates and such as the so-called vertices. The project phases and quality gates form the basic structure for real estate development. By achieving a quality gate it is checked whether the required tasks of all project participants were processed and whether the objectives of quality, costs and schedules can be met. This ensures that the degree of

maturity of the activities of all stakeholders is synchronized. Quality gates only may be passed if all the conditions are met for entry into the next phase. The required tasks of the project participants are more concrete along the real estate development process in the form of vertices. For each vertex the methods and tools are described. In order to ensure the application each vertex has a person in charge for execution and decrease.

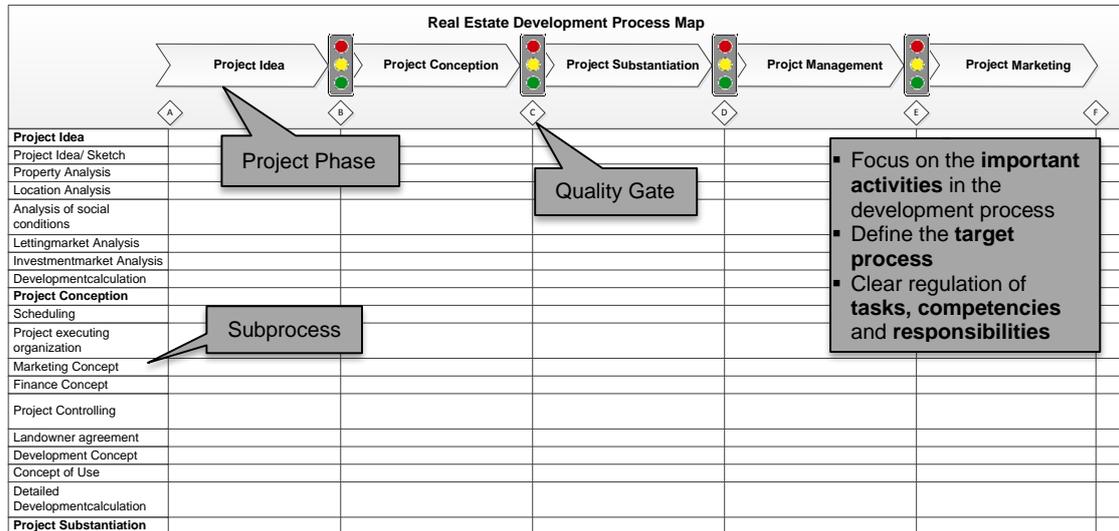


Figure 2: Example showing the structure of a process map

The process map is designed so that it is applicable in accordance with certain rules for each type of real estate development. Thus, the effort to create the process map is only necessary once and it can be used again depending on the project. Not be changed may the names of the vertices, the number and position as well as the phases of the project and the quality gates. The sum of all persons of charge for execution in the process map forms the interdisciplinary team, typically consisting of the following persons: Project developer/ project manager, architect/ engineers, users, finance/ banking, investors, contractors, government/ authorities and real estate services.

For each vertex of the process map a target date is planned by the project team at the beginning of the project. The project team is responsible for regularly reviewing the project status with respect to the faultless delivery, if necessary taking special measures and lastly to report project status. For this purpose the AEM systematic provides special tools. First: from the process map directly derived AEM checklist in which all vertices from the process map are evaluated. Second: the management summary that compactly summarizes the overall status of the project including the indication of deviation causes and countermeasures. All instruments are fully connected to the process map that is to say the use of the defined standard process is automatically ensured.

A major challenge in the real estate development is the ever-changing and decentralized project organization. As a result, the use of modern means of communication is required within the project teams. Multimedia team meetings are held. Efficient team meetings will be realized, for example via conference enabled phones and a common view of the tools. Reporting is generated directly from the weekly meetings of the project team and therefore requires no additional effort. The

project status by using a traffic light rating is reduced to answer the essential question: "Will the next milestone be held in compliance with the quality, costs and schedules from the perspective of the project team?" Can the project team under its own power no longer ensure the achievement of a milestone, the switch over to a red light on a decision memo (incl. solution alternatives and recommended of the team) escalates the problem. This procedure ensures that the status of a project is updated with each team meeting and corresponds to the consensus opinion.

The standardization of the real estate development process on the process map enables further continuous improvement of the AEM. Great potential is in the case of any problem in the question of the project management to the project team: "How can we ensure the process that this error does not occur again?" In this way in purpose of error prevention the process map should be constantly improved by any error over all projects.

## **RESULTS**

### **Clear overview of the processes in real estate development and project organization**

By using the AEM systematic the entire real estate development process is known with its complex interfaces, and generates a holistic understanding of the process. The project participants communicate regularly and have clarity on assigned tasks, competencies and responsibilities. The resources in the various phases of the project are clearly defined by lack of capacity and qualification. Resource constraints are obvious. The improved transparency leads to much smoother and more stable project collaboration.

### **Increased responsiveness through early detection of deviations**

Weaknesses and errors can be detected early by the interdisciplinary team. Solutions will be immediately developed by the project teams. At the same time knowledge across divisions is used and exchanged.

### **Objective Project Status Review - errors are seen as opportunities for improvement**

The degree of maturity of the project is clearly defined by the quality gates and gives everyone involved a common understanding of the current status. By the joint review in the team honesty is promoted in the project organization. An important finding is that the award of red lights should not be sanctioned. Incentives must be created to establish an open error culture. The clear escalation barriers and rules demand focused decisions on all hierarchy levels.

### **Improved internal project discipline and cooperation**

The processes involved in team meetings, for example, Participation rate and the use of standards is measured. This leads to improved discipline in preparation and cooperation.

## **LIMITATIONS**

The described process model has its limitations in the areas that cannot affect the project developers as a management person in charge, such as increasing creativity

and problem-solving skills of project participants. The wrong use and dislocation of participants can be avoided by assigning the skills in the process. At least an unobstructed authorization may be granted by the definition of the output requirements for the quality gates.

## CONCLUSION

The transfer of lean principles to the real estate development supports the continuous improvement of effectiveness and efficiency. At the same time a uniform orientation option, alignment and language of the project stakeholders is established. The implementation of lean principles is done on best practices, which are first tailor-made and then sustainably introduced for the company. The existence of a good real estate development process is an important success factor. However, the sole mapping of the real estate development process is not enough. The modeling of real estate development processes by Event-Sequence models and process chains makes an important contribution to increasing the tor the process chain "from Market to product" shows that there is a basic procedure by which - regardless of the project - real estate can successfully be placed on the market. By extension, these models can be adapted to the requirements of different domains. However, it is important that process models are combined with a project management that considers the specifics of the project. In each project the activities have to be planned targeted and subjected to regular controlling. Therefore at the end of each phase a project continuation decision should be made by oriented towards the goals of the project management.

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