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INFLUENCE OF PROJECT PREPARATION QUALITY ON THE PROJECT OUTCOME: A QUALITATIVE APPROACH

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To achieve the targets of all project key stakeholders, construction projects, in particular, require sufficiently long preparation and execution periods that go beyond ensuring project break-even. Assessing the break-even, or commercial viability, of a project directly depends on its complexity and underlying conditions. Time and funds are necessary to achieve a sufficiently high quality in construction project management, planning, and specification. At the project planning stage, the budget associated with specific use requirements should be calculated whilst also determining the quantities and quality standards achievable within a pre-defined budget. To successfully plan and execute construction projects, it is crucial to identify available resources in terms of funds and time in advance, thus making it possible, at a very early stage, to strike a realistic balance between the (financial) project targets and the available budget. If these targets exceed the budget, works are often specified incompletely, or specified quality standards are lowered with a view to arrive at lower costs in early project phases in order to ensure that the required permit is issued. This paper adopts a qualitative approach to highlight the influence of project preparation (i.e. project lead time and project preparation budget) on achieving the client's/owner's project targets.

Keywords: Project preparation time, Construction costs, Construction time, Productivity, Management of chances and risks.

1 INTRODUCTION

Sound preparation and sufficient time allotted to construction are important environmental factors of project target achievement. Besides construction time, however, project success will essentially depend on the way the project is prepared, and how its completion is managed and coordinated (i.e. project lead time, project working hours, project organization, project coordination, and project interfaces).

It is not only the contractor commissioned with performing construction works that will be influenced by the construction time specified by the client when selecting and combining its production factors. Likewise, the client itself will be dependent on its own specifications. Project break-even is essentially determined by the client's allocation of an appropriate time period in the construction contract. Any short (or extremely short) period for project completion specified by the client will keep the pace of the work at a high level (Hofstadler 2017). Both the contractor and the client are influenced by this speed: the former will be forced to work faster, while the latter will have to significantly accelerate their planning, control, management, coordination,

inquiry, and decision-making processes. Accordingly, the client's agents must also be able and willing to keep up with this high pace.

It is well-known from road traffic, for example, that exceedingly high speeds may also result in hefty penalties if you are caught by a speed camera (e.g. Road Traffic Act and Driver's License Law for Austria). On the other hand, not only speed limits must be complied with; driving speeds also need to be adjusted to prevailing circumstances, such as traffic flow, road conditions, weather, and visibility, as well as to road characteristics such as slopes, gradients, bend radii, and lane widths, and one's own driving skills. Speeds may be too high and lead to accidents even in the case of compliance with the permissible maximum speed. In road traffic, exceedingly high speeds can be associated with major risks.

Likewise, all stakeholders involved in a construction project are more or less penalized if the speed or pace of project preparation and completion is too high. The magnitude of such "penalties" will essentially depend on the provisions of the construction contract and the associated rights and, in particular, obligations of the parties thereto.

Generally speaking, any analysis of past and current projects boils down to the following statement: "If you want to achieve a high quality standard of the building, you need to come up with detailed plans and specifications whilst keeping work speed at a reasonable level and considering, or adhering to, required setting, drying, and evaporation times, timing of formwork stripping, pull-out and adhesive strength values etc.". This paper refers to the major influence of project preparation and construction time in the context of overall project success, or viability.

2 TARGET SYSTEM FOR CONSTRUCTION PROJECTS

The well-known "project management triangle" establishing a relationship between cost, quality, and time is no longer sufficient to achieve project and operational targets. From a holistic point of view, reaching project break-even essentially requires the triangle to be transformed into a hexagon to integrate planning and forecasting. This enlarged system integrates the additional targets of process quality, insensitivity to disruption, and quantity; it covers not only the construction but also the operational phase.

Such an integrated approach is mainly driven by the decision-making/design variables of quality, time, cost, quantity, sensitivity to disruption, and process quality. These factors need to be analyzed more thoroughly to arrive at a sufficiently comprehensive assessment of the construction project. Project quality is the determining success driver because it will define the market price achievable for the project. Moreover, the quality of the project constitutes the lever with which to control follow-up costs because higher quality usually implies longer maintenance intervals, for instance owing to the robustness and easy maintenance of surfaces (such as those of metal or copper roofs or created by emulsion or mineral paints), thus optimizing building operation and use. Any time-related analysis will be guided by the key principle that ever-shorter product life cycles lead to corresponding cost increases. In this context, potential costs are obviously limited by the credit lines provided by banks. As holistic considerations are becoming increasingly popular in the construction industry, such views require enlargement of the classic "magic triangle" of cost, time, and quality beyond the project target to also cover newly introduced operational targets. The latter focus on life cycle costs, sustainable quality standards, and time-bound long-term targets such as warranties and service agreements and contracts. It thus becomes obvious that current project targets can be considered "spot on" (or narrow) in terms of quality and deadlines because costs will usually have been defined by the client. Furthermore, a life cycle approach is necessary to prevent this rigid focus on targets and to develop a strategic sourcing strategy with long-term targets, as shown in Figure 1 (target system

for the life cycle of construction projects). Moreover, process quality and sensitivity to disruptions in the construction and operational phases of the building should be assessed (Hofstadler and Kummer 2017).

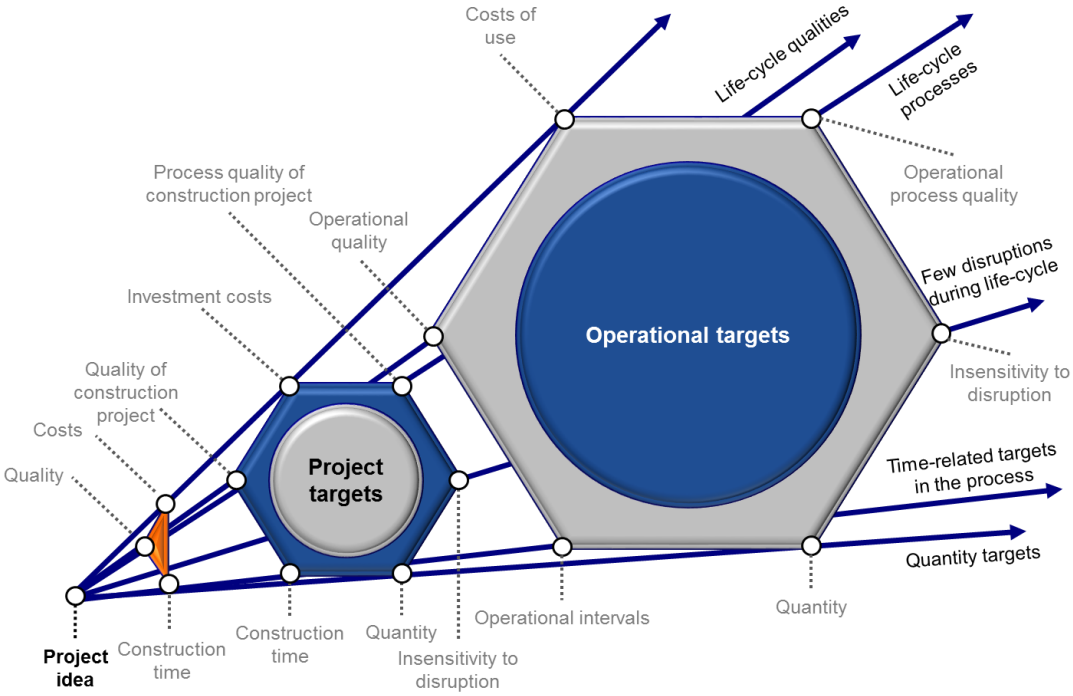

Figure 1. Target system for the life cycle of construction projects (Hofstadler 2014).

The defined (selected) chance/risk ratio will have a major influence on target achievement. If, for instance, a very short period and tight budget are chosen for project preparation, there will be a correspondingly high probability for project preparation costs to be relatively low. However, such an approach will inevitably be associated with a relatively high risk of underachievement (or no achievement at all) of defined project targets.

3 PROJECT PREPARATION TIME AND PROJECT TARGETS

Sufficient time and funds are required for achieving a high-quality standard in the management, planning, and specification of construction projects. Moreover, significant additional resources are needed especially for the systematic, structured preparation of highly complex projects to be completed within a short timeframe in a sophisticated work environment whilst involving a large number of stakeholders with an influence on specific structural parameters and having to comply with comprehensive requirements in terms of their environmental impact. Add to this the impact of political lobbying activities, and the need for specific yet comprehensive preparatory works will increase even further.

Time is money! This famous Benjamin Franklin quote is included in his essay entitled "Advice to a Young Tradesman" and suggests that we will save money (i.e., costs) if we expend less time (i.e., effort). However, this approach can also be fallacious, particularly in construction

projects where it may lead to disastrous time and cost overruns whilst having an adverse effect on building quality and use.

Construction projects require sufficient preparation and completion times aligned with their degree of complexity to achieve the targets defined by all project stakeholders. Any assessment of viability thus directly depends on the complexity of the project and its underlying conditions. For construction projects, achieving a high-quality standard in project management, planning, and specification requires time and funds to be aligned with the necessary effort.

Based on a requirements analysis, project planning should derive the budget necessary for certain use requirements. Another plausible approach would be to start from an available budget (cost cap or ceiling) to define possible quantities and qualities for the building or structure. Any successful project planning and implementation effort will inevitably necessitate prior definition of required resources in terms of time and funds, which makes it possible to strike a realistic balance between the project targets and the available budget at a very early stage. More often than not, works are specified in the absence of sufficiently detailed planning information, or quality targets are initially reduced to adhere to the specification so as to arrive at lower costs in early project phases in order to ensure that the required permit is issued (e.g. Lechner 2018, Wall 2018). These cost caps result, for instance, from public-sector constraints and potential co-funding by government agencies.

Cost estimates are initially kept at a low level particularly in the case of public buildings with the associated political influence because decision makers fear public resistance or outrage and thus do not want to put the project at risk before it has even started – a prime example of politicians' fear of losing voter support!

Furthermore, the structural framework is sometimes specified to a lesser extent at the contract award stage, as opposed to the degree of complexity shown in the detailed design or construction phases. Only after the contract has been awarded will the selected bidder find out that the structural framework and associated works are much more complex than originally disclosed by the client in the bidding phase. If the contract was awarded to the seemingly "cheapest" bid (i.e., the lowest contract amount), the quality and quantity targets will subsequently be increased by the required additional works identified post-award, as well as by subtly different interpretations of the works owed under the construction contract.

This approach to project handling leads to much higher costs – as if the actual requirements for the building or structure and the circumstances and conditions under which work should be performed had been incorporated in the specification prior to the award of the (original) contract. Client's requests or needs that become known only after the contract award will almost always result in cost increases, which can be avoided only if such requirements are stated as clearly and unambiguously as possible before awarding the original contract. Such cost increases are mainly due to the fact that the competitive setting has changed and "forgotten" works need to be procured at a higher price level. Prior to entering into the construction contract, the bidder is bound to compete with other bidders and is thus under severe competitive pressure. After the award, the contractor is the only counterpart of the client when it comes to requested changes or alterations, and is thus in a stronger negotiating position. Pricing of changed or additional works does no longer (completely) take place in the competitive environment of the original contract with corresponding prices of originally agreed works or services. Any simplified or incomplete work specification must be firmly rejected because it will almost always give rise to a disaster from a construction management and/or economics point of view because the originally agreed cost, timeframe, and quality of the building or structure can no longer be adhered to.

Besides sufficient funds, it is crucial to allocate sufficient time in line with project complexity to ensure networked project preparation and effective work execution. In an integrated planning

exercise, this step will enable the feedback loops needed for a sufficient degree of planning detail. Planning quality has a direct influence on specification quality and thus on the achievable planning and specification maturity as a basis for bid costing and pricing exercises that reduce pricing risks for bidders. The resulting high degree of bid comparability will also enable the client to commission construction works exactly as specified and on budget. In early project phases, estimation methods play a prominent role in order to arrive at initial values and ratios that are then replaced with more solid calculations as the project is progressing. Such calculations lead to predominantly deterministic results. In these project phases, there are no quantitative options (yet) for interpretation of risks taken or of chances that may potentially arise.

Figure 2 shows the qualitative correlation between estimated project lead time and achievable project, structural, operational and use qualities. The horizontal axis represents time, whereas the vertical axis shows the degree of target (under)achievement. A "normal" project lead time should be aimed at, depending on the type and nature of the project. The normal project lead time area describes the range of lead times sufficient for preparing or processing the bases for planning and decision-making to a sufficiently high-quality standard. The 100% mark shown on the vertical axis indicates that defined targets can be achieved at minimal costs, disruptions, disputes etc.

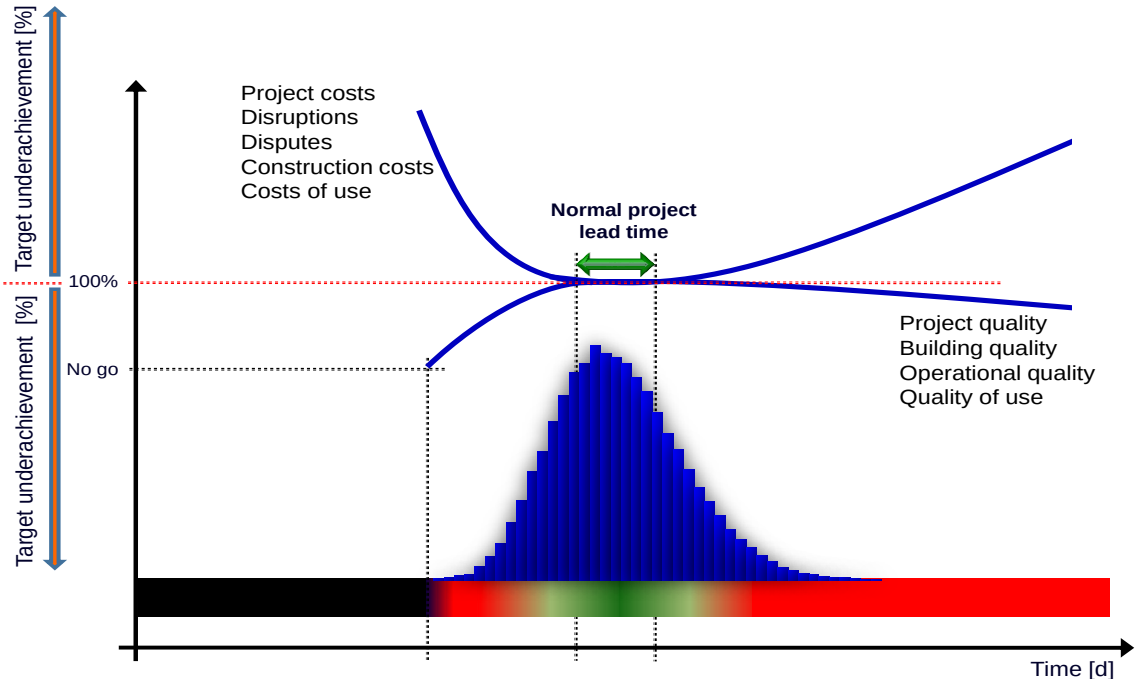

Figure 2. Correlation between project preparation time and project targets (Hofstadler 2014).

Any project lead time that is too short or too long will lead to cost increases. The number and severity of disruptions or disputes will rise particularly in the case of an exceedingly short (and continuously shortened) lead time, resulting in higher construction and project costs as well as higher costs of use at a later stage. Although the client will often have prepared a very stringent construction contract, its provisions may not be sufficient to resolve all issues arising in the ensuing project phases due to deficient project organization (structural and workflow organization), planning, and specification. The key factor to be considered in this context is that any planning, organization and coordination activity will still be performed by humans requiring

adequately allotted time periods in order to achieve normal productivity. All too often, important steps to coordinate and clarify responsibilities at project interfaces are skipped because of the existing "project pressure" and exceedingly tight time budget.

Follow-up costs potentially incurred by an exceedingly short project lead time are hard to quantify *ex ante*, which is also associated with the major issue of having to "discount" such costs to the corresponding point in time according to the net present value method. This approach also makes it impossible to compare total costs in the case of normal project lead time to those associated with project lead times that are too short.

Even in the (rather rare) event of an exceedingly long project preparation time, costs will increase as a result of unnecessary planning and organizational activities (such as considering compliance with new regulations and guidelines, changes in the client's ownership structure, or modified financing agreements) that do not lead to a further improvement of results. Quite on the contrary, exceedingly long project lead times can reduce quality standards, for instance by overstretched planning. At the execution stage, the production system will be in the center of considerations. Achievable productivity is essentially determined by the efficiency and effectiveness of the production system.

4 CONCLUSIONS

It is not only "chaos projects" that highlight the importance and necessity of integrating aspects related to project lead times into organizational, management, planning, and construction processes more thoroughly and systematically. A forward-looking, smart approach to managing chances and risks in order to define the related targets and methods will pave the road to success.

Key aspects of the correlation between project preparation time and the degree of project target achievement are outlined in a transparent and plausible manner.

This paper provides a particularly realistic basis for demonstrating the relevance of project preparation time in project and construction management and economics, thus laying a sound foundation for drawing the right conclusions in the interest of ensuring the commercial success of the project. Consideration of the aspects outlined in this paper makes the steps of preparing and making decisions more systematic and target-driven whilst also enhancing decision certainty and transparency.

References

Hofstadler, C., *Methoden zur Ermittlung von Lebenszykluskosten*. In: Nachhaltig Bauen mit Beton: Werkstoff und Konstruktion, Beton Graz´14 – 2. Grazer Betonkolloquium; 25. / 26. September 2014. Nguyen, V., Maydl, P., Freytag, B., and Santner, G. (eds.). 139-152. Graz, Verlag der Technischen Universität Graz, 2014.

Hofstadler, C., *Calculation of "Normal" Construction Time for Building Construction Projects Whilst Considering Uncertainties*, Resilient Structures and Sustainable Construction, Proceedings of the Ninth International Structural Engineering and Construction Conference, Valencia, Spain, July 24-July 29, 2017.

Hofstadler, C., and Kummer, M., *Chancen- und Risikomanagement in der Bauwirtschaft – Für Auftraggeber und Auftragnehmer in Projektmanagement, Baubetrieb und Bauwirtschaft*, Springer-Verlag, Berlin, Heidelberg, 2017.

Lechner, H., *Systematische Kostenschätzungen und –berechnungen – Wo sind die Lücken im Kostentrichter?*. In: Kostenschätzung, Kostenberechnung, Kostenanschlag – Baubetriebliche, bauwirtschaftliche und rechtliche Aspekte, Tagungsband zum 16. Grazer Baubetriebs- und Bauwirtschaftssymposium, Verlag der TU Graz, Graz, 2018.

Wall, J., *Lebenszyklusorientierte Modellierung von Planungs-, Ausschreibungs- und Vergabeprozessen*, PhD Thesis, Graz University of Technology, Graz, 2018.