Incentive Contract for IPD

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ZUSAMMENFASSUNG

Incentive Contract for IPD

Due to their organisational structure and contracts, conventional project delivery models reach their limits in complex large-scale construction projects. In this context, Integrated Project Delivery (IPD) is an alternative regarding a joint project realisation. A probabilistic determination and integral consideration of cost, schedule and risk is the basis for developing an appropriate incentive mechanism for IPD. These elements are linked, simulated and analysed using a digital project risk twin. The results are transparently available to all project partners. Through the set incentive mechanism, the goals of the participants are harmonised and individual risk potentials and dependencies become visible. Based on this, an incentive mechanism has to be designed that ensures a fair pain/gain distribution between the participants.

ERLÄUTERUNG

1. Project Delivery Models

1.1 Overview

A project delivery model consists of three components: the type of award, the contractor assignment form and the type of contract [1, pp. 64-65]. A distinction can be made between conventional project delivery models, which consist of an award and a contractor assignment form (e.g. sole contractor or general contractor), and a contract, which can be a unit price contract or a lump sum price contract. Integrated Project Delivery has a collaborative project structure, which leads to all participants acting in a “best-for-project” manner [2, p. 84]. This is supported by an incentive-based contract and should lead to a shared project success. Conventional project management is briefly explained in section 1.2 and IPD in section 1.3. Section 1.4 principally describes the implementation of IPD.

An overview of the most common project delivery models is given in Figure 1, where the parameters of project complexity, level of design/denied scope and risk allocation are listed first. These parameters influence the choice of project delivery and contract model.
In general, a distinction can be made between project delivery methods and contract models [3, p. 15–17]. Project delivery models are designed by the client – usually by engineers from a project management office. The choice of contract is a consequence of the previously chosen project delivery model. Legal experts are then consulted to draft the contract.

As an example (cf. Figure 1), the allocation of risk between the client and the contractor can be described by a ratio. For lump sum price contracts, the ratio is 0/100. The first figure represents the client’s share of the risk and the second figure is the contractor’s percentage share of the risk. The ratio of 0/100 thus states that the contractor assumes 100% of the risk under the lump sum price contract [4, p. 145].

An incentive contract (cost plus incentive fee) is used in IPD. In this form of contract, target cost is defined. If the final cost falls below the agreed target cost, the saving is shared between the two partners according to a contractually agreed ratio. If the target cost is exceeded, both partners share a malus. As a rule, a minimum and a maximum remuneration are also set [5, p. 110]. Beyond these limits, the client assumes 100% of the opportunities and dangers (risk) [6, pp. 232–233]. This incentive mechanism is negotiated individually for each project.

A hybrid form of incentive contract is the “fixed price incentive fee” model. Here – as in the “cost plus incentive fee” model – an incentive mechanism is defined, but there is a fixed cost component [7, p. 35]. The incentive mechanism from the target cost can be supplemented by other key performance indicators in target areas for schedules, quality, occupational safety and others.

1.2 Conventional Project Delivery Models

In Germany, unit price or lump sum price contracts are mostly used for conventional project delivery models [8, p. 12]. However, especially in complex construction projects, conventional project delivery models do not always achieve the desired results. Structural difficulties often arise as the required services cannot be fully specified in advance with a bill of quantities. Moreover, various disruptive factors can be identified: Inadequate assessment of requirements, uneconomical selection of participants, lack of risk management, strict separation of planning and execution, lack of cooperation and inadequate conflict resolution management.

To reduce these negative factors in planning and execution, innovative project delivery models have been developed in various countries [9, p. 21–31].

1.3 Integrated Project Delivery

The Integrated Project Delivery (IPD) model originating from the USA has also been used in Germany since 2018 [10, p. 63]. This innovative project delivery model relies on increased integration of all project participants [2, p. 80].

The core principles of IPA can be summarised as follows [9, p. 125, 11, p. 149]:

- **Low Project Complexity:**
  - Level of design / defined scope: 100%
  - Risk allocation: Contractor

- **High Project Complexity:**
  - Risk allocation: Owner

**Delivery Method:**
- Design Bid Build or Design Build
- Integrated Project Delivery (IPD)
- Design Build

**Contract:**
- Lump Sum Turnkey
- Unit Price
- Fixed Price and/or Defined Scope
- Early Contractor Involvement, Cost Reimbursement (Open Book)
- Cost Plus Incentive Fee
- Cost Plus Fixed Fee
- Cost Plus Percentage Fee

In these models, the level of risk and responsibility is shared between the client and the contractor according to the contract terms.
• Early Contractor Involvement (ECI), to integrate expertise as early as possible
• Financial transparency through the use of the Open Book method, joint decisions and development of project objectives
• Early identification and quantification of risks
• Shared risk management and risk bearing incl. compensation based on the success of the project (incentive contract)
• Exchange of knowledge and information using technical resources
• Equal representation in the project team and unanimous decisions by the key participants
• Mutual and comprehensive exclusion of liability and avoidance of legal disputes by means of internal conflict resolution processes

2. Implementation of Integrated Project Delivery

An adaptation of the IPD for complex large-scale projects in road construction is the delivery model “Partnership Project Delivery (PPA)” [4, p. 152, 11, p. 149-150] and in railway construction the delivery model “Partnership Rail Model”. This essentially has the core principles listed in section 1.3 and is subdivided into four further sub-models. The sub-model PPA3+ (Partnership Project Delivery 3+) is initiated after a feasibility study as of HOAI service phases 3/4. It can be divided into five elements (A-E) [12, p. 6-7]. As shown in Figure 2, these can also be assigned to the service phases.

In this article, the implementation of the PPA3+ model is considered. Here, elements A (integral design) and B (overall execution preparation) are explicitly considered. During the research project DigiPeC (Digital Performance Contracting Competence Center), these elements were developed into a detailed process (see Figure 2):

1. Initiation of the partnership model
2. Selection of the project partners (award)
3. Start of the partnership model
4. Optimisation of planning and preparation of a cost and risk analysis
5. Development of the incentive mechanism, agreement on target cost and schedule
6. Joint contract design

The aim of the DigiPeC research project is to improve the efficiency and cost-effectiveness of public procurement for complex large-scale projects in the long term. The research project is intended to contribute to aligning the target systems of the client and contractor through incentive-based contracts and risk-based control to ensure that major projects can sustainably be procured and operated more successfully [13].

Part 1 and part 2 of this publication series already dealt with step 4 (optimisation of planning and risk analysis) of the detailed process according to DigiPeC. The structure of a project risk twin was explained, which offers an integral and probabilistic view of cost, schedules and risks [14, 15]. This enables both the client and all contractors to validate the costs transparently and to agree on target costs for the project. In the execution phase, accounting is carried out with the Open Book method [16, p. 667]. The review of execution costs is accompanied by an external expert (auditor/construction expert). The digital project risk twin is continuously updated; thus, deviations from the agreed target cost can be identified at an early stage, e.g. through scenario analyses. Based on the validated and agreed results of the project risk twin, the incentive mechanism for determining the target cost and target schedule is developed.

3. Development of Probabilistic Incentive Mechanisms

3.1 Basic Principles

This chapter deals with the determination of target costs. A model for dening the incentive-driven target dates is developed analogous to the project risk twin. The target cost (Fig. 3) is determined based on the direct project cost.

The overhead and the base prot are set as percentags. The target cost should be chosen at a realistic level that can be reduced. The target cost also includes the risks identified and assessed by both contracting parties [5, p. 116]. The target prot is the prot that the contractor would receive for exactly achieving the target cost. If the direct project cost at completion correspond to the target cost, the contractor’s prot corresponds exactly to the target prot. The sum of target cost, overhead and prot results in the target price from the client’s point of view. Depending on the actual performance, the contractor can achieve an additional bonus on top of the target prot if the target cost is undercut; conversely, a malus is also possible.
3.2 Example 1: Incentive Mechanism With Covered Direct Project Cost

Figure 3 depicts an incentive mechanism. The horizontal axis shows the potential final costs for the client, the vertical axis the compensation of the contractor. The light blue dashed line shows the owner/contractor share-ratio. In this example, the ratio was set at 50/50 across all areas. This means that if the target cost is undercut or exceeded, the deviation is split equally between the two partners.

Figure 3 (1) shows the target cost and the target profit, which were defined in the contract.

Figure 3 (2) shows a scenario at the end of the project in which the final cost is lower than the agreed target cost. Due to the lower final cost, the green dashed line shifts to the left. This can be achieved by, for example, increased efficiency, use of new, innovative construction methods, etc. In this case, the contractor generates a bonus of 50% of the savings in addition to the target profit (increased profit). The remaining 50% of the savings go to the client. Figure 3 (3) represents a negative scenario. In this case, the target cost is exceeded, resulting in a reduction of profit. The final cost (yellow dashed line) shifts to the right in the horizontal axis. This can be caused, for example, by poor work performance, errors in the execution of the work, construction defects, etc. In this case, the Contractor is charged a penalty of 50% of the overrun of the target cost. The Client also has to pay 50% of the overrun.

Figure 3 (4) shows a further increase in final cost. In this scenario, the contractor would not make a profit at the end of the project and loses part of his overhead. If this happens, there is no incentive left for the contractor. In the worst case, only the production cost is covered.

In addition to the model in Figure 3, Figure 4 shows the distribution density of the potential final cost from the project risk twin. The distribution contains all uncertainties from base cost, risks and escalation (future price increase) based on the direct project cost.

In the example in Figure 4, an underrun probability of 50% (P50) is selected for the target costs. This means that the target cost will be reduced with a probability of 50%.

The decisive factor for an agreement between the client and the contractor on the target cost is the potential of the contractor to reduce the target cost and thus generate an additional profit. The success of an IPD depends largely on the correct choice of the target cost. This must be done individually on the basis of the results of the probabilistic risk analysis and the integral consideration of cost and schedules.

Figure 4 on the bottom shows the evaluation from the contractor’s perspective of a potential gain or loss (pain) at the selected target cost of P50. The probabilities for the pain/gain potentials in this example are as follows:

A. 15% probability that the target profit and the full bonus (maximum profit) will be achieved.
B. 35% probability that the target profit and a portion of the bonus will be paid. In total, there is a 50% probability (blue dashed line) that a profit above the target profit will be achieved.
C. 30% probability that the target profit will not be achieved and only part of the profit can be generated
D. 15% probability that no profit is achieved and a share of the overhead is deducted as a malus
E. 5% probability that the profit and the overhead are completely lost and only the direct project cost is reimbursed
LITERATUR & EINZELNACHWEISE
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