

Analysis of the Interference from Risk-Determining Factors of Cooperative and Conventional Construction Contracts

E. Harrer, M. Mauerhofer, T. Werginz

Abstract—As a result of intensive competition, the building sector is suffering from a high degree of rivalry. Furthermore, there can be observed an unbalanced distribution of project risks. Clients are aimed to shift their own risks into the sphere of the constructors or planners. The consequence of this is that the number of conflicts between the involved parties is inordinately high or even increasing; an alternative approach to counter on that developments are cooperative project forms in the construction sector. This research compares conventional contract models and models with partnering agreements to examine the influence on project risks by an early integration of the involved parties. The goal is to show up deviations in different project stages from the design phase to the project transfer phase. These deviations are evaluated by a survey of experts from the three spheres: clients, contractors and planners. By rating the influence of the participants on specific risk factors it is possible to identify factors which are relevant for a smooth project execution.

Keywords—Collaborative work, construction industry, contract-models, influence, partnering, project management, risk.

I. INTRODUCTION

SOME major characteristics of building projects are their uniqueness, the high complexity of the building process and the very cost-intensive construction. Because of this, builders are bearing risks which must not be underestimated. In order to keep them as low as possible, they are trying to transfer these risks to the sphere of the contractors. Another trend is that builders increasingly choose forms of contracts with as few contractors as possible, or even a single one (e.g. Total Contractor) to minimize the interfaces between them. In this case also carries risks; for example, the planning-risk or the risk of coordinating the different professions, are shifted to the contractor. By executing projects in this form, the controllability of the project by the builder is reduced and the potential for conflicts is rising.

Due to the highly saturated and competitive market of the construction sector in Europe, contractors often make offers with very low or even not economically adequate prices. To get positive results in their business, they try to increase their profit with claims of additional charges. As such, if there are

any modifications or problems in the building process, these are automatically used by the contractors to increase their profits, instead of solving them quickly. Due to the continuous feed of information in the planning and construction of buildings, modifications and improvements are inherent to get the best solution for the builder. This leads in many cases to higher final costs, even if the suggested modifications optimize the building process. Especially, flat-rate or all-inclusive contracts, which are a very common method for the construction of turnkey-ready buildings, are not designed for these changes after they are signed [1, p. 131].

The increasing implementation of cooperation elements in the process of building projects (e.g. incentive based refunding models, cooperation meetings, Lean Management, etc.) are indications that market participants are searching to avoid the mentioned problems above. A crucial component of these so-called “Partnership Models” is to integrate the main stakeholders of the building process in an early project stage. So, it is possible to gain their competences for the project and ensure an equal distribution of information and risk allocation between them. The implementation of partnering in the construction process regularly is convenient for all participants, which is shown by a number of scientific publications. Chan et al. presented the critical success factors for partnering [2]. Also Black et al. did an analysis of the success factors and benefits of partnering in construction [3]. Schmidt and von Damm gave some reasons why partnering is convenient for all participants of the project [1, pp. 142-143]. The effects of an early integration of stakeholders to the value of properties were analyzed by the author at a previous observation [4]. Meng showed how relationship management effects on project performance [5]. And Bennett and Jayes were some of the first authors to write down how partnerships in the construction projects can be handled [6].

The main benefits for the builders are [7]:

- 1) Increasing of cost- and term-security,
- 2) Minimization of project duration,
- 3) Reducing the potential of conflicts,
- 4) Optimization of the planning process, and
- 5) Optimization of building- and operational costs.

The following study provides information about the relative difference of influence on project risks from conventional and cooperative contract models. Methodically this was realised by a quantitative survey of the main stakeholders of the project management (client, planner and contractor).

The following proceeding was applied for the study:

E. Harrer is with the Institute for Construction Management and Economics of the Technical University Graz, Austria (e-mail: edwin.harrer@tugraz.at).

G. Mauerhofer is with the Institute for Construction Management and Economics of the Technical University Graz, Austria.

T. Werginz was with the Institute for Construction Management and Economics of the Technical University Graz, Austria. He is now with Weiner ZT GmbH Vienna, Austria.

- 1) Definition of the framework of the compared contract models,
- 2) Deducting and categorizing the project risks,
- 3) Carrying out the survey, and
- 4) Interpretation of the results.

II. DEFINITION OF THE COMPARED CONTRACT MODELS

The multitude of different variants of conventional and cooperative contract models requires the setting of concrete

framework conditions to enable a comparison. The basis for this is the definition of the project-profile according to Haghsheno [7].

A construction project therefore can be characterized by five elements: Project organization, form of tendering, contract form, conflict resolution procedures and the form of cooperation (see Fig. 1).

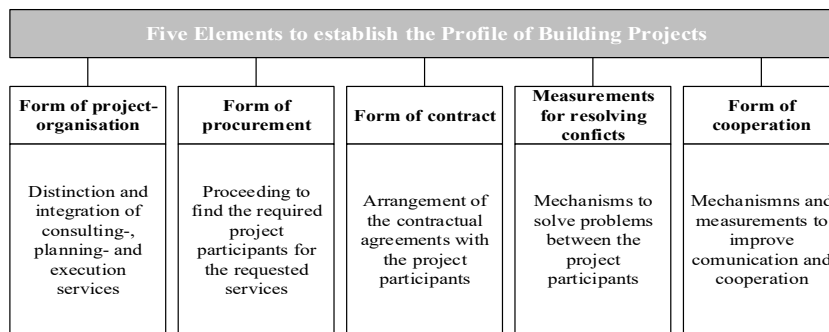


Fig. 1 Elements of the Project-Profile [9]

The following describes the specific framework for the comparison of the conventional and cooperative contract model.

A. Framework of the Conventional Contract-Model

As the *project-organizational form* of the conventional process, a general contractor model (GC) was selected to handle the construction services. For the planning services, the assumption was that the client chooses the required planners individually (Single contracting). This form of project-organisation strictly separates the contractors of the planning- and construction-phase.

The *form of procurement* is of secondary importance for comparing the contract-models. The European law of public procurement signifies that partnership models can only be applied on building projects with very specific conditions. True to that, the assumption was made that process models are limited for private awarding.

The *form of the contract* is divided into the type of payment and the type of tendering. As for type of payment for the conventional model, a lump-sum agreement was chosen as it is often used for GC models. In this case, the tendering of the crafts follows a constructive or functional specification of the services.

Measurements for resolving conflicts and *mechanisms for cooperation* are typical elements of partnership procedures. Therefore, they are not considered for the conventional contract-model.

In summary, the conventional contract-model is characterized as the following.

B. Framework of the Cooperative Contract-Model

As the *project-organizational form* of the cooperative contract-model assumed that all planning and construction

services are transferred to a single contractor (e.g. Total-Contractor, General-Contractor with included planning services, Construction Management at risk). The project organization forms mentioned here are established models for the integration of executing companies in the planning-phase to exploit the potential for optimization of the building. This assumption ensures the early involvement of the executing companies and demonstrates its effects in the results.

As in the case of the conventional process model, there was also defined a private awarding for the *form of procurement*.

A guaranteed maximum price agreement (GMP) was set as the *contract form*. The remuneration at GMP contracts is usually an incentive-based, target-cost agreement, in which the provided amount is the declared target for the building costs. Therefore, cost savings are divided according to a distribution key between client and contractor. Risks for cost overruns are assumed by the contractor or if they arise from additional demands of the client, the GMP is adjusted. For calculating the amount of the GMP, the contractor prepares a preliminary design of the project, which is based on a functional project description by the contractor.

TABLE I
DEFINITION OF THE CONVENTIONAL CONTRACT MODEL

Elements of the Project-Profile	Defined Characteristics
Form of project-organisation	General-contracting of construction and single contracting of planning
Form of procurement	Private awarding
Form of contract	Lump-sum agreement with constructive specification of services
Measurements for avoiding conflicts	none
Mechanisms for cooperation	none

To *avoid conflicts*, team-building workshops should help to increase trust. If conflicts still cannot be prevented, the parties

have to solve their problems out of court.

In order to *improve communication and cooperation*, the principle of "transparent pockets" as well as a high partnership-based and trustworthy cooperation between the contract partners was assumed for comparing the models. In summary, the cooperative contract-model is characterized as the following.

TABLE II
DEFINITION OF THE COOPERATIVE CONTRACT MODEL

Elements of the Project-Profile	Defined Characteristics
Form of project-organisation	Total-Contractor
Form of procurement	Private awarding
Form of contract	Guaranteed maximum price agreement
Measurements for avoiding conflicts	Team-building workshops, Out of court agreement
Mechanisms for cooperation	Principle of "transparent pockets" and partnership-based, trustworthy cooperation

III. DEDUCTION AND CATEGORIZATION OF EVALUATION CRITERIA

After defining the frameworks of the contract-models for the comparison, the evaluation criteria for the quantitative survey were deducted. Because of the uniqueness of construction projects, the challenge of a general comparison is that it is actually valid for the high variety of building projects. Therefore, a comparison on the basis of criteria which are directly related to a specific building is not permitted. For this reason, evaluation criteria with superior and general validity have been selected.

The basis for this is the risks classification according to Busch [8]. It describes and groups risks for a project into strategic and operational risks, which are equally relevant for all project participants.

TABLE III
CLASSIFICATION OF PROJECT RISKS ACCORDING TO THEIR ORIGIN [9]

STRATEGIC RISKS	OPERATIVE RISKS	
General strategic risks	General operative risks	Project risks
<ul style="list-style-type: none"> Market risks Competition risks Performance risks Management and organizational risks Social and ecological risks General economic risks 	<ul style="list-style-type: none"> Personal risks Other risks of the support process Operative economic risk 	<ul style="list-style-type: none"> Risks of generating output

Strategic risks are those that have a long-term effect on the project (e.g. influence on project organization, team composition, etc.).

Operational risks tend to be short-lived, but they have a wider and more frequent impact on the continuity of the project (e.g. influence on decisions which are in the sphere of other parties, the possibility of introducing innovations, resource planning, etc.).

In addition to the overall strategic and operational project risks, three further sections are part of the survey. These are the *risks of the project phases (phase-related risks)*, *external influences and influences on the life cycle*.

The objective of considering the *phase-related risks* is to analyse the influence of the project participants on specific services within the respective project phases (e.g. Influence on the scheduling and cost planning, influence on the design, choice of construction methods, etc.). In order to achieve this, questions are defined, which relate to typical actions of the project participants in the individual project phases.

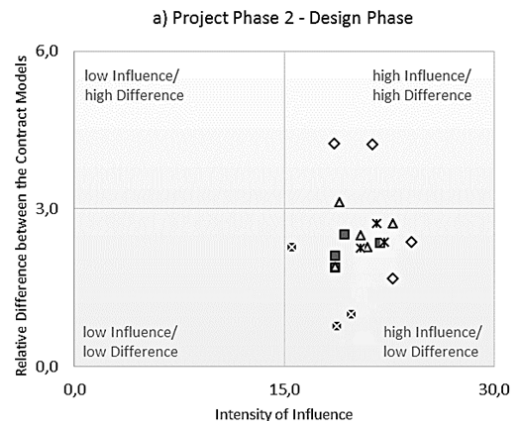
External influences on a project are an important factor for the successful integration of a building into its environment. Conflicts of interest with locals, politicians, users and other parties can prevent or at least significantly delay projects. Selective preventive measures as well as adaptations in planning and execution can possibly prevent delays of the project at an early stage. The objective of the survey is to examine the strength of influence by the project partners on the previously described measures.

The increasing consideration of *lifecycle costs*, instead of the building costs, is reflected in many ways on a project. Therefore, the influence of the three spheres (builders, planners, and contractors) on the life cycle of a building is also assessed.

IV. SYSTEM OF EVALUATION AND INTERPRETATION OF THE RESULTS

The deducted evaluation criteria and the set framework conditions of the contract models were the base for the survey. The questions were sent to selected experts from the three superior spheres, clients, planners and contractors, in the form of an online survey. The query was executed for all project phases in the building process, except the first project phase, since these services have to be provided by the clients in advance. In the evaluation, at first the relative difference of the influence between the two compared contract-models related to the intensity of influence by the participants was examined. The objective was to make a statement about the relevance of the parameters in the individual project phases by recognizing clusters in the evaluated graphics. The results are presented and explained in the following paragraph.

A. Intensity of Influence and its relative Difference between the Contract Models



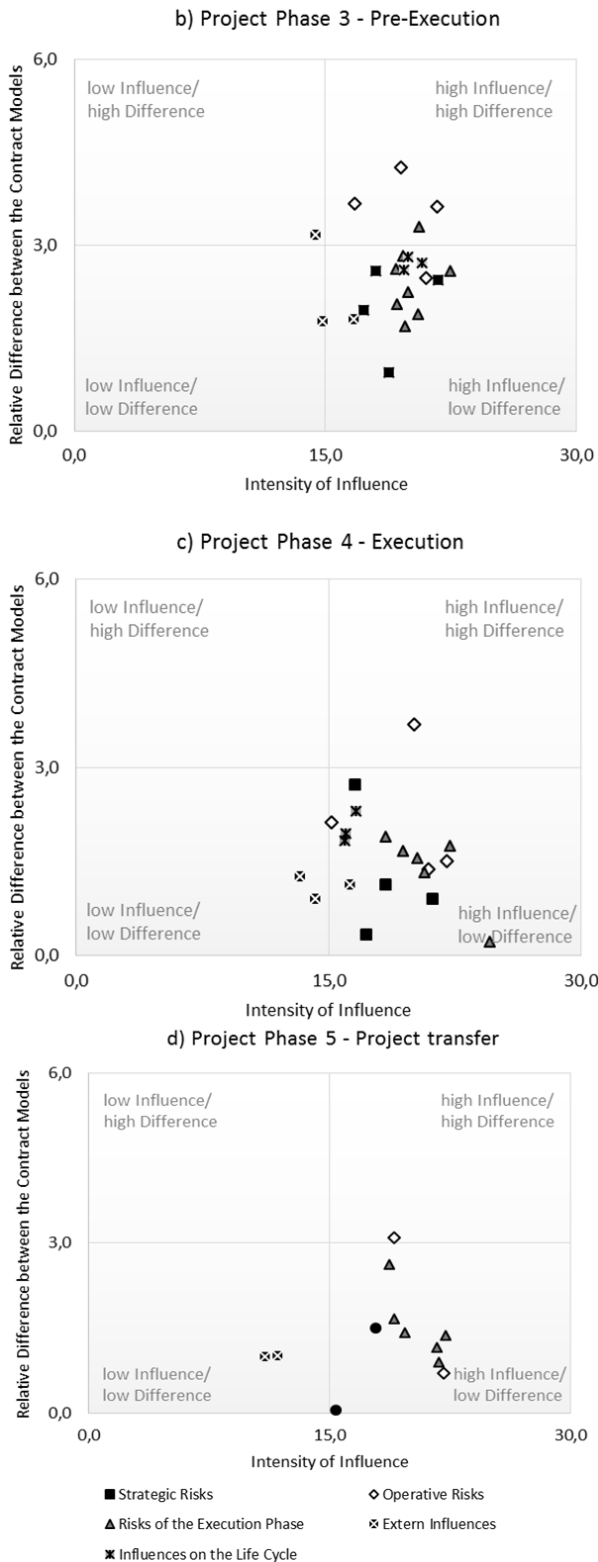


Fig. 2 Intensity and Difference of Influence in the Project Phases

Fig. 2 shows the intensity of influence and the relative difference between the compared contract models in project

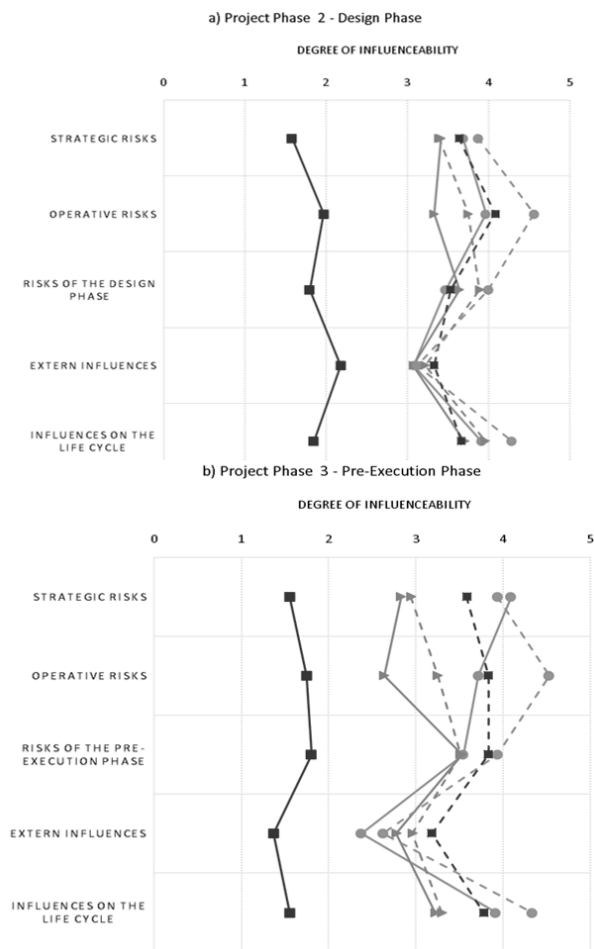
phases 2-5. In this evaluation, the statements of all three project participants, client, contractor and planner, were summarized.

It can be observed, that the parameters in all phases are situated in a very confined space. In the main, they are located in the quarter of high influence and low difference. Further, it can be observed that the relative difference of the influence between the models in the design and the pre-execution phase is higher than in the execution and project transfer phase.

The most relevant parameters relating to the difference of influence are the operative risks. Especially in the phases before starting the execution of the project, the difference has a high level. This can be ascribed to the early involvement of the contractor in the collaborative contract model.

B. Comparison the Influence of Client, Planner and Contractor

In a next step, the collected data were used to analyse the two models separately for the project-participants, client, planner and contractor. This was made to get more detailed information from participants as to their level of influence on the observed parameters in relation to the two defined contract models. The different line-diagrams of Fig. 3 show the results of this comparison for project phases 2-5.



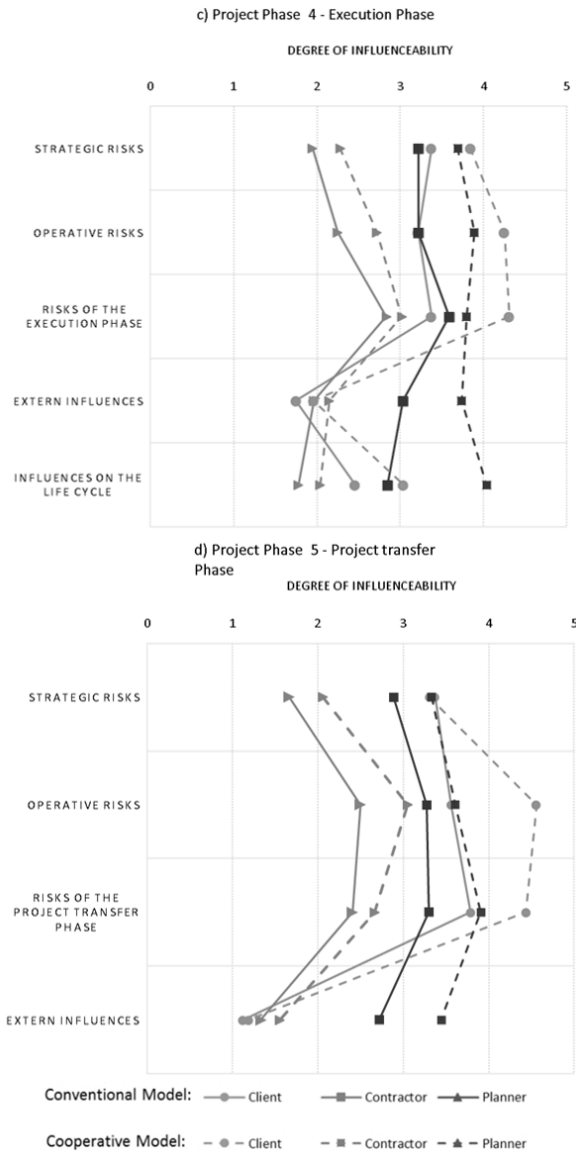


Fig. 3 Influence of Client, Planner and Contractor at cooperative and conventional Contract Models

The survey shows, that the *client* in all project phases has the most influence on the strategic risk, the operative risks and the risks of the different project phases. The influence of the client sinks with the ongoing project duration for parameters which effects the building itself. This can be seen at the later project phases, the execution phase and the project transfer phase. The difference between the cooperative and the conventional model for the client is not very high. However, the results of the survey show that the influence of the client in the cooperative model is consequently higher than for the conventional model. A reason for that may be the close collaborative teamwork with the other participants of the project. This causes less frictional losses and more direct communication between them to lead the project in the right direction.

As well, the *planners* say that their influence in the cooperative model is slightly higher or equal than for the conventional one. This statement is in contrast to the common assumption that planners in the cooperative contract models are losing influence. Generally, planners are independent consultants for the client and try to find the best solution for his demands. This role does not change in cooperative contract models, as long as they are not addicted to the contractor. This means, that planners lose their independence if they are directly commissioned by the building contractor. So if the contractor is also responsible for the planning services, what is usual in cooperative models, an independent planner, so-called value engineer, should be provided to check the planned solutions for the client. This is an important fact and something to be keep in sight when a cooperative contract is prepared.

Not surprising are the results of the *contractor*. Because of the late access to the project at conventional processing, he has no or only weak influence on the early project stages. Only if the client or the planner needs information for special forms of construction or materials, there is a chance for the contractor to give some input. By using a cooperative model, with an early integration of the contractor, the influence also in the design- and pre-execution phase can be raised (Figs. 3 (a) and (b)). In the later project phases, like the execution phase and the project transfer phase, the differences between the contract-models are sinking.

V. CONCLUSION

The comparison of the influences from the main project participants on project risks for conventional and cooperative contract models shows two main aspects.

One objective was to extract parameters from the conventional and the cooperative contract model, which have a high influence on the project for clients, planners and contractors. The result was that the influence of the participants on the parameters in the different project phases does not spread very much. Only the operative risks in the early project phases (e.g. possibility of bringing in innovations, influencing the decisions of other project participants, influence in handling conflicts) stand out. To gain these effects and minimize the operative risks in the early project phases, applying a cooperative contract model for building projects will be an advantage.

The second evaluation was to examine the influence of the project participants in the different project phases. In contrast to the assumption of reducing the planner's influence by applying a cooperative contract model, the result was that there is no difference or even a higher influence on the defined parameters.

The examination should be a helping contribution for integrating participants in the building project if there is a choice for applying a conventional or a cooperative contract model. Always important for the decision is that there are also several other criteria (e.g. kind of project, size, complexity, participants, etc.) which have to be considered when choosing a contract model for a building project.

REFERENCES

- [1] B. Schmidt, C. v. Damm, „*Partnering-Modelle der Bauunternehmen im Hochbau*“, in „*Partnering in der Bau- und Immobilienwirtschaft*“, K. Eschenbruch, P. Racky, 2008.
- [2] Albert P. C. Chan, Daniel W. M. Chan, Y. H. Chiang, B.S.Tang, Edwin H. W. Chan and Kathy S. K. Ho, „*Exploring Critical Success Factors for Partnering in Construction Projects*“, *Journal of construction engineering and management*, 2004, pp. 188-198.
- [3] C. Black, A. Akintoye, E. Fitzgerald, „*An analysis of success factors and benefits of partnering in construction*“, *International Journal of Project Management*, 2000, pp. 423-434.
- [4] E. Harrer, „*Value oriented Project Development – Effects of an early Integration of Stakeholders to the Value of Properties*“, in „*Interaction between theory and practice in civil engineering and construction*“, Istanbul, ISEC Press 2016, pp. 256-259.
- [5] X. Meng, „*The effect of relationship management on project performance in construction*“, *International Journal of Project Management*, 2012, pp. 188-198.
- [6] H. Bennett, S. Jayes, „*Trusting the Team: The Best Practice Guide to Partnering in Construction*“, Reading, 1995.
- [7] S. Haghsheno, „*Analyse der Chancen und Risiken des GMP-Vertrags bei der Abwicklung von Bauprojekten*. Berlin: Mensch & Buch Verlag, 2004, p. 23.
- [8] T. A. Busch, „*Holistisches und Probabilistisches Risikomanagement-Prozessmodell für projektorientierte Unternehmen in der Bauwirtschaft*“, <http://e-collection.library.ethz.ch/eserv/eth:28178/eth-28178-02.pdf>, date of access: 17.08.2017, p. 45.
- [9] M. Viering ,N. Rodde, C. Zanner, „*Immobilien- und Bauwirtschaft aktuell - Entwicklungen und Tendenzen*“, Wiesbaden: Springer Vieweg, 2015, p. 62.