

Optimization of the integrated contracting process of Witteveen+Bos by adding structure and visualization

Main Topic of the Thesis

Witteveen+Bos

The company where the research takes place is Witteveen+Bos. Witteveen+Bos is an engineering and consultancy firm. The company advises and helps clients all over the world in resolving today's complex challenges. With a network of 21 offices in 11 countries and over 1.200 engineers and consultants they work on projects with areas of expertise in:

- Built Environment
- Deltas, Coasts, and Rivers
- Energy, Water, and Environment
- Infrastructure and Mobility

Witteveen+Bos provides advice to contractors, engineering and architectural firms, energy and water companies, railway and port authorities, and industry. In the public sector, they work for national governments, water boards, and provincial and local authorities. Witteveen+Bos' activities cover the entire chain, from policymaking and design to contracting and supervising the performance of work. With this, Witteveen+Bos establish long-term relationships with her clients that enable them to meet the client's needs and expectations as effectively as possible while delivering maximum added value.

Contracting Department

This research takes place within the contracting department of Witteveen+Bos. This department is drawing up large integrated contracts for the construction industry. The contracting procedure consists of a lot of different phases. From the announcement of the client to the end of the process, where the final contract is offered to the client. Every drafting process is different because the request from the client is different. The difference is in the client, type of project, location of the project, and the tender requirements of the client.

Integrated Contract

As mentioned before, this research focuses on integrated contracts. The term integrated contract indicates that the design and execution are in the hands of a single party. The party in control of the project may be the contractor, but also the designer (architect or consulting engineer) or another party altogether. Design and actual construction are united in a single contract, which is why the term 'integrated contract' has taken hold. Witteveen+Bos consults the client and is therefore involved in the phases of the client. However, Witteveen+Bos is often also engaged in the phases of the contractor to keep the project on track. This depends on the project.

Purpose of the Thesis

Currently, the offer price for drawing up contract documents of Witteveen+Bos differs too much. Witteveen+Bos is looking for a way to decrease this and getting a competitive advantage. This can be done by setting up a more efficient process of drafting contract documents. Therefore, Witteveen+Bos wants to get insight into which tasks needs to be done in which phase of the project. Next to this, they want to get clear which tasks are essential for the integrated contracting process.

To get insight into the process of contract drafting and thereafter make it more efficient, information is needed. The current situation of drafting up contracts needs to be analysed. Witteveen+Bos has all this information in the form of project reports, opinions of employees and previous thesis assignments. With this information, a blueprint/process description of drafting contracts can be made. This makes the process clearer for Witteveen+Bos.

The core problem is formulated as follows: *“The contracting process of Witteveen+Bos is currently too inefficient by having too little visual overview, this is needed to be chosen more often by clients.”*. Solving this problem leads to reaching the overall goal of the contract writers of Witteveen+Bos. This goal is to reduce the difference between the predetermined budget of the contracting process and the actual spending of the contracting process at Witteveen+Bos. Witteveen+Bos gets a competitive advantage and potential clients select more often Witteveen+Bos to do the project.

Research Questions

The research answers the following overall research question: *“How can Witteveen+Bos get more insight into the order and the contribution of tasks within certain phases in the contracting process of integrated contracts (under UAV-GC 2005 conditions)?”*. The following research questions are formulated to answer the overall research question:

1. What models and theories from literature can improve the efficiency or structure of integrated contracts?

The literature about efficient contracting and alternative process descriptions can attribute to the research. This literature indicates models and theories that increase efficiency during the integrated contracting process. This literature also shows problems that are occurring during the process.

2. How are the contract writers at Witteveen+Bos currently working on the contracts?

To optimize the contracting process, the current way of drafting integrated contracts at Witteveen+Bos must be known. Through what phases go the contract writers and the contract itself? Where is the client involved in this process? What phase are there in every contracting phase? Is this the same in every project? Next to this, the order and dependency of the different tasks must be known. Certain tasks can only begin when another is finished. On the other hand, other tasks can be done parallel and do not influence one another. The analysis of the current integrated contracting process is done by interviews with the contract writers of Witteveen+Bos.

3. What are the essential tasks within every phase of the contracting process according to the employees of Witteveen+Bos and literature?

The tasks according to the employees of Witteveen+Bos are compared with the tasks mentioned in the literature. Furthermore, there are guidelines in the literature on how to go through the integrated contracting process. However, Witteveen+Bos can also have their thoughts about the importance of certain phases and tasks. These thoughts of Witteveen+Bos could differ from those of the literature. Firstly, this information is gathered with the use of interviews. This creates a list of tasks and the necessity per phase. Secondly, the literature study presents essential tasks according to other researches and institutions. This information is gathered from articles, reports and books from the government, clients, other civil consultancy companies and educational institutes.

4. How are the phases and tasks related to integrated contracting at Witteveen+Bos structured?

The relationship between phases and tasks are structured in a flowchart. This is done in the process modeler program Bizagi. This model displays the process phases, other employees and client involvement, and information exchange between them. Later, the essential tasks per phase are added. The selection of the tasks is based on the answers that are given in research question three, the interview, and the results of research question five, the survey. This gives a complete advised visual process description of the contracting process of Witteveen+Bos.

5. What tasks do the employees of Witteveen+Bos and the competitors perform and are essential in their opinion?

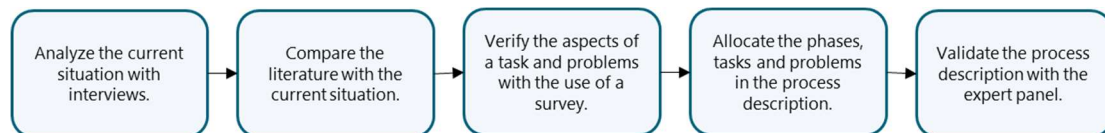
Based on the results of research question two, a list of essentials and tasks is created. All this data is processed in a survey. This survey is spread among the contract writers at Witteveen+Bos as well as the contract writers at competitors. The survey verifies the tasks mentioned in the literature and interviews. Besides, the results of the survey influence the presence and position of certain elements in the visual process description. It also presents the causes of budget deviation during certain phases and tasks.

6. What advantages obtain the contract writers and Witteveen+Bos with the deliverables and results?

The results and deliverables are beneficial for the contract writers and management of Witteveen+Bos. These outcomes give them information about the status of the contracting process. With the visual overview of the process, the contract writers can potentially have more insights and can show managers and clients where they are in the process. The process description potentially gives the contract writers more clarity of the essential tasks and where the most value is added to the contract and therefore to the clients. The results of this research lead to new research subjects. A piece of advice can be given for future research.

Research design

To solve the core problem a couple of steps must be taken. It starts with getting to know the current way of working on integrated contracts. This is done with the use of the experiences of employees and literature. Thereafter, it must be determined what the tasks are that add the most value to a contract and the client. This is done with the experiences of the employees and literature. These outcomes are verified with the use of a survey. All these findings are compared and result in a flowchart and process description as deliverables.



The flowchart visualizes the contracting process. It shows which phases the contract writers go through and where the client and colleagues are involved. The information exchange between the different actors can be found in the flowchart as well. This model is extended with a process description. This process description provides the tasks that need to be done in every stage.

Data gathering

The data is gathered with the use of literature, interviews, a survey, and an expert panel. The systematic literature review and Witteveen+Bos provide the literature resource. The literature focuses on problems and methods to improve efficiency at construction contracting. Next to this, literature is gathered related to the integrated contracting process. Literature about integrated contracting is used to get to know the basics of the process.

The contract writers of Witteveen+Bos have been interviewed to get to know the process. In advance, an e-mail with information about the research and a selection of questions is sent to the interviewees. The interviews go according to the principles of conducting a research interview. The comfort and privacy of the interviewees are priorities. The answers of the interviews are written down and after the interview confirmed by the participant. The interviews are used to get to know the current situation. The participants tell about the phases, tasks, and problems in the integrated contracting process.

The results of the interviews and literature study are the base of the survey. This survey is spread among the contract writers of Witteveen+Bos and competitors. Witteveen+Bos ensures that the survey arrives at the competitors. Within the survey, the participant shows anonymously what task they do and how important they think these are. The data from the survey can be made quantitative with the use of the relative importance factor. These results of the employees of Witteveen+Bos are compared with the literature and with the results of the competitors. Therefrom follows the conclusions and the flowchart with process description.

To validate the process description and research occasionally the expert panel gives feedback. The expert panel consists of the contract writers of Witteveen+Bos. In prepared sessions, the expert panel checks whether the right terms are used. The flowchart is also checked for clarity and usability. In the end, the employees use the documents. Therefore, it is important to get their opinion on the layout and content of the documents.

Literature Reviews

The literature contains the theory and model related to problems and efficient methods of the construction contracting process. It also presents what tasks must be done in what phase according to other process descriptions. Lastly, it shows how the information from literature study is used for the research.

Contracting Problems

Literature presents where problems arise and extra money needs to be claimed. These findings indicate that information and clarity is needed from the client. The client must give clear information to prevent performing tasks incorrectly. However, contract writers also need to be clear about their expectations. Contract writers need to specify what information must be known at which stage of the contract. Another main problem is the complexity of construction contracts. These contracts are related to different areas: law, construction, management and so on. All those conditions must be evaluated and accurately described in the contract. It makes construction contracts multimodal and difficultly considerable document.

Contracting Efficiency

The improvement of efficiency and structure can be done in different way. Lean thinking and lean construction can systematically be introduced to and developed with contract writers. The specialized information systems for construction contracts are important. These information systems lead to the collection of big amount of relevant data, a structured way of working and specialist models for contract evaluation. Therefore, it important to properly define the life cycle of a construction contract. A structure of the process allows realizing a complex view to contract preparation and can be helpful for construction contractors, subcontractors, investors, and other related construction process participants.

Contracting Process

Based on the literature the integrated contracting process is divided in different phases:

1. Contract Strategy
2. Contract scope
3. Level of Detail Contract
4. Contract Structure
5. Contract Elaboration
 - a. General Specification (Current Situation & Basic Specification)
 - b. Customer Requirements Specification
 - c. System Specification
 - d. Contract Specification
6. Contract Completion

Solution Design

During the research, the flowchart and process description are continuously developed. This results in multiple versions based on the available information at that time.

Version 1

Version one of the flowcharts is based on the output from the interviews and the literature. The flowchart presented the current way of working according to these data sources. In this version, the phases are indicated and structured in the right order. Most of the tasks are assigned to one of the phases. However, these tasks were not structured within the phases. This version is presented to the expert panel of Witteveen+Bos and the supervisor University of Twente to acquire feedback to validate to model.

Version 2

The feedback of the expert panel of Witteveen+Bos is the base for the second version. The panel provides feedback related to the content of the flowchart. The feedback covered the following points:

- Missing or redundant elements in the flowchart
- Unclear elements in the flowchart
- The layout of the flowchart to create clarity and oversight

The feedback from the supervisor of the University of Twente focusses on the layout and formatting of the flowchart. The feedback resulted in changes in the position, colours and numbering of elements in the flowchart. The feedback of the expert panel and the supervisor resulted in a multiple level flowchart consisting of an:

1. An overview flowchart consisting of the phases and checkpoints
2. A detailed flowchart consisting of the phases with tasks, interactions between involved parties, contract documents and checkpoints
3. A process description consisting of the goal, input, tasks description and output of the phases

Version 3

In version 3 are the results of the survey processed. The survey verifies the previous version. The question types in are related to the task importance index, the task executor, the budget deviation index, the cause important index. The more detailed process description is also made with these results. This consists of the goal, input, tasks for Witteveen+Bos, tasks for the client and the output of each phase.

Version 4

Version 4 is the final version of the flowchart. Based on the validation session with the expert panel the flowchart is once more checked on clarity and usability. Furthermore, the expert panel validated the tasks that need warning signs to warn for potential budget deviation. The corresponding cause of the deviation is added in the process description. This final version of the flowchart is the deliverable for Witteveen+Bos.

Methods used for validation of the design

Verification & Validation

This research contains data from the literature, interviews, a survey, and an expert panel. The used literature is collected with the method of systematic literature review. Therefore, this research only includes relevant literature. The literature related to the process description was not specified to only civil consultancies. This may result in an incorrect task comparison between the interviews and literature.

A pre-structured Word document contained the layout for the interview results. After the interview, the participant checked the noted answers. It occurred that participants described the same task differently. These are allocated under the same task label. This allocation may be done wrong and that the participants mean something different. In these doubtful cases, the supervisor is asked for advice.

The survey verifies the tasks that are mentioned in the interviews. It is checked whether an often-mentioned task is also rated very important in the survey. The survey is also spread among competitive contract writers. They may have filled in the survey with false answers. To prevent getting these answers in the results, the surveys are checked with the trick questions. Surveys are removed based on incomplete or incorrect answers.

The expert panel is validating the flowchart and process description. The expert panel gives feedback on the flowchart related to the clarity and layout of the flowchart. Next to this, the expert panel helped with using the right terms of phases and tasks. These validation sessions increase the usability of the flowchart. The layout is in that way created to the preferences of Witteveen+Bos.

Limitations

During the research, there were a couple of limitations. The research has a limited timeframe of ten weeks. Therefore, not all parts of the research are fulfilled to the fullest. A result of the limited timeframe is the number of responses to the survey. Whereas more potential participants promised to fill in the survey than the actual responses show.

Another limitation is the perspective of the research. The research is only from the perspective of the contract writers. The research is written with the data from the contract writers. Therefore, the process of creating contract specifications is discussed in this research. Further broader research could also involve other disciplines.

Generalization

The model is made with the data of Witteveen+Bos. This means it is specifically made for the company. However, a similar company in the same sector could also use it. Competitive companies are dealing with the same problems according to the survey. The model from this research can help the contract writers at competitors to improve their integrated contracting process. With minor changes, the flowchart is usable for the competitors.

The model presents the perspective of contract writers. The client in this sector can learn how Witteveen+Bos looks at the process. If the client has a process description, the model of the client could be updated with the findings of this research. If the client has no process description, this research could be the base for a potential process description.

Companies outside this sector can also use the model as a reference. The structure of the flowchart applies to companies related to project work. The sequence of phases could be used in a range of companies. Companies in other sectors can use the sequence of strategy, scope, level of detail, structure, elaboration, and completion for their projects.

Future Research

The research is focused on the tasks of the contract writers and the problem that the contract writers encounter. Further research could also involve the perspective of other disciplines in the project team. For example, the financial group, the system designers, the client, and other involved disciplines. This gives the bigger picture of the process. However, it could also make the process description of the integrated contracting process even more complex.

The flowchart and process description are made in cooperation with the contract writers of Witteveen+Bos. However, it is not used in a project yet. Future research could be the implementation of the flowchart. It can be checked whether the flowchart is helpful for the project team. Future research can potentially make the flowchart and process description more accurate.

Conclusion & Recommendations

Conclusion

This research aimed to answer the question: *“How can Witteveen+Bos get more insight into the order and the contribution of tasks within certain phases in the contracting process of integrated contracts?”* The conclusion answers this overall research question.

The literature study and the problem statement of Witteveen+Bos point out that a visual overview of the integrated contracting process creates more insight into the order and contribution of phases and tasks. This has resulted in a flowchart. The flowchart presents:

- The essential tasks and phases in the process;
- The tasks that need to be done by Witteveen+Bos, the client or in cooperation;
- The tasks where the approval of the client is needed to continue;
- The point in the process where the information must be checked for completeness, actuality, and reliability;
- The tasks where frequently budget deviation occurs with visual marking.

Recommendations

The research aimed to solve the core problem: *“The contracting process of Witteveen+Bos is currently too inefficient by having too little visual overview, this is needed to be chosen more often by clients.”* The research resulted in a flowchart of the integrated contracting process and a list of tasks with the degree of budget deviation. Other findings of the research are the causes of budget deviation.

The advice to Witteveen+Bos is to use the flowchart in the coming projects. This already starts in the tendering phase. Other civil consultancy companies do not have this according to Witteveen+Bos. This gives Witteveen+Bos already a competitive advantage at the tender process. It can persuade the client to choose for Witteveen+Bos instead of the competitive companies.

During the integrated contracting process the flowchart is also very useful. It gives an overview of the order of the phases and tasks. The flowchart also visualises the dependence between tasks. Furthermore, the flowchart tackles the top three overall causes of budget deviation. By using the flowchart the integrated contracting process becomes more efficient.

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