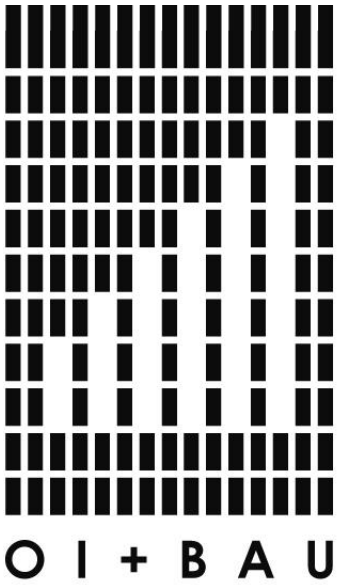

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O I + B A U – Optimization of the Initiation of Complex Construction Projects

Research at the Technical University of Braunschweig

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Short Report: Successful Construction Projects Through Optimized Initiation

Irrespectively of the size or future use of a construction project, the parties involved the initiation phase are often exposed to tasks, whose subsisting solution can only succeed based on a systematic approach and comprehensive expertise. Often, however, the stakeholders lack sufficient knowledge and methodological foundations to grasp the challenges of the preparatory planning phase and to make sustainable decisions. In the course of the project, this regularly leads to high loss of time and quality with associated cost increases. There is therefore an urgent need for research to reduce – ideally to avoid – these negative effects.

A study of 300 completed federal building construction projects (with individual construction volumes of 10 to 240 million euros) as part of the project "Reform Bundesbau" showed, for example, that in 40 % of the cases the budget could not be met and in 35 % of the cases the timescale targets could not be met.[1] No concrete information is given on the extent of the cost overruns, but the projects are described as "*significantly more expensive*"[2]. More precise information on cost overruns can be found, for example, in a study by the Hertie School of Governance. Among other things, this study examined 50 new construction projects for public buildings and found that average cost increases of 41% occurred.[3]

Beside the former Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), which aims to counteract this development with the aid of the project "Reform Bundesbau", the Federal Ministry of Transport and Digital Infrastructure (BMVI) has drafted an "action plan large projects/ Aktionsplan Großprojekte" through the "reform commission Construction of large scale projects/ Reformkommission Bau von Großprojekten" in order to improve project implementation, which is currently being implemented.[4] Both programs describe, for example, the potential for improvements in the early project phases (including initiation) as key fields of action. Furthermore, the BMUB notes in its comments that cost and timescale target overruns occur more frequently in complex construction projects than in less complex ones.[5]

The aim of the research project was therefore to develop the basis for a reliable definition of the project objectives and accordingly the necessary prerequisites and fields of action to be worked on. For this purpose, initially the prevailing opinion regarding the existing theoretical and practical processes in the initiation of complex construction projects was compiled as the result of a comprehensive survey. In addition, conclusions concerning the initiation phase were extracted from common disturbances during the course of the realization of construction projects and then classified. These findings were conditioned, merged with additional research on stakeholders and social systems in complex construction projects and analysed in order to iden-

1 Cf. BMUB Referat B II 1 (2016), p. 4
2 BMUB Referat B II 1 (2016), p.4
3 Cf. Kostka/Anzinger (2015), p. 8
4 Cf. BMVI (2017)
5 Cf. BMUB Referat B II 1 (2016), p. 4. No clear distinction was made between complex and non-complex construction projects.

tify optimization potentials within customary procedures. On this basis, a user-friendly and practical guideline for the initiation phase was developed, accompanied by a collection of methods and instruments to support the implementation of this phase.

Results of the research

The research showed early on that not only the selected part of the project initiation has research potential, but that the entire research field of early project phases – especially in connection with complex construction projects (cf. **Chapter 4.1**) has not yet been comprehensively investigated. For example, it already became clear during the delimitation of the research that no universally valid definition of complex construction projects exists, although construction projects become more and more demanding in the course of time, for example due to technical progress, the shortening of construction times and the increasing number of project participants, and thus constitute a challenge for the respective initiator.

Therefore, in addition to etymology, corresponding approaches to the definition of complexity and complex systems with and without reference to civil engineering were investigated. Based on the extractable characteristics of complexity and complex systems, complexity drivers in construction projects were identified and possible indicators for complex construction projects of the initiation phase discussed.

It became apparent that different approaches for the aggregated representation of complexity drivers in civil engineering are conceivable. Crucial is the conscious perception of the individual facets of the complexity drivers as dynamic risk factors in the project, as these are of essential importance for the development of the further course of the project. However, for the identification of complex building projects in the initiation phase a quantitative evaluation on the basis of these drivers is not expedient, since at the beginning of the project no or only very little information is usually available. Against this background, it was discussed whether a forecast of the complexity potential for construction projects could be possible with the help of empirical values and variables for certain developments of different complexity driver constellations. As a result, it was established that based on the construction volume or the type of building alone, it is not necessarily possible to make a general statement towards the assessment regarding the complexity of a construction project.

In **Chapter 4.2**, the contents of the initiation phase in theory and practice were examined. In the first step, conceptual definitions were made for this purpose. It became clear that although commonalities prevail, there is no unambiguous definition of the concepts and task areas or contents of the initiation phase. Not even the terms used for the phase classification in the project are uniformly designated in the literature.

For an in-depth examination of the contents of the initiation, the individual task areas of the various works that were examined were extracted and summarized in a matrix. Among other things, it was established that the contents of the early project phases were defined similarly by the authors, but that the structure and chronological sequence of the tasks to be completed differed greatly. The divergence regarding the formation of the initiation as well as the difference in the designations are partly originating on the different perspectives of the authors.

Depending on the characteristics of the initiator (e. g. public authorities, companies in the stationary industry, project developers) and the initial situation of the project (e. g. idea and capital available - no location), the course of the initiation – especially with regard to the sequence of the processes – can differ greatly and lead to a prioritization of different tasks in the following course of action.

Furthermore, structured expert interviews with the practice partners were conducted to validate the initiation. The results show that the contents of the initiation in practice show similarities to the results of the investigation of the initiation according to prevailing opinion, but that they do not reflect these in detail. In addition, clear differences can be seen between the respective processes of the various builder-owner or initiators, owing to varying outsets as well as the initiator's distinct organizational and procedural structures.

Based on these findings, the particular contents of the initiation were juxtaposed in a qualitative comparison and a definition of the contents of the initiation introduced.

In order to optimize the initiation process, errors from the planning and execution phases which may have been caused by failures during the initiation phase were examined in **Chapter 4.3**. For this purpose, by means of an extensive literature research, possible errors in planning and construction with reference to the initiation were compiled. These were categorized into problem areas and problem fields and an analysis of the contents of the initiation was carried out on this basis.

As part of a comprehensive secondary survey of errors in planning and implementation (61 sources), 43 problem areas with reference to initiation were identified through a qualitative categorization and temporal delimitation of the possible causes. The analysis of the addressing of these fields in the initiation according to prevailing opinion showed that

- no work addresses all problem areas,
- 14 problem areas have not yet been addressed in any oeuvre, and
- disturbances in particular due to human factors have not been taken into account yet.

Against this background, it could be established that in order to avoid later disruptions, additional task areas of the initiation have to be addressed and summarized in a single work. This also confirmed the imperative of the present research work.

Due to the particular neglect of the field "human factor", it was subsequently examined in **Chapter 4.4** to which extent scientific findings relating to the construction industry and in particular the initiation of construction projects are available. It was established that the significance of psychological and sociological factors in the construction industry has so far mainly been investigated by FLYVBJERG ET AL. In the FLYVBJERG ET AL. study, the relevant causes for disorders regarding the human factor are subdivided into psychological and political-economic explanations as well as naming concrete phenomena such as planning errors, anchoring effects, loss aversion, self-interest of the actors, information asymmetry, etc. In addition,

methods for limiting the effects of these phenomena were researched. In order to avoid psychological explanations, reference class forecasting was proposed, which is based on experiences from past projects and is thus intended to increase the objectivity of, for example, cost and deadline estimates. Conscious strategic misrepresentation in the field of political-economic explanations can be counteracted, for example, by binding the interests of the actors and creating transparency and clear responsibilities.

It becomes apparent that the structural, functional and dynamic system "project" is superimposed by social systems. Therefore, an excursion into social sciences was undertaken in **chapter 4.5**, which enabled an alternative view of the possible human influencing factors in complex construction projects. By highlighting different factors in relation to the human being itself, the human being as a stakeholder and the human being in groups, possible areas of tension and conflict drivers were identified, which imply additional requirements for the initiation phase. The investigation into the human being behind the stakeholder has shown that the investigation must take place in the smallest possible constellation. Thus, the human being as a stakeholder was identified as a conflict driver, since particular motives and goals, the generational conflict and other factors from the smallest unit, the human being, to the largest possible unit, the organization, mean a possible summation of the fields of tension.

The following aspects were identified as conflict drivers of interpersonal interaction:

- Unresolved communication structures
- insufficient definition of tasks and responsibilities
- flawed decisions

Based on the results of the previous chapters, an in-depth analysis of the stakeholders involved in the early phase of construction projects and their respective roles was carried out in **Chapter 4.6**, which provides further parameters for optimizing the initiation process. Three key stakeholders were identified and examined in relation to each other, from which the subsequent results can be derived.

For example, the choice of the organizational form of the key stakeholders in complex construction projects has a considerable influence on the complexity of the construction project. With the organisational form suitable for the project as well as the initiator the interfaces required to be controlled within the organisation and between organisations can be mastered. If the organisational form is unsuitable for the project, it can happen that, while the sum of all interfaces remains the same, the majority of the interfaces to be controlled falls upon a single organisational participant. The resulting challenges are then sometimes no longer mastered.

In order to select the suitable organisational form for the further handling of a project, an identification of all internal, external and regulatory stakeholders is necessary during the initiation already. Goals, interests, characteristics and, if necessary, coalitions of the project participants

should be determined and projected on possible risks emanating from the organisation stakeholders. With this state of knowledge, the selection of the organisational form for the project can be made.

The handling of the structural complexity within a project by the acting stakeholders demands specific actions and decisions by those stakeholders. These are rarely objective, but rather dependent on the stakeholder to a certain extent, since the perception and the action strategy for achieving the goal vary.

Based on the findings of the research project, further fields of research to be taken into account in **future research initiatives** were identified in **Chapter 6**. Within the framework of an outlook, the early identification of complexity drivers decisive for the project, the early involvement of potential project participants in the formation of sustainable alliance models as well as the earlier and stronger consideration of social factors in order to promote cooperation between interdisciplinary teams were given attention in particular.

Transfer of knowledge into practice: initiation guideline

A major objective of this research project was to enable the practical application of the results of the analysis of the research fields. For this purpose, a guideline was drawn up which includes explanations of the contents as well as implementation-oriented methods and instruments for the initiation of complex construction projects.

Initially, the contents of the guideline were defined in a workshop. During this process the compiled contents of the initiation phase were consolidated with the identified problem areas and advanced in a multi-stage process into areas of initiation, while taking into account the findings regarding the stakeholders and social systems in complex construction projects. In the course of this process, it also emerged that, in addition to the task area "initial situation" as the first task area of initiation, the task area "human factor" also received a special status due to the processing of the task areas by humans and as it has a branched network to or permanent presence in each of the other task areas. For this reason, the "human factor " as a superior influencing factor is additionally given a special status in the form of an explanatory field with the explanation of all task areas.

In total, the guideline comprises 17 task areas plus explanations of the human factor (cf. figure below). Besides the specification of the first field to be worked on (“initial situation”), no general sequence of work is fixed due to the uniqueness and complexity of the addressed projects in building construction.

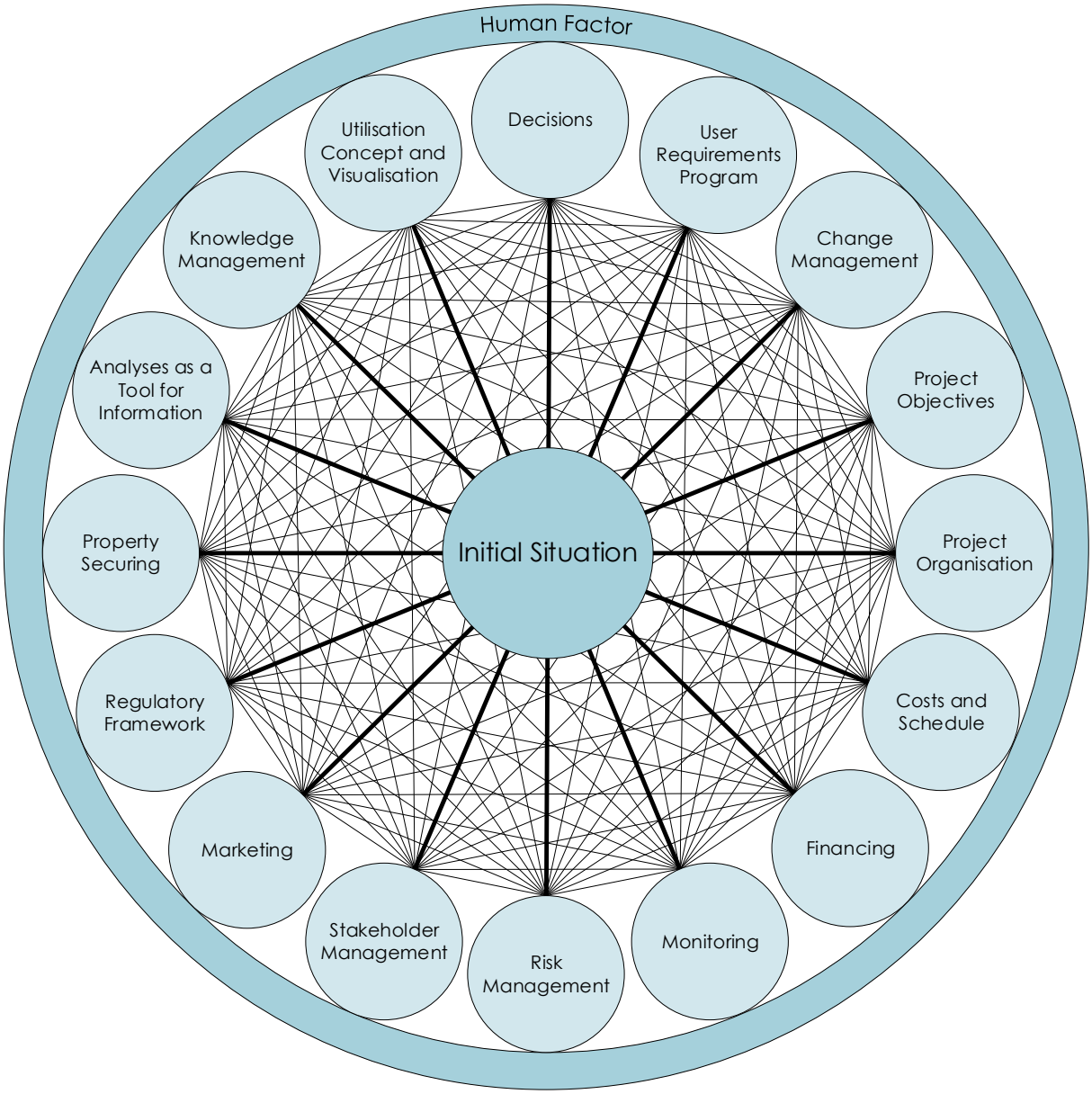

Figure: Initial situation, task areas and human factor in the initiation

Based on the formulated task fields, a layout for an application-oriented guideline was developed, which ensures a quick overview of the essential contents of the initiation as well as of the methods and instruments to support the handling of the fields. The fact that the initiation in this work is represented holistically for the first time increases the requirement for a comprehensible presentation. Against this background, a division of the guideline into two sections was chosen. This ensures that a coherent, concise guideline filled with the essential contents is created in the first part, which gives the reader a comprehensive overview of the contents of the initiation without being interrupted by the description of methods and instruments. This is particularly useful against the background of the interconnectedness of the fields. The second part of the guideline contains recommended methods and instruments for supporting the processing of the task fields, upon which a reference is made from each task field in the first part.

Initially, the first part of the guideline introduces the user in the context of the explanations "About this guideline". Emphasis is placed in particular on

- the significance of the initiation for the construction project,
- the development, content and interpretation of the tasks,
- the holistic approach of the guide,
- the innovative content and
- the structure and the "operation" of the guide

in order to sensitise the user to the importance of initiation and to convey the structure and application of the guide.

Subsequently, the 17 task fields are presented, starting with the "initial situation" and ending with the explanations of the "human factor". Within the scope of the description of the task fields, the

- the relevance,
- the main content areas and
- outcomes

of the respective field of activity are described, and

- references to methods and instruments, and
- references to aspects to be considered from the explanatory field "human factor"

is given.

The second part of the guide presents a collection and description of methods and instruments for dealing with the task areas of initiation. The collection is preceded by an overview. On the one hand, this outlines in which methods and instruments are described directly in the guidelines and in which cases reference is made to further literature due to the degree of awareness and dissemination of the methods and instruments. On the other hand, the methods and instruments are assigned to categories. This makes it possible to refer to a pool of potential methods and instruments for processing the task area. Additionally, recommendations to potentially suitable methods supporting the respective task areas are given.

The methods and instruments are concisely presented on the basis of

- a general (short) description,
- the description of possible implementation in the initiation, as well as
- advantages and disadvantages

In summary, contrasting to existing literature regarding the initiation of construction projects, this guideline does not only describe individual parts of this first project phase, but also summarises all task areas which are intended to enable the best possible project start in a single oeuvre. In addition to the task fields already established in literature, new task fields have emerged which have so far not yet been dealt with in connection with the initiation. Furthermore, innovative focal points have been set in order to optimise the initiation within the known task areas as well as referencing to a pool of methods and instruments within the guideline supporting the implementation of the initiation.

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