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Chapter 20

Feasibility and planning

Marian Bosch-Rekveldt, Hans Bakker and Marcel Hertogh

Introduction

Feasibility and planning are part of the so-called Front End Development (FED) phase of a traditional project life cycle (Bosch-Rekveldt, 2014). The aim of the FED phase is to gather as much information as possible to prepare for the final investment decision (FID) and hence the next phases of the project in case a positive decision is taken. Further down in the project life cycle, the activities are performed with an increasing level of detail and accuracy.

The traditional project life cycle (generally subdivided into stages like initiation or concept development/feasibility/plan, define or design/execution or construction/handover or operation) has been a rather linear one: following a waterfall approach, stage gates mark the transition between the different phases. If the feasibility study provides a promising business case, the project is likely to proceed. At each stage gate, the Go/No Go of a project can be decided; however, the overall idea of the waterfall approach provides limited possibilities for changing the scope. What if the context changes? We might go back a phase, but can't we develop something more flexible?

As opposed to waterfall, agile approaches do allow for iteration. Stemming from the ICT industry, agile is characterised by a short cyclic, iterative approach, in which different parties work closely together. The agile developments started with the agile manifesto in 2001, defining four core ideas (Beck et al., 2001):

- Individuals and interactions over processes and tools,
- Working software over comprehensive documentation,
- Customer collaboration over contract negotiation,
- Responding to changes over following a plan.

It doesn't mean that processes, tools, comprehensive documentation, contract negotiation and following a plan are without value, however, the other items are prioritised stressing the importance of individuals, interactions, a working product, collaboration, and a change in mindset.

Earlier studies have investigated how agile thoughts can be used in engineering projects in a broad sense (Jalali Sohi, 2018). In this chapter, we will explore how the feasibility and planning phases could benefit from a more flexible approach, specifically focusing on interaction, collaboration and adopting a change in mindset. Using some real-world examples, we will illustrate the need for and potential of a more flexible approach.

Illustrating the problem

Large infrastructure projects have a very long lead time. From idea generation to realisation takes easily up to decades. This also means that once the FID is taken, assumptions on which the initial project feasibility was based, are likely to be outdated. Even after the FID, it could take years (in some cases decades) before the project is delivered and taken into operation. What kind of complexities could play a role? (see also Chapter 22).

Controlling complexity?

The case of Zuidasdok presents one of the largest infrastructure projects of the Netherlands. The project aims to improve the accessibility of the Amsterdam business district called 'Zuidas' and the northern part of Randstad by road and public transport. After an intensive tendering process, the Dutch Zuidasdok project was awarded to a contractor consortium in February 2017. Part of the agreement was that the project would start with a so-called 're-baseline' or recalibration

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phase, which aimed to develop the integral preliminary design and corresponding planning of the construction phase before May 2018. The re-baseline phase was defined as a control measure to manage the expected complexities in the project.

Indeed, the Zuidasdok project was characterised by complexity. The project location faces a lot of dynamism and construction works will have to be done 'while the shop is open' including highways, roads, trains, metros, pedestrians, cyclists and ships, at a prime location in Amsterdam. Following the TOE model to grasp project complexity (Bosch-Rekveldt et al., 2011) all types of complexity were present and interrelated, surrounded by uncertainties.

The technical complexity was observed in the integral character of the project: there were many factors with mutual dependencies, for example, due to the limited space of the construction site. This has implications for both the design and the construction planning. Construction logistics were challenging as different infrastructure modalities should continue their operation while construction was ongoing. The overall size of the project enhanced this complexity although the integral character theoretically also enables optimisations within the scope of the project.

In terms of organisational complexity, finding the right resources was a challenge in this multi-actor project. This is partly due to the fact that there was little experience with the integrated contract and that expertise in the market was scarce in general. The project required input from various disciplines: tunnels, roads, structures, public transport, area development, etc. There were several involved parent organisations and funding streams. On the contractor side, work was done in a consortium consisting of three parties, with an unequal distribution of interests. All this created complexity at the organisational level.

In terms of external complexity, a major factor was the uncertainty in the market. At the time of the tender, the economy was in recession, but that changed in the years thereafter. This had consequences for, for example, the availability of employees with the right experience. The specific environment – Zuidas – also played a role with numerous prestigious companies and law firms who adopted a critical attitude towards the project.

Despite the control measure of implementing a re-baseline phase, the project could not overcome the challenges in the early project stages. On the one hand, the complexity of the Zuidasdok project seems largely underestimated, although it was recognised to some extent. On the other hand, the project organisation seemed unable to act upon changing circumstances: controlling complexity was not feasible.

The role of too rigid early project phases

In the case of Zuidasdok, the tender request concerned an optimisation of one specific future and the contractor optimised their design completely to that future, resulting in a winning bid. During the tender procedure, the clients decided on an important change in the scope, but the change was not reported to the bidders at that time, because the clients didn't want to disturb the tender process. This change hindered the start-up phase of the project. Also, some parameters needed to be adjusted (e.g. concerning the underground) in the calculations of the contractor. For these developments, a re-baseline phase was foreseen in the contract. As a result of these changes and the further developed insights in the context (e.g. underground), however, the invented, over-optimised construction phasing and end-solution from the bid seemed less robust and not feasible anymore. The expected cost overruns due to these changes and new insights were extreme, leading to the termination of the contract.

Towards a more flexible approach

What can be done to overcome this? There is not a single solution, but in Figure 20.1, we present a broad approach that covers:

- Awareness of what is happening, particularly regarding the second-order effects of change,
- Scenario building with a longer horizon, repeated periodically, in combination with adaptive measures,
- Flexible project management (agile) for short-run cycles,
- A more phased approach, such as a two-phase project delivery model and a collaborative attitude,
- A more flexible way of planning.

In all of these aspects, a collaborative approach is a prerequisite.

Thinking in scenarios in combination with adaptive measures

In future projects, we suggest including various options in a feasibility phase, that would allow us to anticipate changes in the context. An example of such

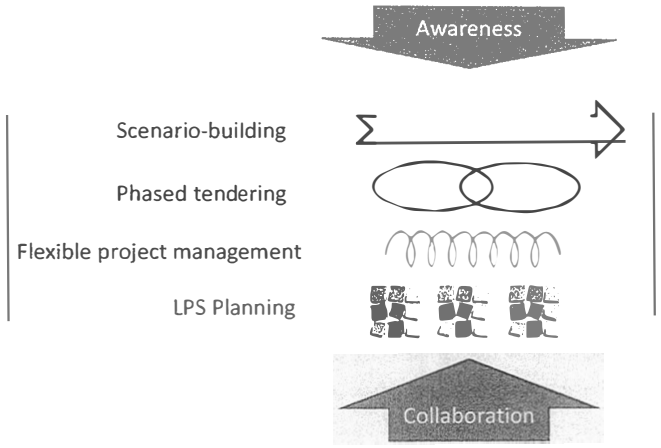


Figure 20.1: Flexibility in feasibility and planning

an approach is found in the Dutch Room for the River program (Rijke et al., 2014), where different scenarios were included, enabling anticipation within certain margins. It is more important to take different scenarios into account than to optimise towards a perfect solution for one scenario, as seen at Zuidasdok in a vibrant environment.

To develop scenarios, a broad view could be adopted, aiming for synergy with other initiatives. A short cyclic approach would allow to adjust scenarios depending on the context, providing flexibility. Flexibility can also be sought in spatial flexibility. In some cases, local space can be reserved for possible future expansions. Even in the highly dense area of the Zuidasdok, this was done by preparing the train station for future track expansion. The use of innovative 3D tools could help to take into account the potential of the subsurface. Also, a network approach could be adopted. For instance, in the scenario of a considerable traffic increase at Zuidasdok, it could be investigated if the capacity of other highways in the network could be used, for instance, the nearby highway A9, south of Zuidasdok.

To develop more robust projects, we need to combine creative solutions with realistic analyses, while working with scenarios. Basically, we need to play with the complexity of the projects. In some instances, we need to expand complexity to create more value or better fit the context. In other instances, we rather split the project into smaller pieces in an attempt to decompose complexity (Hertogh & Westerveld, 2010).

Overall, the Zuidasdok project took place in a very dynamic environment. In an attempt to control complexity, the re-baseline phase was invented, aiming to decompose complexity. Given the immense changes, however, this didn't work out. Awareness of the effects of such changes in an early stage is crucial.

Changing the scope – second-order effects?

In general, additional scope or changes within a project could be expected to lead to higher complexity, with complexity being expressed as a combination of elements and relationships between these elements, with uncertainty in both the elements and the relationships (Williams, 2002). A scope change can affect the number of elements (e.g. scope extension) as well as the relationships between the elements (e.g. scope extension can change the interfaces).

Following an agile change mindset, particularly in the early project phases, embracing scope changes could be considered as long as the consequences are evident and carefully assessed. To avoid premature convergence in scope definition, including multiple stakeholders and seeking interaction is a recommended approach (Hertogh, 2014).

In later project phases, the consequences of such a change need to be carefully addressed. For assessing the consequences of scope changes, it is important to also look at the second-order effects of a scope change. First-order effects of scope changes mainly cover the tangible, visible costs of the changes such as additional scope, delays, and design uncertainties (Bakker, 2020). The second-order effects are the impacts and consequences of the work induced by that change, such as material procurement, increase in equipment cost, increase in overhead, lower productivity, decreased morale, disruption in project progress and scheduling conflicts (Cheng et al., 2015). These second-order effects could largely influence the project and reach a factor of three to four times the direct change costs (Bakker, 2020; Ford & Lyneis, 2019), but these are easily underestimated. This was also the case at Zuidadok, with the scope change that was initiated during the tender process and was reported to the contractor after awarding the project. So, embracing scope changes needs a careful consideration of its effects; first and second order. Another measure would be to contractually split the design phase from the execution phase, as is done in the two-phase delivery model.

To avoid problematic project delivery, a more collaborative early project phase is recommended, in which the client and contractor work closely together, even with other actors like local initiatives, stakeholders, specialists, etc. (Hertogh et al., 2008). The expertise of the contractor is included in the project design phase already. The price of the construction phase can be jointly developed during the design phase, but only be fixed after that phase. By delaying the FID, the idea is to have more certainty about the outcomes of the project and the remaining risks. Although development costs might rise, the predictability of the final performance might increase. Still, attention should be paid to a fair risk allocation: the party who is best able to control and bear the risk should take it, which is not always the contractor.

Regardless of the specific project delivery model, from earlier research, we know that a collaborative attitude between client and contractor in an integral, joint project team seems a necessary condition for success (Molaei, 2021). A two-phase delivery model would allow for such an integral and collaborative approach under the conditions of a fair risk allocation and a collaborative attitude of the people involved. Potentially, a two-phase delivery model aligns well with the agile thoughts about collaboration and interaction. Could project planning benefit from a more collaborative and interactive approach as well?

More flexible ways in planning

The famous quote of Eisenhower summarises the essence of project planning: 'Plans are useless, but planning is indispensable' (Garcia et al., 2017). So the process of planning is more important than the actual plan developed with all details, as the process helps in shaping thoughts and rethinking the project planning in case something unexpected happens. With projects taking place in more dynamic environments, this emphasis on the process supports the idea of working with multilevel project planning, which is how even 'traditional' project management methods look like. Following, for example, Prince2, a high-level planning should be available for the whole project. Only at the stage gates, a detailed planning for the subsequent phase is required. Using the Work Breakdown Structure (WBS) as a base, detailed plans are developed on the different WBS levels only in later stages. Overall, the planning should be seen as supportive of realising the project goals, not as a goal on its own.

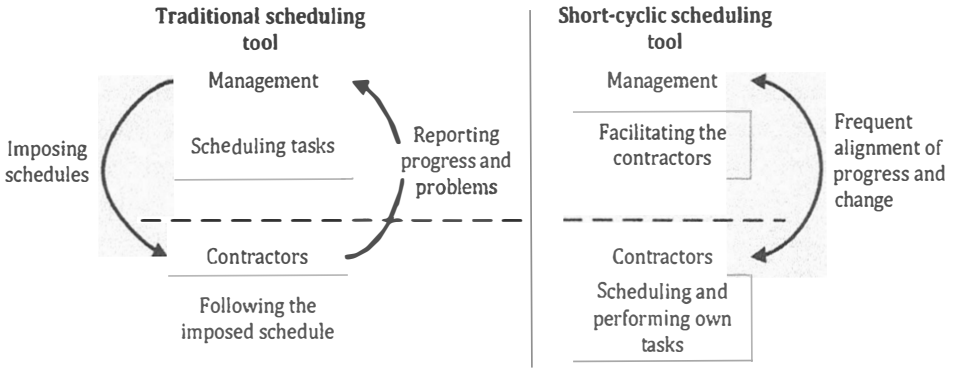


Figure 20.2: Traditional scheduling vs iterative scheduling (after Ballard, 2000)

Figure 20.2 illustrates some differences between traditional project planning and more iterative forms of project planning. In the iterative forms of project planning (right part of the figure), the contractors play a more proactive role as opposed to more traditional forms of planning where management would even impose the project schedule.

The idea of multilevel planning is also adopted in the Last Planner System®, one of the most common Lean Construction approaches (Babalola et al., 2019; Poudel et al., 2020). In traditional project planning, the planning task is seen as an individual task, but with the Last Planner System, this individual task transforms into a collective task. All parties involved in that part of the project have a say in planning those tasks through the presence of the so-called Last Planners, who are the last persons in the value chain. Basically, those who perform the work have a say in planning the work: in an interactive session, the Last Planners discuss the timing and the feasibility of the different activities. A facilitator guides this process of creating the planning, consisting of sticky notes on a schedule. In retrospectives, the earlier activities are reviewed and if needed, the detailed schedule is updated. Reasons for delays are jointly discussed to learn from earlier mistakes and improve future processes.

Implementing Last Planner System (LPS) would lead to a smooth workflow, reduced costs, reduced time of project delivery, improved productivity, collaboration, transparency and mutual understanding between the participating individuals (Lühr, 2021). In practice, cases adopting the LPS suffer from partial implementation, the lack of top management commitment or project practitioners who have difficulties adopting the new ways of working, specifically in transparency between different parties.

The idea of LPS facilitates giving authority to the level of people who have the knowledge to perform the activities. Instead of a linear planning process, an iterative planning process is applied, aiming to deliver a more realistic and flexible planning. Although the iterative scheduling tools could facilitate the late inclusion of changes, still their consequences should be thoroughly considered.

Conclusion

Again, it comes down to the role of the people in the project, and also in the early project phases. In project management literature, more and more attention is being paid towards uncertainties and how to deal with them. In this chapter, we focused on the FED phase which is the phase where projects take shape. FED phase will strongly influence the next phases of a project.

Current developments show that uncertainties will further increase. Think of the uncertain impact of climate change, the shortage of raw materials, changing living patterns, consequences of the ageing of people, new technologies (ICT, blockchain, BIM, new materials, 3D printing), and society will face more unforeseen disruptions such as caused by COVID-19, and large-scale flooding. Also, the extra attention to inclusiveness and biodiversity will increase the importance of the FED. Because of ageing of infrastructures, the focus of project management will shift from newly developed projects to maintenance, upgrade and renewal. Existing structures have additional uncertainties about the state of maintenance, and structural reliability, as well as while adjusting, the operation must continue.

These uncertainties create extra challenges and put additional pressure on the FED. This means that waterfall approaches will be less and less suitable. In this chapter, we presented some more flexible approaches. Agile is a way of working in which a short cyclic and iterative approach is applied, with a focus on collaboration between partners, allowing them to act more flexibly. The Last Planner System can be viewed as an elaboration of a joint planning process. To cope with increasing uncertainties, scenario building is more and more needed. It is essential to discuss for which scenarios the client should be prepared, which will result in more resilient solutions than the optimisation of a single solution. A more phased tendering process could further facilitate such a scenario approach.

Traditional project management theories try to take away uncertainties, but uncertainties are part of the job of a project manager, and cannot always be

removed. Crucial is to deal with these uncertainties, to make these explicit for the client and partners, and to manage these.

All in all, project managers and their teams of clients, contractors and other stakeholders have to deal with an increase in complexity, as we have illustrated with the Zuidasdok example. This implies additional requirements for their individual and team competencies. In addition to affinity with the content and with the basics of project management tools, collaborative skills are becoming more and more crucial. In earlier research on the future needs of project management, leadership and corporate culture were considered as 'a basic requirement or even boundary condition for the development of any future model', or to say it shortly: 'People are Key' (Bakker et al., 2018). These human skills are also required in the early project phases, to create a pole position for the later stages of the project and to allow to act upon any changes in context. And these changes will surely happen in the timeframe of current infrastructure projects.

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