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# A Review of Different Construction Project Lifecycle

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Optimaltid – Rett kompetanse på Rett oppgave til Rett tid

## Optimaltid Project 2020-2024

Involving the right competence at the right stage of development has great influence on public investments. It will lead to better solutions, lower operational cost and more efficient execution of infrastructure projects.

Future transport systems must become more sustainable and public finances should be utilized better. This may be the result if the right competence is engaged in planning and designing projects – at the stage when their input has optimal influence on the outcome. The involved parties have different positions, external regulations and constraints makes the necessary considerations very complex. There is currently no method for doing this right.

This research shall develop such a new method and test it in different real-life infrastructure projects to document the effect. This requires new knowledge about the early engagement of contractors. The method shall be made into a tool or a guideline available to help public owners in the transport sector evaluate the right timing of engaging contractors in planning, design and execution of these projects.

The Optimaltid project is supported by The Norwegian Research Council (NFR p. nr. 309726) through the programme Transport 2025. The project is owned by the Norwegian Public Roads Administration. In addition, the consortium includes Nye Veier, Bane NOR, Bodø municipality, Veidekke and WSP. NTNU is the academic partner and is responsible for developing the method. Project Norway is dissemination partner.

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# 1. Introduction

The involvement of the contractor at the early stage of a project is the main characteristic of the ECI that distinguishes this model from the other frameworks. However, a question may arise about what the early stage of a construction project means. Every project, regardless of its type and nature, goes through a certain process consisting of a series of identifiable phases (Bennett 2003).

Davenport and Short (2003) define process as a structured, measured set of activities designed to produce a specified output for a particular customer or market. This set of activities forms phases throughout the lifecycle of a project. A construction project also goes through various phases from the time it is born throughout its whole lifetime to the point when it expires. A vast number of methods have been developed to model the process and define the phases through the construction project lifecycle in an attempt to enhance the effectiveness and efficiency of the design and construction activity (Tzortzopoulos, Sexton & Cooper 2005).

Walker and Lloyd-Walker (2014) define taxonomy of project lifecycle and categorize the project lifecycle as 'linear' and 'recursive' perspectives. The linear perspective sees a project as the transformation process in which it moves through various steps and phases in a sequential order. On the other hand, recursive observes a highly recursive element involved in most projects due to the constant changes in context and circumstances in projects as time moves on (Walker & Lloyd-Walker 2014).

The sections below provide an understanding of some frameworks that are widely used in the construction industry and conclude with the one suits Optimaltid goals.

## 2. Findings

### 2.1 Overview of the Construction Project Lifecycle

The involvement of the contractor at the early stage of a project is the main characteristic of the ECI that distinguishes this model from the other frameworks. However, a question may arise about what the early stage of a construction project means. Every project, regardless of its type and nature, goes through a certain process consisting of a series of identifiable phases (Bennett 2003).

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Lloyd-Walker and Walker (2015) define taxonomy of project lifecycle and categorize the project lifecycle as 'linear' and 'recursive' perspectives. The linear perspective sees a project as the transformation process in which it moves through various steps and phases in a sequential order. On the other hand, recursive observes a highly recursive element involved in most projects due to the constant changes in context and circumstances in projects as time moves on.

The sections below provide an understanding of some frameworks that are widely used in the construction industry.

#### 2.1.1 Project Management Institute (PMI) PMBOK®

PMI (2013) in their 5th edition of Project Management Body of Knowledge (PMBOK®) identifies four main phases and one overarching phase for the project lifecycle. The first phase is initiating where a new project or a new phase in an existing project is defined. The key purpose of this phase is to help to set the vision of the project and to realize what needs to be accomplished. The second phase, planning, consists of those activities performed to establish the total scope of the effort, define and refine the objectives, and develop the course of action required to attain those objectives. Executing is the third phase where the work defined in the project management plan is carried out to fulfil the project specifications. The final phase is closing, consisting of those activities performed to conclude all activities across all Project Management Process Groups to formally complete the project, phase, or contractual obligations.

PMBOK also identifies monitoring and controlling process as an overarching process covering the whole project process from the initiating phase throughout the closing phase. Lloyd-Walker and Walker (2015) argue that although PMBOK illustrates the planning and executing phase processes, which exhibit some iteration, it sees the project life cycle process as mainly linear. A typical one phase project process based on PMBOK® is depicted in Figure 1.

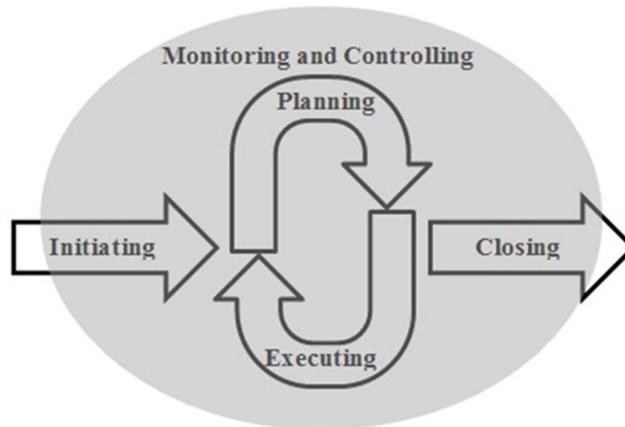


Figure 1: A typical one phase project lifecycle process

### 2.1.2 The Royal Institute of British Architects (RIBA) Plan of Work

First developed in 1963, the Royal Institute of British Architects (RIBA) Plan of Work is a standard method of the building design and construction process that has become widely accepted as an operational model throughout the building industry. The Plan of Work offers a procedure suitable for traditional procurement methods, where the construction begins after the completion of design. The latest version of RIBA Plan of Work (2013) consists of eight stages identified by the numbers 0–7 and each stage include 8 task bars required to deliver that stage. The stages and sequence of which are defined as following:

- *Stage 0 - Strategic Definition:* In this stage the client’s business case and the strategic brief are defined.
- *Stage 1 - Preparation and Brief:* This stage relates to carrying out preparation activities and briefing in tandem.
- *Stage 2 - Concept Design:* The initial Concept Design is produced in accordance with the objectives outlined in the initial project brief.
- *Stage 3 - Developed Design:* During this stage, the main designer develops the Concept Design until the spatial coordination exercises have been completed.
- *Stage 4 - Technical design:* During this stage, technical definition of the project and the design work of specialist subcontractors is developed and finalized.
- *Stage 5 - Construction:* the building is constructed on site in line with the Construction Programmed.

- *Stage 6 - Handover and Close out:* in this stage, project is handed over and, in the period immediately following, the building contract obligations in regard to the defects and the certification are implemented.
- *Stage 7 - In Use:* During this stage, project design information is used to ensure the successful operation and use of the building.

The Plan of Work represents a logical sequence of events that should ensure that sound and timely decisions are made, however depending upon the size and complexity of the project, the model needs slight adjustments.

### 2.1.3 British Property Federation (BPF) Manual

This model was produced by the members of the British Property Federation (BPF) in 1983 in an attempt to devise a more efficient and co-operative method of organizing the whole building process in a response to concern about the increasing problems within the construction industry such as poor design, inadequate choice of materials and poor supervision of the works. Federation (1983) claims that this model, compared with a normal traditional model, delivers a number of advantages including quicker building at lower cost; removing the overlaps between design teams; and less need for variations on site during the construction stage.

This model consists of 5 stages throughout the project lifecycle:

- *Stage 1 - Concept:* development of the concept by the client is made in this stage. The client prepares an outline plan after undertaking a feasibility study. If the project is feasible and the client wants to carry on, a Client Representative is appointed to take care of the client's objectives, i.e., time, cost and quality throughout the project. The Client Representative examines different options for the building followed by preparation of an outline brief. Upon the client's approval, a specification for the full brief in stage 2 is produced.
- *Stage 2 - Preparation of the brief:* during this stage, the client appoints the design leader only for the stage 2 works and Client's Representative if not already appointed at stage 1. The client's requirements including cost limits, time limits and building functionality are studied and analyzed by the design leader and client's representative resulting in development of the brief. The brief consists of a master program for the design and construction phases; and cost plan covering the expenditure through the design and construction phases.
- *Stage 3 - Design development:* The design leader and other potential consultants submit their price proposal for the works in stages 3 to 5 upon the client request. In a competitive environment, the client appoints the design leader and other required consultants. The design leader alongside the other consultants translates the brief into the detailed design leading to production of drawings and specifications. Possible changes in the project cost is reported to the client for further decisions on either changing design to reduce the cost or accepting the increased figure.

- *Stage 4 - Tender documentation and tendering:* During this stage, the design leader develops the tender documents upon obtaining planning permission. The tender documents include drawings and specifications prepared by the design leader but exclude a bill of quantity. Tenderers are requested to submit a priced schedule and program of activities, a statement of resources and a statement of construction methods to be used. Tenderers are informed of any incomplete design to develop and the specification which they must keep in the design. The contractor is appointed by the lowest tender price.
- *Stage 5 - Construction:* Ensuring the project is constructed in accordance with the contract documentations, the client selects a supervisor to work alongside the design leader and the client's representative. The design leader is responsible for checking and assessing the contractor's design and proposed variations against the contract documents and legislation. The client's representative is also in charge of managing the project in all stages including monitoring the work of the design leader and supervisor. The updated master program and the master cost are reported to the client regularly ensuring he is aware of any changes during the project.

The model was designed to be used by all parties involved in the construction industry including the client, designer, contractors, specialty contractors and suppliers, addressing their relationships both formal and informal.

#### 2.1.4 British Airports Authority (BAA) – The Project Process

The project process protocol was introduced by British Airport Authority (BAA) in 1995 in an attempt to achieve the best practice across their business by controlling their construction projects in a way that meets their standards. The reason for generating such a protocol was to have all of their construction projects follow the same processes to ensure the consistency of their projects process. The protocol consists of seven major stages to cover all areas of a construction project. These seven major stages are as follows:

- *Inception:* the need for a project is the question in this stage by bringing the customers' needs with the business strategy together.
- *Feasibility:* during this stage, the full range of options is investigated against the identified needs and objectives in order to determine the most appropriate solution for resource allocation.
- *Concept Design:* Here the solutions for the design and engineering systems are studied and developed.
- *Co-Ordinated Design:* the use of specialist advices in developing the various elements of the design is undertaken in this stage to ensure predictability of cost, safety and operational performance.
- *Production Information:* during this stage contractors and suppliers develop the fully detailed design and planning covering all aspects of construction works.

- *Construction:* The project is constructed in compliance with the agreed specifications developed during the design, planning and consultation work.
- *Operation And Maintenance:* The facility is handed over followed by obtaining information for feedback.

Although BAA (1995) promotes the concurrent engineering practices of integrating the design, fabrication and construction, the proposed protocol follows the traditional delivery method where the design work and all planning operations are completed before construction work can start.

#### 2.1.5 Ministry of Defense (MOD) – Working Document

In 1997 the UK ministry of defense (MOD) set up the Construction Supply Network Project (CSNP) as a learning mechanism to establish the working principals of a prime contracting approach to construction procurement (Holti, Nicolini et al. 1999). The aim of project was to identify and develop a specific process and tool to support the prime contracting procurement model and identify the critical success factors. The CSNP Project divides the whole life of a prime contracting construction project into five specific phases. These phases are explained below:

- *Inception - establishing the client needs:* during this phase the client identifies the business requirements and undertakes an option analysis in order to develop a Strategic Brief. Depending on the available in-house technical expertise, the client may decide to appoint an advisor to culminate in the Strategic Brief.
- *Definition and Qualification:* here, the client appoints the Prime Contractor through a formal pre-qualification and invitation to tender. The Prime Contractor develops an outline program including the fee for undertaking works to the end of the Concept Design Phase.
- *Concept Design:* on the basis of the Strategic Brief, the prime contractor carries out a value analysis and examines a range of potential design solutions to ensure the satisfaction of the client's functional and financial requirements. By the end of this stage, the prime contractor, in consultation with the key supply chain partners, develops the design to a stage where the prime contractor is able to provide the client with an initial guaranteed maximum price.
- *Detailed Design and Construction:* during this phase the design is developed and completed with the help of the supply chain. The prime contractor completes the detailed design and produces the final guaranteed maximum price. Upon the client's approval, the construction phase starts, and the prime contractor undertakes and manages the construction activities. The completion of this phase is the hand-over of the facility to the client for occupation.
- *Post Hand-over:* The Prime Contractor monitors the operation of the completed building and maintains the facility until the project is transferred to the client.

All the above models do not seem to consider specific stage gate review processes; however, it is best to obtain the approvals at the end of each stage to ensure the fulfilment of the business strategic intent (PMI 2008).

This is an important consideration for other authoritative sources in developing decision stage gate approaches such as the OGC gateway™ process, Salford Process Protocol, Victorian ICT investment life cycle, and Decision Stage Gate Reference Model (Kagioglou, Cooper et al. 2000, OGC 2007, Klakegg, Williams et al. 2010, Walker and Lloyd-Walker 2012).

Figure 2 compares the construction lifecycle process models in order to demonstrate the similarities and differences of each model.

<b>BPF Manual 1983</b>			Concept		Preparation of the brief		Design Development		Tender documentation and tendering		Construction			
<b>BAA The Project Process 1995</b>	Inception		Feasibility		Concept Design		Co-Ordinated Design		Production Information		Construction		Operation and Maintenance	
<b>MOD Working document 1997</b>	Inception		Definition and Qualification		Concept Design		Detail design and construction					Post Hand-over		
<b>Salford Process Protocol 1998</b>	Demonstrate the need	Conception of need	Online feasibility	Substantive feasibility & outline financial authority	Outline conceptual design	Full Conceptual design	Co-ordinated design, procurement & full financial authority	Production Information			Construction		Operation and maintenance	
<b>OGC gateway process 2007</b>	Business strategy		Establish business needs	Develop business-case		Develop procurement strategy			Competative procurement		Award and implement contract	Manage contract	Closure	
<b>PMBOK 2008</b>	Initiating				Planning			Executing				Closing		
<b>Decision Stage Gate Reference Model 2010</b>	Business development		Strategy feasibility study			Development of the concept	Pre-engineering		Detailed engineering			Construction and delivery	Completion and hand over	Operation
<b>Victorian ICT investment life cycle 2008</b>	Understand and explore		Identify and refine option	Decide to invest		Procure a solution					Manage delivery	Review and learn		
<b>RIBA PoW 2013</b>	Strategic Definition				Preparation and brief	Concept Design	Developed Design		Technical design		Construction		In Use	
<b>Prince2</b>	<b>Starting Up a Project (Pre-Project)</b> 1.Project Brief, outline of Business case 2.Initiation Stage Plan 3.The Project Product Description		<b>Initiating a Project</b> 1.Strategy documents (Risk, Quality, Configuration & Communication Management 2.Business Case Document 3.Project Plan, Product Descriptions 4.P Control description, Team Structure		<b>Directing a Project</b>		<b>Managing Stage Boundary</b> 1.End Stage Report 2.Update the Business Case and Plan with actuals to date 3.Next Stage Plan 4.Benefits Review Plan (measurements/lessons learned)	<b>Controlling a Stage (Monitor &amp;control act)</b> 1.Risk mng and change control 2.Reporting 3.Progress (Project Board will review progress so far, compare benefits so far, review current stage w/ End Stage Report).	<b>Managing Product Delivery</b> Ensure that planned products are created and delivered 1.Ensure that work is done 2.Quality criteria 3.Check Workpck			<b>Closing a Project</b> (Execute a controlled close to the project) 1.Check:extent to which objectives set out in the PID have been met. 2.PID and customers satisfaction with the deliverables 3.Hand-over and acceptance 4. End Project Report		
<b>Neste Steg</b>	Clarification of ideas and needs	Project framing / project description and choice of strategic solution	Programming and development of planning and project basis		Prepare alternatives based on the chosen strategic solution and choose the main physical design	Establish a sufficient basis for a decision on implementation	Detailed engineering		Production and deliveries	Delivery and commissioning Ev. Transfer to operation		Use and management	Winding up	

## 2.1.6 Prince2

PRINCE2 is defined a generic method for Project Management, that can be used for any project. PRINCE2 consists of four integrated elements, namely Principles, Themes, Processes and Tailoring. The Processes describe the project lifecycle, from pre-project activity until the end. PRINCE2 is a process-based approach and consists of seven processes, each process consisting of a set of activities. The seven processes are:

- *Starting Up a Project (Pre- Project)* is the first phase where the purpose is to examine the question “Do we have a worthwhile and viable project?” by providing the Project Board with the necessary information to make the decision through the Project Brief which will contain information on the Business Case and in that way prevent poor projects from starting up. This phase consists of six activities, namely: Appointing the Executive and the Project Board (by Corporate or Program Management & Executive), Capturing Previous Lessons, Designing & appointing the project management team, Preparing the outline Business Case, Selecting the project approach and assembling the Project Brief and Planning the initiation stage.
- *Initiating a Project is the second phase, where* the purpose is to understand and evaluate what needs to be done in order to deliver the product(s). While the first phase considers if the project is viable, in this phase the focus is to build a foundation so all stakeholders are clear on what the project will achieve. This phase consists of following activities; Identifying the reasons for doing the project and the Benefits and Risks, Identifying the Scope, more precisely what is to be done and what will not be included, identifying the products that are to be delivered, ensure that quality will be achieved, identify ways how risks, issues and changes will be identified and followed up, identify how project progress will be monitored and most importantly identify how PRINCE2 will be tailored to suit the project?
  - *Directing a Project* is the third phase where the purpose is to enable the Project Board to be accountable for the project by making key decisions, and to have overall control. Activities include authorizing the initiation stage, authorizing the project, authorizing a stage/exception plan, giving ad hoc direction and authorizing the project closure.
  - *Controlling a Stage* is the fourth stage where the purpose is for the Project Manager to assign the work to be done, monitor this work, deal with issues, report progress to the Project Board and take corrective action to ensure that the stage remains within tolerance. The activities include authorizing work packages, reviewing work package status, checking if work packages are complete and signed for, reviewing the stage status, reporting highlights, capturing and examining the issues and risks and taking corrective action.
  - *Managing product delivery* is the fifth stage where the purpose is to manage and control the work between the project manager and the team manager by placing certain formal requirements on the accepting, executing, and delivery of

products. The activities included are accepting a work package, executing a work package and delivering a work package.

- *Managing a stage boundary* is the sixth stage. Activities include planning the next stage, updating the project plan, updating the business case, reporting stage end, creating stage end report and producing an exception plan.
- *Closing a project* is the seventh and final stage where the purpose is to provide a fixed point to check that the project has reached its objectives and that the products have been accepted. Activities included are: preparing planned closure or prepare premature closure, handover of products, evaluating the project and recommending project closure.

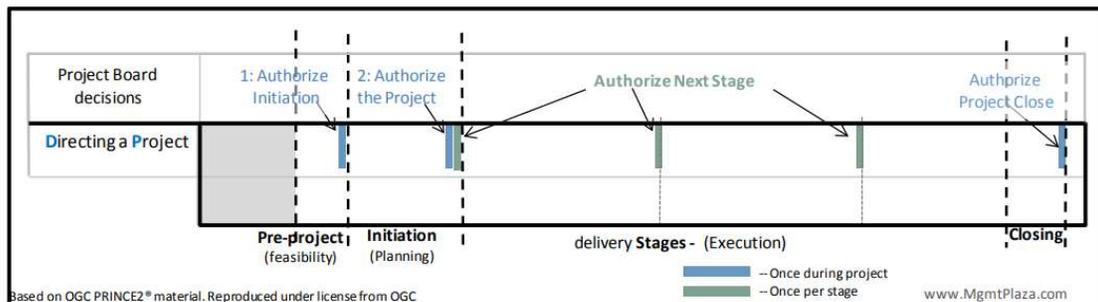


Figure 2: The PRINCE2 timeline

### 2.1.7 Neste Steg/Next Stage

*Next Step or Neste Steg* in Norwegian, is a framework that was created by Bygg21 and that describes the construction process over time, in ten steps from start to finish. The purpose was to develop a common norm for construction projects in Norway, by creating a common language for the industry. Between these ten steps there are decision gates that determine whether one should move on or not. Next Step is based on four different perspectives, namely the owner-, user-, executive- and authority perspective. The four perspectives are again found in each of the ten steps, where the core processes, the management processes and the deliverables are defined for each of them. Next Step takes also into account *The State's Project Model*, which is the process of quality assurance in Norway.

Between each of the ten steps, there are, as mentioned, decision gates. These are based on the management processes and are used as criteria for the next step. Each decision gate consists of six variables, namely, planning, procurement, BIM, communication, and sustainability (economy, environment and socially).

The ten processes of Next Step are:

- *Clarification of ideas and needs* is the first step in Next Stage, where the aim is to identify and clarify opportunities and / or needs at an overall level. The owner focuses mainly on identifying goals and ambitions, preparing the Business case, and mapping

the political guidelines. The user focus is mainly on identifying the gap between need and current condition, whereas the executive part focuses on a preliminary investigation of property conditions, planning status, ground conditions, water supply, etc. From the authority perspective, the focus is mainly on the plan status and other relevant guidelines. Overall, the main deliveries in step one is the need analysis, condition assessment and market assessment along with mandate.

- *Project framing/project description and choice of strategic solution* is the second step in Next Stage. The aim here is to identify and clarify overall needs, goals and frameworks. An example here is location and how the need can be realized (rent, new construction, rehabilitation, etc.). In this step, the owner focuses mainly on the same points as in the first step, but in addition there is a focus on clarification and assessment of government requirements. The authority perspective focuses on review of area plans and early clarification and assessment of regulatory requirements. In addition, a concept selection study (KVU) and KS1 should be performed before completion (phases in the The State Project Model). Looking at the deliveries here, a business plan has been established, so it will result in a concept selection study (KVU) which needs to go through external quality assurance (KS1) before concept selection can be made in the government. This is mainly applicable for Norway.
- *Programming and development of planning and project basis* is the third step in Next Stage. The aim in this step is to establish a sufficiently detailed description of needs (programming) and internal and external framework conditions, including plot conditions and plan status. The owner focuses mainly on opportunities and prerequisites where it is required to specify goals, frameworks and success criteria for the project. The user focus is mainly conducting feasibility studies and investigating actions and their consequences and clarifying concept choice. The executive focus is mainly on start-up meetings with the municipality and announcing the start of the planning work, whereas the authority focus is on start-up meeting and examining opportunities within the municipality area plan and other plan and guidelines. The main deliveries here are alternative analyzes and financial framework along with preliminary management documents and updated business plan. For major public projects, the KVU and KS1 report need to be available.
- *Prepare alternatives based on the chosen strategic solution and choose the main physical design* is the fourth step in Next Stage. The aim here is to identify which main physical design provides the best solution. The owner focus is mainly on confirmation of business plan, including selection and prioritization of management parameters, whereas the user focus is on concretization and verification of requirements and needs. The executive focus is on concretizing and verifying frameworks along with clarifying terms and needs, negotiating a development agreement and making sure that the proposed zoning plan is complete. It also includes checking that the proposal is in line with the minutes from the start-up meeting. The main deliveries here are preliminary

project document, cost calculation, financing, contract and organizational structure, along with solution for construction method, proposal for zoning plan, technical guidelines and possible impact assessment. For major public projects, KS2 is included.

- *Establish a sufficient basis for a decision on implementation* is the fifth stage in Next Step, where the aim is to ensure that a decision on carrying out is made on a correct basis. The owner focus is similar to the one in the previous stage, where one in addition checks the compliance with zoning decisions and business plan. The user focus is on concretization and verification of technical requirements and needs for equipment, along with verifying the assessment of functions and solutions with the required level of detail. The executive and the authority focus are similar to the previous stage, only in the fifth stage, the KS2 is necessary before finalizing the stage. The main deliveries here are similar to the previous stage and stage three, along with updated business plan, an implementation model and a solution for construction method and technical guidelines.
- *Detailed engineering* is the sixth stage in Next Step, where the aim is to develop a sufficiently detailed and quality-assured work surface so that safe and good workmanship is possible. The owner focuses to ensure that the necessary resources and expertise are in place so that the project can be developed in accordance with the business plan, whereas the user focus on ensuring that requirements and needs are considered in the design. The executive clarifies what is to be performed. The main deliveries here are the project plan for production, delivery and commissioning along with an updated business plan.
- *Production and deliveries* is the seventh stage in Next Step, where the aim is to execute and deliver according to the project description and goals. Here the owner focus is on ensuring that the necessary resources and expertise are in place, so the project is executed in accordance with the business plan. The user ensures that the requirements and needs are met and the authority clarifies the responsibilities and ensures consistency between premise documents and produced solutions. The main deliveries are status report, an updated business plan and "as built" documentation.
- *Delivery and commissioning/Transfer to operation* is the eight stage in Next Step, where the aim is to ensure that the structure is ready for use and transferred to operation. Here, the owner assesses whether the building satisfies the business plan, the user runs trial operation and evaluates the results, and the executive party implements corrective measures in the event of deviations. The main deliveries here are the product evaluation according to project goals, FDV documentation and final settlement /completion certificate received.
- *Use and management* is the ninth step in Next Stage, where the aim is to ensure that the intended effect is achieved through the use of the structure. Here, the user focus is

mainly on management of the building or facility, along with possible post-evaluation of economics (possible benefit / cost calculations). The user focus is on maintaining quality of use, evaluating and measuring improvements, along with evaluating usability and user satisfaction. The executive focus is on ensuring optimal operation, testing and controlling according to the contract - and the authority focus is on the follow-up of operating licenses. The main deliveries here, are the post-evaluation of the business plan, establishment of financial coverage for the investment, operational evaluation and evaluation reports.

- *Winding up* is the tenth, and final stage in Next Step, where the aim is to achieve sustainable demolition, termination of ownership or change of the building's purpose of use. The owner focuses on the final accounts, the user on cessation of operation, whereas the executive focuses on disposal of the building and termination of obligations. The main deliveries are ROI (return on investment), final verification of business plan, cessation of operation, disposal of the building and termination of obligations.

### 3. Deciding the standard life cycle model for Optimaltid

In this part it will mainly be relevant to compare PRINCE2 and Next Step/ Neste Steg.

Overall, it can be seen that PRINCE2 focuses largely on the activities within the project life cycle, while answering questions such as what is to be delivered, how to deliver, when to deliver and who will deliver. Looking at PRINCE2, the deliveries themselves are the focus, whereas Next Stage/ Neste Steg is considering the complexity between the different parties involved, where the deliveries are a combination of the ongoing interaction and dynamics between the four parties involved (the owner, user, executive and the authority). Although the core processes, the management processes and the deliveries are defined for each of the four, it is the interaction that leads towards a decision gate that is found between two stages in the ten-stage model. Each decision gate consists of six parameters, namely, planning, procurement, BIM, communication and sustainability (economy, environment and socially).

For the Optimaltid-project, where the aim is not only to identify the right time for involving the contractor, but the 'right' competence on the right task at the right time, it is necessary to identify pitfalls both within the stage and between stages. By breaking down the decision gate itself, along with each stage, it is possible to map the pre-construction activities, along with the competence needed and who can provide it. Here it is possible for the owner to break the competence-need into what contractor should and can cover and evaluate what the owner only need assistance for.

Used correctly, Neste Steg, could have the potential of mapping what is needed when of who and how one's delivery effects someone else's. The project model itself, having the breakdown structure it has, yields an expectation of proactive participation and cooperation as it clearly puts emphasis on dependencies between the parties involved. Neste Steg takes also into account The State's Project Model, which is the process of quality assurance in Norway and the steps Norwegian state-owned projects, that need to relate to a rigid legalization. Priority in NTP is based on KVV and KS1, while the State Budget-priority requires KS2. This complexity and degree of freedom is visualized in a more detailed manner and can be an important tool for contractors in order to estimate risk. Changes may cause delays and high cost, so it is therefore easier to perform the impact analysis changes can cause by using Neste Steg model. This will also be of importance to foreign contractors, who may not be accustomed with details of the national legalization.

For all these reasons above, Neste Steg is considered to be more mature for this particular use as it offers the transparency needed in public projects.

Looking and comparing the final stage in the project lifecycle, Neste Steg stands out, where it does not 'end or close' a project, but rather 'winds it up'. This is an important aspect, especially

for state-owned companies concerning the international-climate obligations for 2050 (FNs Bærekraftsmål/Sustainable Development Goals).

Evaluating the more practical aspects, the official language is Norwegian, where everything from the legislation to formal documents is in the native language. Neste Steg is not only in Norwegian, but it covers different activities in each stage. The whole idea with Neste Steg was to take into account the different project-phase-definitions, by making it a framework for construction processes. The importance of this is clearly defined in Rundskriv 19: Statens prosjektmodell - Krav til utredning, planlegging og kvalitetssikring av store investeringsprosjekter i staten - (Finansdepartementet): ``Dersom departementet/etaten benytter andre betegnelser på prosjektfasene eller begreper i utredningsdokumentene i sine prosjektstyringsverktøy, skal det dokumenteres hvordan disse svarer til faser og begreper i dette rundskrivet` (Rundskriv R-108/19)



Figure 3: The State Project Model

The document is from The Royal Norwegian Ministry of Finance, which says that if other terms for the project phases have been used, it must be documented how these correspond to phases and concepts in the figure above/ its equivalent. These steps and definitions/phases are already implemented in Neste Steg.

Last, but not least, the objective with this project is to enable all public builders to <simulate> their project and identify the most advantageous time for contractor involvement. In order to do so, Neste Steg need to be highly dynamic so it can be used by different infrastructure builders and ‘transfer of experience’ can be gained - while avoiding misunderstandings and inconsistency in term definitions.

*Postscript: In February 2022 Next step comes as a draft Norwegian standard (NS 3467 Steg og leveranser i byggverkets livssyklus [Civil construction project (lifecycle) – phases and deliverables]. If (or when) this becomes accepted as standard, it will be a natural candidate for Optimaltid.*

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