Use of wood in public construction

Procurement guide

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Abstract

Construction and the built environment are a significant consumer of resources. Every year about half of the world's raw materials are used for construction. At the same time, the built environment produces about a third of the global greenhouse gas emissions.

Through public construction projects the builders and developers can play an important role in promoting the market access of new, more sustainable solutions for construction.

Public builders are showing the way for the entire construction sector.

As expertise on wood construction grows stronger and the level of costs decreases thanks to the increasing volumes, investments in public wood construction will increase the use of wood in the private sector as well. By selecting wood construction public operators can also steer common funds to implementing societal objectives: reducing climate emissions by sequestering carbon to the building stock and supporting the domestic economy by making use of domestic raw material and local expertise.

The procurement guide for wood construction has been prepared in cooperation with various wood sector professionals, including consultations with experts from wood products industry to designers and from construction companies to municipal decision-makers. The aim was to create a package that will serve all those involved in construction on an equal standing.

Page 47 were updated on 3 November 2022 and this version replaces the previous one published on 28 October 2022. In addition, page 36 was updated on 27 December 2022

Keywords increasing use of wood, public procurements, public builder, wood construction, carbon neutrality, carbon footprint, procurement, procurement procedure

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Tiivistelmä

Rakentaminen ja rakennettu ympäristö on merkittävä resurssien kuluttaja. Rakentamiseen käytetään vuosittain noin puolet maailman raaka-aineista. Samalla rakennettu ympäristö tuottaa noin kolmanneksen globaaleista kasvihuonekaasupäästöistä.

Julkisten rakennushankkeiden kautta rakennuttajatahot voivat olla merkittävässä roolissa edistämässä uusien kestävämpien rakentamisen ratkaisujen markkinoille pääsyä.

Julkiset rakennuttajat näyttävät suuntaa koko rakennusalalle.

Panostukset julkiseen puurakentamiseen lisäävät puun käyttöä myös yksityisellä sektorilla, kun puurakentamisen osaaminen vahvistuu ja kasvavat rakennusvolyymit painavat myös kustannustasoa alaspäin. Valitsemalla puurakentamisen julkiset toimijat voivat myös kohdentaa yhteisiä varoja yhteiskunnallisten tavoitteiden toteuttamiseen: vähentää ilmastopäästöjä sitomalla hiilidioksidia rakennuskantaan sekä tukea kotimaan taloutta hyödyntämällä kotimaista materiaalia ja paikallista osaamista.

Puurakentamisen hankintaopas on työstetty yhteistyössä eri puualanosaajien kanssa. Työssä on kuultu asiantuntijoita aina puutuoteteollisuudesta suunnittelijoihin, rakennusliikkeiden edustajista kuntapäättäjiin, ja näin on pyritty luomaan kaikkia rakentamisen osapuolia tasapuolisesti palveleva kokonaisuus.

Sivua 47 on päivitetty 3.11.2022 ja aineisto korvaa aikaisemmin, 28.10.2022 julkaistun version. Lisäksi sivu 36 on päivitetty 27.12.2022.

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Användningen av trä i offentligt byggande: Guide för upphandling

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Referat

Byggande och den byggda miljön är en betydande resurskonsument. Årligen används cirka hälften av världens råvaror för byggande. Samtidigt producerar den byggda miljön cirka en tredjedel av de globala utsläppen av växthusgaser.

Byggherrarna kan genom offentliga byggprojekt spela en betydande roll i fråga om att främja att nya, hållbarare lösningar inom byggande släpps ut på marknaden.

De offentliga byggherrarna visar riktningen för hela byggnadsbranschen.

Satsningarna på byggande av offentliga byggnader i trä ökar användningen av trä också inom den privata sektorn, eftersom kunnandet på området stärks och de ökade byggvolymerna även håller kostnaderna nere. Genom att välja att bygga i trä kan de offentliga aktörerna också använda de gemensamma medlen till att uppnå samhälleliga mål: att minska klimatutsläppen genom att binda koldioxid i byggnadsbeståndet samt att stödja landets ekonomi genom att använda inhemskt material och lokal kompetens.

Guiden för upphandling av träbyggande har sammanställts i samarbete med olika experter inom träbranschen. I arbetet har man hört olika experter, från personer inom träindustrin till planerare, från företrädare för byggföretag till kommunala beslutsfattare. Avsikten med detta har varit att skapa en helhet som gynnar alla parter inom byggande jämlikt.

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PREFACE

The Wood Building Programme is a joint Government programme coordinated by the Ministry of the Environment aimed at increasing the use of wood in urban development, public buildings and large constructions. The programme also aims to diversify and expand different applications for wood while creating as much value added as possible.

The Ministry of the Environment's Wood Building Programme commissioned and produced this procurement guide for wood construction. The aim of the guide is to increase wood construction in Finland as a form of carbon-neutral construction. Naturally, there are other carbon-neutral building methods, but this publication focuses on wood construction.

Public developers are pioneers, trendsetters and facilitators in promoting wood construction, which is why the guide is aimed at those whose actions can create a strong platform for achieving the carbon neutrality goals. Leading by example, public developers can also guide the private sector and remove obstacles from achieving the private sector's carbon neutrality targets.

Extensive cooperation with experts in the different areas of wood construction was seen as the only correct way to approach the topic. The procurement guide was produced in cooperation with professionals from different fields of wood construction. Six workshops (log construction, CLT and prefabricated construction, designers, construction companies and clients) and numerous discussion groups helped us gain an understanding of how different parties perceive the challenges and successes related to wood construction procurements and the means that can be used to genuinely promote and strengthen the carbon neutrality goals and to create healthy competition between companies.

One of the clearest lessons learned during the project is that wood construction in its current form cannot be put out to tender in the same way as normal projects. Industrial wood construction includes several different systems, different implementation models and combinations of these, and the client should understand and account for their different effects on the course of the project. The recurring themes of the guide are market surveys, dialogue between the client and the tenderer, and frontloading.

The use of new, not yet standardised, project models is recommended to be done in close cooperation with potential tenderers right from the start. Frontloaded communication

between tenderers and clients gives the client an understanding of the project's boundary conditions, the possible limitations of capacities or technical solutions, and the kind of opportunities for innovation that the client might not otherwise be able to require. It also gives the tenderer the opportunity to invest and develop its production as needed in a timely manner. Open communication and market dialogue promote healthy competition and enable competitive tenders.

The procurement of wood construction, like the development of other new, not yet established methods, requires the client organisation to have a common will and, to some extent, change its operating methods, but I believe that only in this way is it possible to bring about genuine change.

The development of carbon-neutral building methods, the promotion of the vitality and attractiveness of municipalities and the creation of local jobs are certainly among the objectives of every public client, and we hope that our guide will help you in achieving them.

A carbon-neutral city is created through procurement!

I hope you find reading our procurement guide for wood construction a rewarding experience.

Sini Koskinen
Specialist, Wood Construction Programme
Ministry of the Environment

1 Introduction

1.1 Role of public construction as a trendsetter for sustainable construction

Construction and the built environment are a significant consumer of resources. Every year about half of the world's raw materials are used for construction. Approximately 40% of the available primary energy is used in construction and buildings. At the same time, the built environment (construction, heating of buildings and electricity use) accounts for about a third of global greenhouse gas emissions. Through public construction projects, municipalities, cities and other builders and developers can play an important role in promoting the market access of new, more sustainable solutions for construction.

The promotion of wood construction is undoubtedly a step in the right direction. Public builders are showing the way for the entire construction sector. As expertise in wood construction increases and the cost level decreases thanks to the increasing volumes, investments in public wood construction will increase the use of wood in the private sector as well. By selecting wood construction, public operators can also steer common funds to implementing societal objectives: reducing climate emissions by sequestering carbon to the building stock and supporting the domestic economy by making use of domestic raw material and local expertise.

Various experts in the wood industry contributed to writing the procurement guide for wood construction. Considering the different frame systems of industrial wood construction and the comparatively new industries, discussions with different groups of experts in wood construction became a particularly important method in the work on the guide. The experts consulted during the process ranged from the wood products industry to designers, from representatives of construction companies to municipal decision-makers, and these experiences were leveraged with the aim of creating a guide that serves all parties involved in construction equally.

As part of Finland's carbon neutrality target, the Ministry of the Environment's Wood Building Programme has worked with stakeholders to develop national targets for public wood construction. Targets have been set for the share of wood in all new public construction and for the most significant building types in terms of building quantities.

1.2 What is a public wooden building?

In this guide, 'public building' refers to a building built by operators whose procurement must comply with the Act on Public Procurement and Concession Contracts, and 'wooden building' refers to a building with a load-bearing frame that is mainly made of wood.

There is no unambiguous definition of a wooden building. The most commonly used definition is Statistics Finland's definition of building material: "'Building material' means the material from which the load-bearing vertical structures of a building are mainly made." This is the definition used to compile statistics on wood-framed buildings.

The reduction of carbon emissions and the construction of carbon reservoirs are a key societal objective. Wood can also be used in building components other than load-bearing structures, and the quantities can be significant. A construction project must always be considered as a whole, and the use of wood can also be significantly increased in non-load-bearing structures.

In every wood construction project, it must be determined whether the project refers to a wooden building as defined by Statistics Finland or to something else. Those making the definition should pay attention to what the project is aiming for and, on this basis, draw up an appropriate definition of the building.

Photo 1. Finnish-Russian School, 2021, Helsinki. Building owner/developer: Senate Properties, Construction Manager: Timo Juolevi. Type of contract: Alliance contract. Architectural design: Arkkitehdit Frondelius+Keppo+Salmenperä Oy, Juha Salmenperä. Photographer: Kimmo Räisänen

1.3 Why use wood in public construction?

As one cubic metre of wood grows, it sequesters a tonne of carbon dioxide from the air and releases 700 kg of oxygen into the atmosphere through photosynthesis at the same time. Half of the dry weight of wood is carbon. Forests are carbon sinks when they grow and, when felled, they act as carbon reservoirs as wood products. This means that wooden buildings, like other wood products, are carbon reservoirs that sequester carbon throughout their life cycle, which includes use, reuse and recycling. The impact of a felled tree on the climate depends on the purpose for which it is used. From the point of view of the climate, the best thing would be for the carbon sequestered in the wood to remain in the final product for as long as possible before it is released back into the atmosphere. Naturally, carbon remains longer in long-lived wood products, such as wooden buildings, than in short-lived wood products.

Wood is an ecological construction material. A timber frame specifically reduces emissions from the frame, and the wood also stores carbon. When properly used, wood is durable and long-lasting. The tree stock regenerates every 100 years or so. In Finland, forests are managed sustainably and produce more wood than is used. More than half of the annual forest growth could be sustainably used. (Natural Resources Institute Finland, 2022) The carbon footprint of wood construction is several tens of per cent smaller than that of the solutions typically used today. In particular, the carbon spike during construction can be reduced by building from wood.

Wood construction and the wood products industry are highly significant for the Finnish economy (Natural Resources Institute Finland, 2021).

Unlike other manufacturing of construction materials and products, increasing wood construction creates jobs especially outside growth centres and, by supporting wood construction, public developers also support domestic industry and create new jobs in the wood products industry.

Wood construction has many advantages compared to traditional concrete construction. Modern solutions for wood construction are often prefabricated. In prefabricated construction, a significant part of the construction takes place at the factories making the prefabricated components, which significantly shortens the on-site construction time of a wooden building. A short on-site construction time is an advantage, especially in an urban environment, and the construction sites of wooden buildings have been found to produce less noise and dust nuisance.

The weight of wood is also seen as an advantage; since wood weighs about a third of the weight of concrete, wooden buildings are considerably lighter than concrete buildings. In practice, the lightness of wood means lighter and cheaper foundations and enables use on, for example, clay soil or protected terrain. A solid wood structure is a single-material structure, which is safe in terms of buildings physics.

Wooden interiors have been found to have positive effects on wellbeing. Wood has the ability to bind and release moisture, which helps to even out the humidity of indoor air and to prevent mould, for example. Wood has also been found to have antibacterial properties that reduce the amount of microbial growths and dust mites. (Vainio-Kaila, 2017)

Wood is also an antiseptic material. While emissions of volatile organic compounds (VOC) from many materials are considered a health risk, the combination of alcohols, aldehydes and terpenes (extracts) that creates the characteristic scent of wood has been shown to be harmful to bacteria but not to humans.

1.4 Special characteristics of wood construction and industrial construction

Wood construction in itself is no more challenging than any other type of construction. There are several different systems and implementation models for wood construction, so the client needs to make certain decisions earlier than in more standardised concrete construction.

When the developer designs the building, it is advisable, at least during the first few projects, to use a wood construction consultant or material suppliers to support the design in order to ensure that the plans correspond to existing systems and any production constraints from the very beginning. Changing advanced designs later can be costly and challenging.

This section aims to highlight the key differences of a wood construction project that the client organisation should take into account when planning the procurement and selecting implementation models.

In industrial construction, products are manufactured in factories with a high degree of prefabrication. This requires more careful planning and more detailed scheduling and management than usual. The advantages of prefabrication are improved productivity, faster construction time and better quality management. In many implementation methods, the process may differ from on-site construction, and its key differences must be identified so that the potential benefits can also be realised for the project and the client.

The main types of wooden buildings are

- solid wood on-site builds,
- timber on-site builds,
- various column and beam frames,
- prefabricated wood frame panel or module solutions,
- prefabricated solid wood panel or module solutions,
- various hybrid frames,
- different combinations of all of the above.

It may not be possible to cost-effectively implement different solutions with the same plans. Technically, there may be differences in a number of aspects, such as spans, implementation of building technical systems or dimensions. Consequently, competitive tendering using a single set of reference plans may lead to inefficient competition. Advanced planning in the project phase reduces the competition between different methods. At worst, the planning work will have to be redone several times and the best solution for the project will not be found.

In addition to technical solutions, the functioning of the market must be considered. Operators in the wood construction sector have different business models, so the market situation and the suitability of the offering for the planned procurement and building must be confirmed in advance. Some operators offer turnkey deliveries, even including maintenance during use, and, at the other end of the scale, operators sell products to the construction site without installation. These extremes lead to very different procurement processes and implementation models.

Wood construction does not automatically involve more risks than other types of construction. However, the client must identify a few unusual situations in its project, which it must take into account in the risk management plan. The main technical difference is moisture management, which must be taken into account from the factory to the use of the building, not just during the installation. Another factor is the consideration of business risks, as a significant proportion of the work can be done off-site. This must be taken into account in contracts and contract terms.

Wood construction enables more extensive industrial prefabrication in factories. Prefabrication increases the productivity of work and improves quality. However, the client must pay special attention to the fact that, in this case, the work is not carried out on the site, and instead a significant part of value creation may take place far away. This results in an obvious need to agree on product manufacturing control and responsibilities with the contractor. Industrial prefabrication also leads to extensive production subassembly contracting and the production of design documentation in several different locations. The client must understand this change in the value chain even if the project itself is carried out with a main contractor.

The main competitive advantage of wood construction is the speed of construction. The short lead time of the construction site is due to the fact that components can be prefabricated in production facilities in parallel with the construction site. This means that purchases are clearly more frontloaded, as is the project's cash flow compared to conventional construction. Frontloading must be taken into account as part of the drafting of contracts in the normal terms and conditions on instalments, guarantees and insurance and in other key commercial terms.

Increasing the level of prefabrication also requires significantly more detailed and frontloaded planning and more planning in general. The production of prefabricated products can sometimes be started even before the earthworks. In machined manufacturing, all dimensional data and details must be planned before the start of production. The project may use new design solutions and, due to subassembly design, the project may have several different design parties. One key part is designing the project's information management and building information model (BIM) requirements. Building information modelling and its design are prerequisites for utilising industrial manufacturing. For the client, this

may mean the need to think about quality assurance in new ways, for example through third-party inspections, model reviews at the factory or other possible measures. The scheduling of and responsibility for these potentially unusual phases is a key part of project planning. In this way, the level of prefabrication and scheduling of planning affect the procurement of the entire project and the selection of the implementation model. Front-loaded planning requires cooperation with industry, so it is often a good idea to select the supplier even before the start of the design phase. Tendering for projects in an advanced stage of design is often difficult, if not impossible, for industry, and modifications can be costly for the client.

In general, it can be said that wood construction can change the entire construction process in some implementation models. On the other hand, in some models, wood construction is practically no different from conventional construction. Assessing these differences and their impact on the procurement process and gathering the right information about them early on are the keys to a successful procurement. (European Commission, 2020)

1.5 Structure of the guide, interfaces and advisory services

This guide deals with a single wood construction project and its commissioning. The guide does not address the strategic goals of a municipality or society in general or land use issues. However, it can be generally said that a wooden building often meets strategic objectives, so a wood construction project should be seen as an entity larger than a single project.

This guide is also not a presentation of the interpretation of the Act on Public Procurement and Concession Contracts; it focuses on the procurement of a wooden building and its special characteristics. Neither is this guide a design guide or a technical guide. The aim of this guide is to highlight key factors connected to the market and technical implementations that may have an impact on the choice of procurement procedure and implementation method.

In this guide, conventional construction, traditional implementations, normal operations and typical on-site construction refer to buildings that are not industrially prefabricated wooden buildings. The compiling of this guide took account of previous guides:

- Puuinfon opas julkisiin hankintoihin ("Puuinfo's guide to public procurement") (2017) https://puuinfo.fi/puulehti/puulehdet/opas-julkisiin-hankintoihin/
- The Ministry of the Environment's Green public building Procurement guide (2017) https://julkaisut.valtioneuvosto.fi/handle/10024/80653
- A-Insinöörien Opas vähähiiliseen rakennuttamiseen ("AINS Group's Guide to low-carbon construction") (2021) https://www.ains.fi/oppaat/vahahiilinen-rakennuttaminen?hsCtaTracking=1abb960f-299c-4c5b-a6cd-de6f-4339f35e%7Cafb800b7-6d62-4851-be3a-4e222be09867

An electronic, more complex and evolving version of this guide has been published in Finnish at www.puuinfo.fi under Rakennuttaminen.

Photo 2. Little Finlandia, 2022, Helsinki. Building owner/developer: City of Helsinki, Urban Environment Division. Form of contract: Contract for technical solutions. Architectural design: Jaakko Torvinen, Elli Wendelin, Havu Järvelä, Professor Pekka Heikkinen and Architects NRT Ltd, contractor's architect Oy Arkkitehtisuunnittelu Arkitekturum Ab Ltd. Photographer: Tais Griguol

2 Value chain of wood construction

The value chain of wood construction is a multi-stage entity. This section aims to describe the entire value chain and to highlight issues that may affect the implementation of the project along the way. The developer does not need to be able to answer all questions in the value chain; suppliers and tenderers solve and optimise issues related to the value chain together. However, it is good for the developer to know the factors that may affect the construction and implementation of the operators' tenders.

Wood construction works well as a long-term carbon reservoir. In general, efforts should be made to lengthen the carbon cycle, and wood construction is one of the key means for this. Figure 1 illustrates the upstream value chain of wood raw material in 2021. In 2021, plywood and sawn timber used as construction raw materials were, to a large extent, exported. It is important to be aware that wood construction can be significantly increased without increasing logging by reducing the export of sawn timber. Another key finding from the upstream value chain is that the different wood products form a whole. A tree produces different products at different stages of its growth, and different stages of the process generate side streams. Sustainable forest management generates all of these products, and responsible production and use of the entire product portfolio leads to a sustainable way of building. It should also be noted that the properties of the products used in construction already begin to be formed in the forest. Different regions produce products with different dimensions, different sawmills cut different woods, and there are regional differences in, for example, the distribution of wood strength classes.

Photo 3. Photographer: Tero Pajukallio. Ministry of the Environment

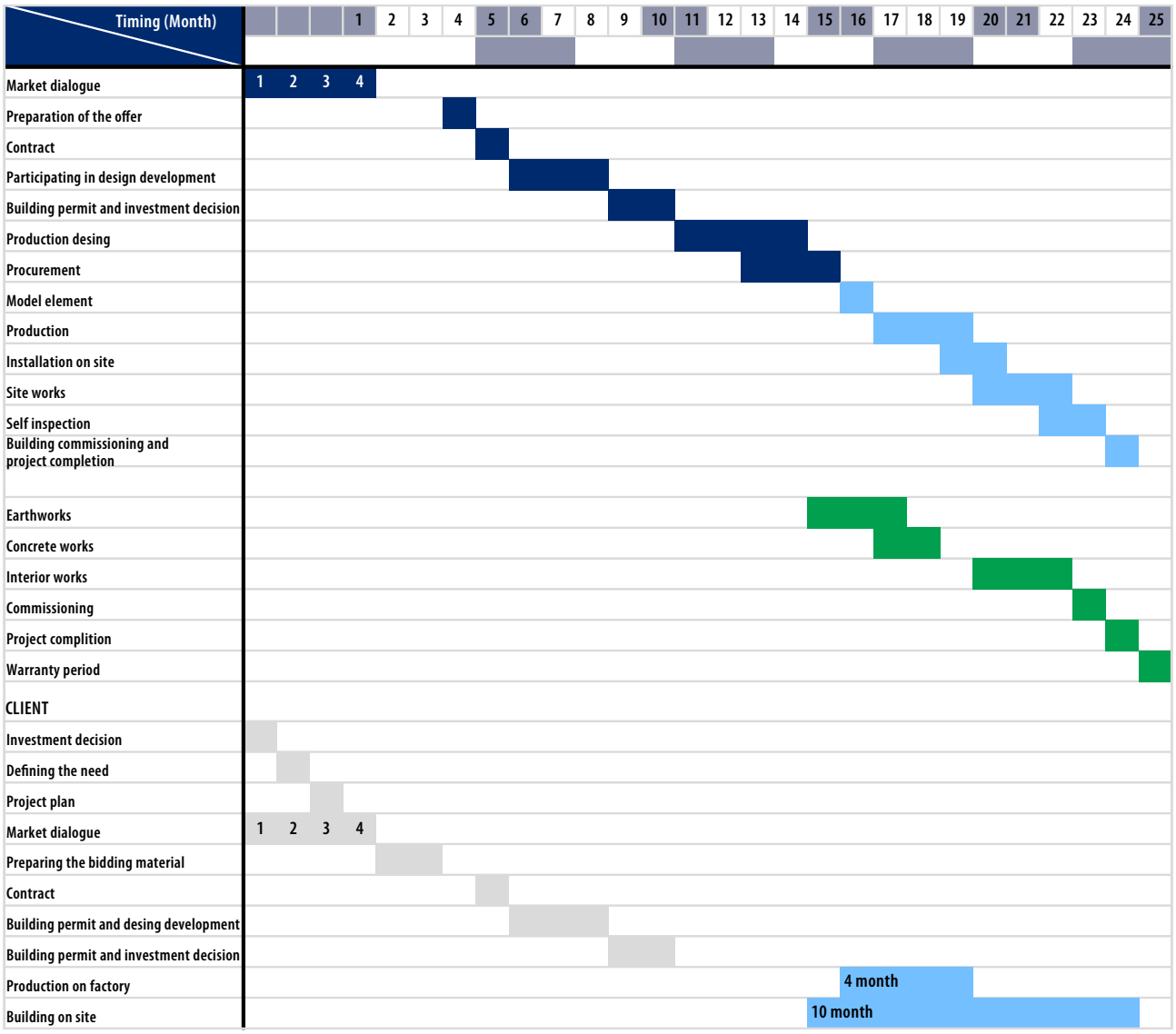
Sawn timber and other wood products can be further processed into engineered wood products. The most common engineered wood products used in construction are logs, cross-laminated timber (CLT), glued laminated timber (glulam) and laminated veneer lumber (LVL). It is important to note that, at this stage, the products typically turn into project products, i.e. they are made to order. In practice, a project product always requires completed designs with dimensions and other features. Consideration of the planning and procurement schedule is a critical step in planning the implementation of the procurement.

Engineered wood products and sawn timber can be prefabricated before on-site construction work. There are many variations of prefabrication and its value chain. This stage is critical in improving the productivity of the entire construction process, and special attention must be paid to prefabrication when planning the procurement. In addition to the factory making the prefabricated components, the industrial value chain of wood products may include numerous subcontractors and network operators. Prefabrication factories can also form their products by combining the offerings of several prefabrication factories.

An essential part of subassembly manufacture and especially leveraging its efficiency is design for manufacturing and assembly (DFMA), where, in addition to the technical design of the products, the manufacturing of the product with its work phases and installation is planned. In subassembly manufacture, the design and procurement time of the subcomponents again plays a critical role in the planning of the procurement, often setting the pace of the planning of the entire project. The process of reviewing and approving the subcomponents, too, must be planned together with the client, and time must be reserved for it in the planning schedule.

The value chain and the chosen implementation method must also be taken into account in the construction site. The benefits of prefabrication must be realised during the construction site phase as a shorter construction time and a smaller site organisation. In order to optimise the project and the value chain, it is essential to optimise the whole instead of a single phase. It is also critical to understand that high-quality planning is the foundation of leveraging the value chain in the project.

Figure 2. The figure illustrates an example of the scheduling relationship between the purchasing organisation, the subassembly supplier and the construction site. The time required for the needs analysis and the project plan varies significantly from project to project. The procurement organisation may choose to conduct market dialogues at all stages of the process. In the example, out of a project time of approximately two years, the supplier produces products for approximately four months. The implementation time of the construction site in the example is ten months. Production planning and procurement synchronise production, and the time required by the implementation method must be reserved for these. It should be noted that production or procurement can rarely be commenced before the elimination of any conditionalities, which are typically conditions for financing or for receiving a building permit.



Providing the client with correct and up-to-date information is essential in order to arrive at feasible and profitable design solutions. The reader should note that this chapter only deals with the technical side of the value chain. Commercial relations, the offered product content and the market situation also have a significant impact on decisions, which also emphasises the need for correct information from the very beginning of the project.

When the value chain is long, it is essential for the development of industry that clients communicate their needs and future projects. This is a prerequisite for the development of the supply chain and for achieving benefits for the client in the long term. Timely and front-loaded communication on future projects also encourages the industry to make investments and develop production if they receive indications of future orders well in advance. The development of the entire value chain is slow, so it is critically important to develop solutions that are relevant to clients, in particular. The management of the entire chain differs from one supplier to another, which also supports not designing too far ahead to make the solutions effective and to enable competition.

Recommendations for carbon-neutral public procurement

1. Take advantage of the opportunities offered by the Act on Public Procurement and Concession Contracts. The act enables the use of environmental minimum requirements, criteria and ecolabels in public procurement. The most economically advantageous tender may also be the best for the environment.
2. Prepare carefully. Achieving a higher than normal level of environmental performance requires the ability to spend sufficient time, expertise and consideration on the preparation of the procurement. Carbon-neutral public procurements of wood construction are not necessarily more expensive than normal projects. However, cost-optimisation should be based on careful assessment.
3. Apply a life-cycle approach. There are standardised methods for assessing the environmental and economic impacts of a building throughout its life cycle. These methods can be used to avoid sub-optimisation and to identify cost-effective ways to improve a building's environmental impact or service life. The best benefits of a life-cycle approach are achieved if it is applied already at the design phase.
4. Check the criteria for green financing as well as any start-up assistance available for wood construction. There are products on the financial market that are particularly suitable for supporting ecological construction. The criteria of these financial products should be taken into account during the procurement design phase.
5. Ensure resources for design control. The design phase has the greatest potential to influence, for example, the carbon footprint of the building. The procurement and contracting of building materials after the design phase implement the design and cannot fully bridge any gaps in objectives left unachieved in the design phase.
6. Remember coordination. Public buildings are often implemented as a chain of several successive public procurements. In this case, it is important that the objectives set for the building are transferred to each procurement, taking into account their special characteristics.
7. Utilise existing means. Building regulations, the Act on Public Procurement and Concession Contracts, sustainable development standards and assessment tools all facilitate the objectives of carbon-neutral public construction. The existing means can be used to set effective goals and monitor their implementation throughout the implementation chain. The construction and consulting sector has sufficient expertise to create more carbon-neutral public wooden buildings.
8. Develop procurement expertise through wood construction projects. The procurement preparation phase, the alliance procedure or procurements based on innovation partnership may provide the contracting entity's experts with a good opportunity to update their knowledge. In order to take advantage of this, the procurement should be prepared carefully.

3 Promotion of wood construction in public decision-making

Municipalities' key means of guiding public construction projects are municipal strategies, town planning, land use and land transfer agreements, as well as individual procurement decisions, which are governed by the Act on Public Procurement and Concession Contracts.

This guide focuses mainly on the promotion of wood construction through procurement, but the workshops organised also highlighted the importance of the municipal strategy in its promotion. A strategy for wood construction and/or carbon-neutral construction acts as a 'back support' for the officials handling the projects. It is easy to rely on a strategy, and it eliminates the need to justify carbon neutrality principles again and again for each project.

Strategies also communicate the objectives of wood construction to the industry and encourage the industry to invest and develop its operations.

3.1 A public body as a developer

3.1.1 Needs analysis and project plan

Needs analysis

The preparation of the needs analysis starts with the definition of needs. The needs analysis prepared in cooperation with the user and the client justifies the need for the procurement of the premises or the need to change the existing premises. In addition, the analysis provides a preliminary description of the required facilities and their operational objectives in relation to the needs of the users of the facilities. At the same time, the objectives of building technical systems and their space requirements are defined, and the life-cycle objectives for sustainable development in accordance with the organisation's sustainability objectives are set. On the basis of the specifications, various options for meeting the needs are examined, compared and contrasted, taking into account the preliminary cost impacts. The comparisons are used to select a basic solution that meets the requirements of the client organisation. The needs analysis results in a needs analysis document approved by the client organisation, which it can use to decide whether to embark on the project. (RT 103254, 2020, p. 4.)

It may be challenging to prepare a cost estimate at the needs analysis stage, but that is not a valid reason not to prepare one. The potential uncertainty of costs must be highlighted, and it is an additional piece of information for decision-making. The importance of cost accounting is emphasised in a wood construction project, as there are often no comprehensive space-based cost estimates available for them. Efforts should therefore be made to compensate for this shortcoming with experience gained from previous projects, the experience of other procurement organisations, market dialogues or other means available.

The client organisation either selects a consultancy company to prepare the needs analysis based on the criteria it has set or prepares the analysis itself. Depending on the scope of the project, the needs analysis can be carried out using only the organisation's own resources, or the project group can include a lead designer from outside the organisation and representatives from other areas of design in addition to the lead designer. At least initially, on the first few times that the client orders wood construction, it is worth considering including the material supplier in the team to better understand the project's boundary conditions in terms of material, production and so on. The boundary conditions may affect, for example, the floor height, the dimensions of facilities or other similar conditions.

It is very important to take wood construction into account in the needs analysis and especially in the preparation of the cost estimate. If wood construction or other carbon neutrality targets are not taken into account from the beginning, it is challenging to add them to the project later.

It is recommended to draw up a sustainable development plan that defines the key sustainability goals and how to ensure their implementation in the project as part of the needs analysis.

Setting sustainability goals

The organisation's strategic policy, social responsibility policy or environmental roadmap may be the starting point for the project's sustainability goals. The sustainability goals set at the needs analysis phase are often imprecise, and it is not desirable or even possible to set numerical values for them. However, instead of numerical values, at the very least goals in principle can be set to guide the entire project as constraints. Target setting can include, for example, design requirements related to the carbon footprint, use of materials, energy, space or material efficiency, and the transformability and versatility of facilities.

Project plan

On the basis of the summary document resulting from the needs analysis, the client can make a decision on whether to embark on the project or reject it. If a decision is made to proceed with the project, the next step is project planning.

Project planning is divided into two stages: the project fiche and the project plan. During the project fiche phase, new solutions are proposed and the potential space and land options as well as implementation options and methods are assessed with sufficient accuracy. The necessary studies are commissioned as a basis for analysis. It is advisable to conduct comparative life-cycle and cost assessments and low-carbon assessments of potential options. Based on the life cycle assessment and emission impact assessment, life-cycle objectives are defined for the project and the principles of sustainable development are specified. In addition, the implementation method of the project can be provisionally determined. (RT 103254, 2020, p. 5.) 66

At the project design phase at the latest, a decision should be made on the possibility of constructing the building from wood. If the special characteristics of wood construction are not taken into account in the project design phase and in the subsequent calculation of the target price, it may be challenging to add the principles of wood construction to the project and the target price later on. Wood construction often requires sprinklers, so it is advisable to consult the rescue authority and the water utility already as project planning progresses. Preliminary comparisons of different structural systems, feasibility and other technical aspects should often be commissioned from an external expert if the organisation does not have experience of similar projects.

The completed project plan is approved by the client, and on the basis of it, the client can make an investment decision. The objectives defined in the project plan serve as the starting point for all planning against which the plans are compared throughout the planning process. (RT 103254, 2020, p. 5.)

3.1.2 Defining the object of the procurement

The definition of a wood construction project is not in itself different from the definition of other construction projects. As a special characteristic, the procurement must take into account the schedule, which may differ from the usual. Designing a wooden building, especially with prefabricated implementation methods, requires more detailed advance planning and, consequently, longer planning time. However, the construction time may typically be shorter. In terms of schedule, the market situation may affect the amount and timing of available capacity. Particular attention must be paid to these special characteristics when drawing up the project plan and conducting market surveys.

When describing the procurement, commercial terms should also be considered to ensure that the tenders received when the time comes are comparable. On the other hand, aspects that are not actually relevant should not be defined in the description. It is also advisable to leave room for the tenderer's innovations and to avoid defining the details too precisely. In negotiated procedures, the content may be defined on the basis of preliminary tenders and proposals submitted during negotiations.

In practice, if a public developer wishes to acquire a wooden building, wood construction must be defined as a mandatory minimum requirement for the project in the procurement description. In addition to the technical aspects, the description can define requirements for the production method, such as the requirement of ecological manufacture. The description can also take into account social and environmental aspects more extensively.

In wood construction, it is essential to draw up the description in such a way that it does not exclude different manufacturing and implementation methods, unless this is expressly desired. For example, instead of specifying the fire regulations precisely, the method can be left to the tenderer to decide, as long as it complies with the regulations. Construction contractors are typically better aware of the impact of many solutions on the entire process, such as the fire class in the implementation, up-to-date cost information and the effects on production methods, and excessive specification may lead to more expensive solutions.

Photo 4. Martta Wendelin Daycare Centre, 2022, Tuusula. Building owner/developer: Municipality of Tuusula: Type of contract: Split contract. Architectural design: Arkkitehdit Frondelius+Keppo+Salmenperä Oy. Photographer: Mika Huisman

4 Costs and financing

4.1 What do the costs of a wood construction project consist of?

When determining costs, it must be taken into account that the structural solutions and implementation method of a wooden building are usually different from typical on-site construction. Industrial manufacturing and the properties of wood products lead to a different method of implementation. For this reason, it is rarely sensible to price the same reference plan with different materials or methods. A genuine comparison of implementation methods requires that the calculated presentation take into account the benefits of the technology in question. Due to this, different frame solutions cannot be put out to tender with the same reference plan, because their dimensioning ratios and implementation methods are so different. If you want to compare implementation methods or materials, this special characteristic must be taken into account when planning the procurement.

The cost of participating in tendering is one of the essential costs of a project. Citing the previous paragraph, the best way to compare different solutions is to ask suppliers to provide, for example, design-build presentations on the project. However, this is costly and significantly limits the number of tenderers. The developer must always assess how much it will cost to participate in the tendering and, on this basis, estimate the number of potential tenders. One way to increase the number is to compensate the tenderers for submitting tenders. The second aspect to be considered is collaborative models, and the third is that operators or consultants can be used as external experts in the development of solutions during the project planning phase.

The level of cost information based on floor area or building volume varies a lot by building type in wood construction. For some implementation methods, there is no reliable cost information on this basis. There is also no updated nomenclature for industrial manufacturing based on which the costs of factory manufacturing would be systematically recorded.

Therefore, the choice of the procurement and delivery model is a critical factor. It is essential to incorporate expertise in the planning process at a sufficiently early stage. It should be noted that it is important not only to price the design solution, but also to know how to compare different options. The client must make use of market dialogues and other opportunities for discussion to gather information on costs.

At the project level, the formation of costs in a wood construction project may differ from other projects. Design is more frontloaded. The formation of costs differs from purely on-site work in that costs are generated significantly earlier at the factory. This should result in a shorter construction time. The potential need for earlier payment of instalments and shortening of construction time must be taken into account when determining the profit and financing costs.

The fixed costs of a factory are typically high even if the unit costs of the products are lower. Consequently, the factory's utilisation rate plays a significant role in its profitability and pricing. From the perspective of factory operations and pricing, it is therefore critical that the production order book is predictable in the long term. This directly benefits the client, as it results in pricing done at a higher utilisation rate. Procurement models should consider how the client benefits from offering suppliers a longer-term perspective than usual.

After the start of the building's production and procurements, the possibility to influence the costs is limited, and this should be taken into account as part of the project process.

4.2 Life-cycle economy of the construction project

Traditionally, construction involves comparing investment costs and operating costs over the entire life cycle. Life-cycle costs can be many times higher than construction costs, so factual life-cycle analysis is a critically important part of project planning and target setting. Reducing, or saving on, investment costs must not lead to sub-optimisation and a significant increase in life-cycle costs. The right balance must always be sought on a project-by-project basis. Different types of projects offer different opportunities to influence life-cycle solutions, so it is essential to set clear targets for life-cycle economy to invite tenders for the right solutions and to select timely measures in different types of project.

When considering life-cycle costs, it should also be taken into account that choices are not just about optimising costs but also, to a large extent, about managing risk. For example, investing in energy efficiency reduces the risk of changes in energy prices in the long term.

One part of the life-cycle assessment is the need to use the space itself throughout its entire life cycle. Various transformability solutions, the possibility of expanding or partially dismantling rooms and portability can be significant factors if there are likely to be changes in needs over the life cycle.

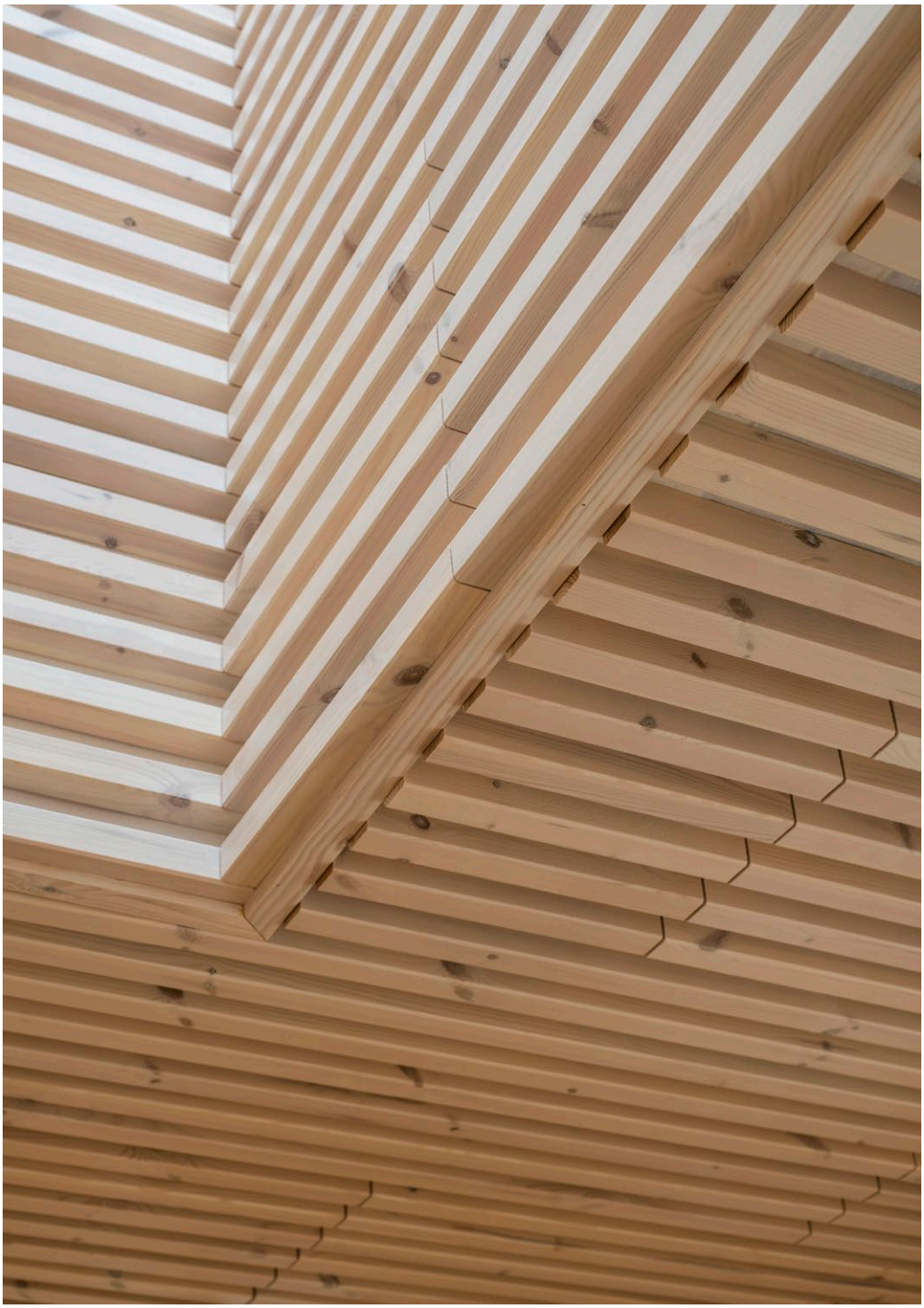
The life-cycle economy of a wooden building must take into account similar issues as other construction. One key decision is the design life of the building. A wooden building can be designed with a service life of over 50 years. In service classes 1 and 2, the service life of a wooden building can be increased to 100 years when the requirements for a longer service life are met. However, it should be noted that the changes in design solutions may be significant.

Wood construction in itself makes it possible for the building to be easily updated over its entire life cycle as long as the building is well designed. As lightweight and easily removable structures, changing the building technology of, for example, vertical chimneys is significantly easier than in cast structures.

The life-cycle assessments of wooden buildings pay particular attention to facades. Maintenance programmes for wooden facades must be planned in advance and the price of facade maintenance must be compared over the entire life cycle. Many products may have shorter maintenance intervals than other solutions, but the maintenance operation is significantly more inexpensive to carry out than in solutions requiring heavier facade renovations. The low or high life-cycle cost of a facade cannot be demonstrated at a general level but must always be examined in the project.

The demands of the circular economy will increase in the future. This may bring significant requirements for the contents of design, and up-to-date circular economy requirements must be reviewed when the project is started.

Photo 5. Martta Wendelin Daycare Centre, 2022, Tuusula. Building owner/developer: Municipality of Tuusula: Type of contract: Split contract. Architectural design: Arkkitehdit Frondelius+Keppo+Salmenperä Oy. Photographer: Mika Huisman



4.3 Financing sustainable investments

This section briefly discusses some financing models that may be suitable for financing sustainable investments. A typical issue to be resolved is that, in order to reduce the life-cycle costs, the cost of the investment phase must be increased. Another factor is that traditional development on one's own balance sheet has very little flexibility. Space needs can change over the decades, and it is sustainable to strive to increase transformability and adjust the property portfolio as needs change. Financing must enable sustainable changes and sustainable investments.

When planning financing, it should always be considered whether additional investments will bring benefits for the better performance of the building over the entire life cycle of the project. Life-cycle costs are one of the accepted assessment criteria for public procurement.

Leasing is a model in which the ownership of the building is retained by the supplier and the client pays rent for the space. This can be advantageous in situations where the need for space is temporary. The leasing model promotes the circular economy and encourages the implementation of facilities that can be adjusted efficiently at a reasonable cost.

Leasing with option to buy is used to lease a building for a predetermined period of time, after which the client has the option to buy the building for a residual value agreed in advance. If the right is not exercised, the building returns to the seller. These arrangements often involve a separate leasing finance company that owns the building during the lease period. Leasing with option to buy is especially advantageous in situations where the future need for use is not completely certain. Wooden modules are suitable for portable and adjustable spaces.

In the **public private partnership (PPP) model**, the construction contractor is responsible not only for the project planning, construction and maintenance of the building during its life cycle, but also for the financing of the project. This model is also called DBFM (design, build, finance, maintain). The client uses the model to seek a predictable level of costs (and thus also a maximum level) for the entire contract period. In practice, all the risks of design, construction, use and financing are transferred to a private operator. The administrative burden makes the project model only suited to large projects. The public operator has the right of ownership during and after the contract period. Due to the long liability period and maintenance obligation, the model encourages the construction contractor to use sustainable solutions and to genuinely optimise the life-cycle costs.

The PPP model is closely related to the life-cycle model, which is not a financing model as such. You can read more about the life-cycle model in the RT card RT-103164. In the

life-cycle model, the financing comes from the contracting entity, and it is possible to finance the costs of the service period, for example, through leasing with option to buy. In addition, there is no need for a separate project company in the life-cycle model. From the client's point of view, the implementation phase of the life-cycle model resembles a turn-key contract. In the model, the costs during the life cycle of the building are transparent to the client during the tendering process and the service period.

Green financing. In this document, green financing refers to all financial instruments where financing is conditional on more ambitious and measurable climate or environmental objectives. Financing is available on the market at a lower interest rate for projects that meet the criteria.

Building as a service (BaaS) is still a rare and not fully established financing model related to PPP. BaaS refers to all types of service contracts where the tenderer provides services instead of a traditional building or leasing. The basic idea is that when only the required deliverables are purchased, the tenderer retains the responsibility for optimising the life cycle and its risks. In the case of lifts, for example, the client buys services of lifting between floors instead of buying a physical lift. A contract on use supports many principles of sustainability, such as eliminating unnecessary use and providing the service only as needed.

5 Preparation of the procurement

A public developer can promote the use of wood as a building material by requiring in the description of the procurement object in the contract notice or invitation to tender that the construction project be carried out using wood as a building material. The use of wood as a building material does not need to be separately justified in public procurement construction projects. The new Act on Public Procurement and Concession Contracts allows the contracting entity extensive discretion in selecting the procurement procedure used in the procurement, especially when the procurement is below the EU threshold. However, when choosing a procedure, attention must be paid to ensuring that the procedure complies with the principles of non-discrimination, transparency and proportionality.

During the preparation phase, the client creates criteria for the content to be procured and specifies what the object of procurement is aimed to achieve and what aims of the client the procurement is to meet in the first place. All decisions and work done in the preparation phase have a direct impact on the entire procurement process and up until the use of the building. The preparation phase is the most effective phase in the entire procurement process, so preparation must be invested in. While preparation may take a long time, it is always an important step that should not be skipped. The preparation phase must be properly resourced, and a reasonable schedule must be set aside for it. Good preparation minimises the risk that the procurement contract needs to be modified during the project and reduces errors and shortcomings in the definition of the procurement object.

5.1 Objectives of the public developer

Achievement of the objectives set for wood construction must be examined as a broader issue than the use of wood in one construction project. Public procurement plays a key role in politically selected strategic objectives: innovation, environment and social inclusion. Wood construction contributes to all of these strategic objectives.

It is essential that the objectives are recorded as unambiguously as possible and that the desired objectives are communicated. This could mean, for example, a solid wood school building or a daycare centre that is industrially prefabricated to the highest degree possible. The objectives must also be consistent and not too numerous. When setting objectives, it is important to consider the possible impact of the objective set. For example, long design life significantly changes design solutions and can change the price and the number of tenderers. In this example, the key question is whether the developer emphasises the investment cost or the life-cycle cost in its decision.

Procurement must, as a rule, promote the creation and introduction of innovations, so the client must always consider whether the procurement can promote the development or introduction of new products or facilitate the creation of new investments. The client can implement solutions or products that have been used little or not at all. The client can, if it so wishes, commit to longer-term contracts, enabling additional investments. The client also plays a key role in providing information to suppliers so that product development can be guided to the client's key needs.

To develop the wood construction industry, public clients should promote the formation of markets. One EU-level objective for competitive tendering is to enable SMEs to participate in public procurement procedures. The client should always examine whether the contract can be divided into smaller lots in order to increase competition. Another key condition aimed at promoting this objective states that the call for tenders may not require more than double the turnover of the contract from an economic operator unless there are specific grounds for doing so. The EU guidelines start from the premise that the client can decide not to divide the contract, but in this case it must state the reason. If smaller contracts are decided on, the procurement organisation's resources and competence must be ensured.

The definition of other project objectives is also essential. Is the client aiming for the best carbon-efficiency possible, an architecturally ambitious building or just price competition? The public developer can define its objectives independently, but these must be clearly stated in order for the solution to meet the objectives set.

To increase the use of wood, it is necessary to increase public awareness of completed projects. It is important to report even bad experiences openly to other public clients, as they will serve as a basis for the market surveys of projects. Projects should therefore plan already in the preparatory phase how information will be collected during the project so that it can be genuinely shared after the completion of the project.

In addition, the amount of wood used in the form of different products must be monitored, along with the impact achieved with it, that is, the carbon footprint and the stored carbon handprint. The Ministry of the Environment recommends using the national calculation method it has published. When allocating resources for the initial phase of the project, the ability to assess the differences between different methods and construction contractors in the project must be ensured.

Circular economy requirements are being increasingly emphasised, and a public developer can also be a trendsetter and lead the way in this respect. The circular economy and the reuse of building components require different design solutions and products, and the requirements of the circular economy must be taken into account from the very beginning

of the project. Particular care must be taken in defining these requirements in order to ensure that they are feasible. The market will develop significantly in the coming years in terms of circular-economy products and recyclability.

The origin of the wood material is also important. Information on the origin of materials is part of the sustainable implementation of the construction project. Public procurement can require the wood used to be sustainably sourced. A good way to verify that the wood material is sourced from sustainably managed forests and complies with climate criteria is forest certification. Forest certificates can be used to prove the origin of timber and its supply and processing chain from the forest to the construction site. There are two major forest certification systems used in Finland: PEFC and FSC.

When setting objectives, possible portability, ability for dismantling and service life must also be taken into account. All of the above may affect the financing and depreciation programme. There are no general criteria for such matters, so they must be dealt with on a project-by-project basis. For example, the possibility of expanding a school may be a profitable option in certain situations. The criteria can be, for example, the RTS Environmental Classification system or another similar commonly used quality system.

The client can set the project concrete targets for carbon emissions or carbon reservoirs as early as during the need analysis stage. Public developers can lead the way by committing to concrete emission limits even before they become mandatory.

Objectives for the use of wood to be comprehensively mapped in procurement include

- the amount of wood used in the form of different products,
- the environmental targets met, such as carbon handprint and footprint,
- the ways in which market formation, investment and increased competition will be promoted,
- the measurement and distribution of information for the use of other clients,
- the fulfilment of other strategic objectives set by the client organisation.

All projects should be submitted with a cost-benefit analysis that takes a stand on the fulfilment of the objectives for the use of wood in the construction project.

5.2 Competence and resources of the public developer

The developer's own resources can be divided into two important entities to be examined: the resourcing of the procurement phase and the resourcing of the implementation phase. The selected procurement procedure and project model require a certain amount of resources, and the most serious mistake in a project is if the client fails to plan its resourcing correctly. In addition to the client's own resources, external services can also be used in

management. However, it is recommended that the project always has a supervisor working in the client organisation who is in charge of the project as a whole. Outsourcing this responsibility is very challenging.

Different procurement procedures require different resources. A multi-stage negotiated procedure commits significantly more resources than the comparison of the tenders in an open procedure. Correspondingly, the management of a turnkey contract is significantly lighter than the management of a project carried out as a split contract or as an alliance.

The second key element is expertise. Different procurement procedures and implementation models require different amounts of in-house knowledge and skills. In-house expertise must be critically assessed and, if necessary, supplemented with external services. The construction project can also serve to increase expertise. For example, in an alliance project, information is shared using the principle of open books, which gives the client an exceptionally good view of processes, price formation and other factors affecting operations.

Resourcing should be seen as a strategic choice. If the client's organisation is thin, it cannot accumulate expertise and know-how. Public developers are typically able to anticipate their future construction investments well, which enables long-term resource planning.

A skills gap cannot be solved by purchasing all projects on a turnkey basis, either. It would significantly reduce the supply and would not accumulate expertise in the organisation. Public developers must have the courage to train their own personnel and systematically seek to increase their expertise.

A key part of the project plan is the procurement organisation's own resourcing plan, which must affect the choice of implementation model.

Photo 6. Finnish-Russian School, 2021, Helsinki. Building owner/developer: Senate Properties, Construction Manager: Timo Juolevi. Form of contract: Alliance contract. Architectural design: Arkkitehdit Frondelius+Keppo+Salmenperä Oy, Juha Salmenperä. Photographer: Kimmo Räisänen

5.3 Market survey

Without knowing the market situation and the market, it is practically impossible to prepare a successful contract notice. In the worst case, the contracting entity may end up trying to procure a service that no one is able to tender for, or the invitation to tender may significantly limit the number of tenderers. The primary objective of the market survey is to obtain information on possible solutions, to help determine the content of the procurement, to improve the efficiency of the use of the money to be invested, and to share information on upcoming procurements. This work cannot be done from an office; direct communication with the market and industry is vital.

The result of the market survey should have a significant impact on the chosen product, implementation method, procurement model and, ultimately, the contract model. A well-executed market survey, together with the result of the needs analysis and the strategic objectives, serves as a starting point for planning the procurement.

Market surveys can be considered as a process, the purpose of which can be both the sharing of information and the clarification of factors affecting the procurement. The steps of a market survey may include

- public prior information notices to provide information on the procurement and/or to determine the market,
- public market information sessions,
- bilateral meetings,
- site or project visits,
- electronic surveys, etc.

Market dialogues can also take the form of interactive events and different types of workshops, where contracting entities can draw on the expertise of potential tenderers. In addition to potential tenderers, stakeholders related to the object of the procurement can also be invited to these events.

A market survey always serves to inform the market as well. Providing information early enough enables

- preparation by tenderers for upcoming procurements,
- preparation for the competitive tendering,
- selection of potential partners or subcontractors,
- tendering and project resourcing,
- speeding up the tendering procedure, if desired (prior information notice to shorten the tendering period).

A market survey provides an opportunity to examine the factors affecting procurement, such as

- the market and competition situation, supply and demand, and the economic cycle,
- the number and quality of tenderers,
- the solutions offered and their alternatives,
- implementation models suitable for procurement,
- suitable procurement procedures,
- suitability requirements for tenderers and criteria for comparison of tenders,
- contracts and contractual terms,
- required initial data or plans.

The content of the market survey may be based on the state of preparation or planning of the object of the procurement. An early-stage market survey should focus on information and determination of the market situation while, in a final-stage market survey, it may be justified to focus on the implementation methods of the project and the details of the procurement process.

When drawing up a market survey, the client must make sure to treat operators equally and fairly; solutions that exclude tenderers should be avoided unless there are specific grounds for doing so. The specific purpose of the survey is to promote the organisation of functional tendering, not to reduce the offering. In wood construction, different structural solutions can be mutually exclusive, so this aspect must be specifically taken into account when selecting the procurement procedure and solutions.

If the content of the procurement is modified on the basis of the market survey, it must be ensured that all tenderers are informed of this sufficiently early so that they can, if they so wish, react to the changed solution before submitting their tender. One of the essential purposes of the market survey is to find better solutions, so the process must be designed in such a way that the resulting additional understanding can be utilised as part of the project without distorting competition.

Another consideration is to assess in advance whether the parties involved in the preparation of the procurement need to be excluded from the actual competitive tendering. In this respect, it is important that all tenderers have access to the same information on the procurement as those involved in the preparation of the procurement. To put tenderers on an equal footing and to eliminate any distortions in competition, data and background information obtained during the preparation of the procurement can be described, for example, in the invitation to tender or in the project description. In principle, an exclusion must only be made if it is the only way to achieve equal treatment of tenderers. In other

words, precautionary exclusions should be avoided, and the expertise of suppliers should be utilised from the very beginning of the project, if possible. If an exclusion is proposed, the tenderer must be given the opportunity to prove that its actions have not distorted competition.

Surveying the market is even more essential in innovation procedures and collaborative contract models. These models make it possible to proceed step by step with the selected tenderers, developing a solution for the project together. This makes it particularly important to assess in advance the market, its situation and whether the necessary solution already exists on the market. It is typical of innovation activities to not know in advance how the project will be implemented, so special attention must be paid to comparing different tenderers to ensure that potential tenderers and solutions can be identified in the first place and that the partner(s) with the best potential for the project's objectives can be selected.

Market surveys are a cost-effective way to develop procurements. They are particularly important in emerging markets, where both the number of potential tenderers and the solutions offered evolve rapidly. Wood construction and energy-efficiency services are examples of such markets.

5.4 Risk management

In this guide, risk refers to an unforeseen event that can have a negative or positive impact. The planned and expected outcome represents the default value of the event. Risk always has a magnitude and a probability of realisation.

Wood construction in itself does not pose significant additional risks, but the location of production away from the construction site, potentially unusual contract models, moisture management, limited supply in case of certain solutions or other special characteristics must nevertheless be taken into account as part of risk assessment.

The key means of risk management are the project implementation model and the selected contract model. The contract defines not only the fee and the sharing of costs between the supplier and the client, but also the sharing of risks. Identified risks and the level of risk chosen are the key criteria when choosing a contract model. The client must take into account that transferring risks to the supplier always costs money, and transferring risk does not eliminate risk. When assessing the right level of risk, it must be considered what risks the client and the operator are able to bear at a reasonable cost.

A well-conducted market survey plays a key role in managing commercial risks. It enables the client to ask for a solution that is available on the market or to select a procedure through which a solution can be developed in cooperation with the market. Breaking up the contract into smaller lots, for example as a divided contract, may increase the number of tenders but requires more procurement expertise and resources from the client. It is considered good practice to have design solutions for non-standard buildings inspected by a third party.

6 Procurement phase

6.1 Selecting the procurement procedure

Contracts can be awarded by open procedure, restricted procedure, competitive procedure with negotiation, competitive dialogue, innovation partnership, design contest, negotiated procedure without prior publication, pre-commercial procurement (innovation partnership) or framework agreement. In practice, negotiated procedures without prior publication and framework procedures are only suitable for very limited situations.

This guide does not discuss the different procedures in detail, instead focusing on their characteristics from the point of view of a wood construction project. The procedures should also not be confused with the various implementation methods and contract models. For example, an alliance project can be procured through an open procedure or as an innovation partnership. As a rule, it is not advisable to implement wood construction projects by any specific procedure; the right procedure should always be selected based on the project's objectives, the market situation and strategic objectives. The selection of the procedure is one of the key choices related to the management of the project.

Open and restricted procedures are excellent choices in a situation where the content of the tender can be unambiguously defined, such as routine construction projects. Open procedures significantly increase competition and, in a market situation where it is possible to receive a large number of high-quality tenders, open procedures should be favoured. The threshold for using open procedures can be lowered by carrying out comprehensive market dialogues and surveys before the actual tendering. In case of requirements for sufficient references or other client requirements, it may sometimes be sensible to use a restricted procedure where the actual invitation to tender is issued only to eligible tenderers.

The advantage of negotiated procedures (including competitive dialogue) is that the client can contribute to the content and quality of the tenders, guiding the tenderers to offer implementation that better meets the client's needs. Particularly in complex projects where defining the content in advance may be challenging, negotiation may lead to a result that benefits the client. Negotiated procedures are relatively burdensome, which may limit the number of tenders received. On the other hand, many solutions in wood construction are specific to one factory or contractor, in which case negotiation is the only way to achieve an optimal solution. It should be noted that, after the negotiation, the contract can be concluded at a fixed price.

However, it needs to be taken into account that the various negotiated procedures cannot be chosen automatically as the procedure; their use must always be justified. The justification may be that no acceptable tenders were received through open procedures, that no direct solution to the need exists on the market, that the procurement includes design or innovative solutions, or that there are no sufficiently established practices (e.g. standards) for the technical implementation. All of the above are possible in a wood construction project. A wood construction project may involve, for example, the need to plan the outcome of the procurement and the particulars of the building in more detail.

In addition to the building, the innovation partnership procedure purchases the R&D services necessary for the development of a new solution. This differs from negotiated procedures in that the content is still in development after the contract has been drawn up. Innovation partnerships are suitable for product development projects, which will also be needed in wood construction in the future. A particular advantage of an innovation project is that a public procuring entity can make a significant contribution to the emergence of solutions on the market that operators might not be able to implement alone.

Design competitions are primarily intended for drawing up designs. Particular care must be taken when using design competitions in wood construction projects. Operators and different implementation models may have significantly different design values or other boundary conditions. When drawing up the requirements for a design competition, clients must ensure that the design to be drawn up is feasible. It is advisable to use market dialogues in the definition of design competitions.

In general, it can be said that all the different procedures can be used for the procurement of wood construction. Choosing the right procedure according to the project is the key to a successful procurement. The overall theme is the diversity of operators and solutions, which makes it difficult for an outside party to identify the optimal solution for different projects. Such a situation favours the use of various negotiation models when their conditions are met. In simple projects, open and restricted procedures are the most effective.

Photo 7. Expansion of Mankkaa Daycare Centre, 2022, Espoo. Building owner/developer: Espoo Premises Department public utility. Type of contract: Two-stage fixed-price contract.
Architectural design: Arkkitehtitoimisto Lehto Peltonen Valkama Oy. Photographer: Mika Huisman

6.2 Suitability requirements for tenderers

To create a healthy competitive environment, the client should carefully consider what suitability requirements to set for tenderers.

The purpose of references is to ensure the tenderer's ability to manage and participate in large projects, but requirements that are too strict will exclude tenderers from the competition.

Market surveys, or market dialogues, have also been found to be a good tool for mapping references, minimum turnover requirements and so on. Views obtained through a market dialogue make it easy for the client to set the bar at the right level in accordance with its own objectives while still facilitating a healthy competitive environment.

It is a good idea to study the tendering materials of other public developers. By imposing as similar requirements as possible on tenderers regardless of the city or municipality, clients can make tendering less burdensome and take up less of the tenderers' time, which also reduces the price of individual projects by significantly lightening the workload of tenderers when preparing an individual tender.

When setting reference requirements, it is good to study the existing wooden building stock to make the reference requirements realistic. When considering references, it is also worth noting that 'wooden buildings' are often 'hybrid buildings'. References for joints with other materials are important, so the experience of tenderers in, for example, certain types of concrete buildings can be taken into account when they also have experience in some type of wood construction.

A minimum turnover requirement may not be the most reliable way to get information about a company's eligibility, as turnover can be manipulated and grows through central invoicing. Growth rate and 'balance sheet' tell more about the company's financial situation. Instead of a minimum turnover requirement for an individual company, in case of a consortium, the entire consortium's combined turnover can be taken into account, also allowing smaller companies to gain a foothold in the market. The contracting entity may promote this by explaining clearly in the invitation to tender that the turnover of consortia and joint ventures, i.e. the members of a syndicate, is added together.

The eligibility and risks of the tenderer must always be considered as a whole and on a project-by-project basis. The risk management measures should also be proportionate, and additional requirements should not be required as a precautionary measure. It may make economic sense for the client to bear some of the risks itself; it is not advisable to outsource all risks to the market. The client organisation's capacity and willingness to bear risk also significantly guides the setting of minimum requirements. It is also essential to not allow absolutely everything but to require the things that are important to the client.

6.3 Tender materials and other documents

The client should carefully consider which materials it must require from tenderers. One example of good documentation requirements for ensuring the reliability of the tenderer are extracts from the Reliable Partner register.

Tenderers find it burdensome to compile supporting documents, which increases the cost of drawing up tenders. Harmonisation of tender materials and documentation requirements would facilitate the tender process and reduce costs. In principle, it is also a good idea for the contracting entity to require certificates and reports only from the winner of the competitive tendering. In this case, tenderers are required to submit certificates and reports upon request, not automatically with their tender. This reduces the administrative burden for tenderers.

It is not advisable to require long validity from tenders (two months has been found to be appropriate), or the tenderer may feel the need to add a significant risk margin to the price.

6.4 Carbon footprint and handprint calculation as comparison criteria

Carbon footprint and/or handprint calculation can also be used as criteria for comparison. A requirement for carbon accounting has been found a good practice. If used, it is also scored as part of the quality comparison. In certain restricted procedures, carbon accounting can also be scored as part of an interim assessment, in which case the operator still has the opportunity to develop its solution before the final tender.

As carbon footprint calculation methods are still evolving, it is advisable to have all tenderers' tender materials calculated by a single party, such as an external consultant, to ensure that the calculation uses consistent parameters and comparable materials. When using an external consultant, it should be noted that this requires that 1) the invitation to tender clearly describes this process and the use of an external expert, 2) the performance of the comparison is transparent, i.e. the tenderers know when preparing the tender which factors are relevant for the comparison, and 3) the comparison is based only on the data presented in the tenders, i.e. the tenderers themselves provide all the data used for calculating the carbon footprint.

The carbon handprint of a building refers to the positive climate impacts of construction that would not have occurred without the construction of the building. These include carbon tied to wood-based structures and the recycling of construction products.

6.5 Comparison of tenders

When comparing tenders, quality criteria can and should be used in addition to the price. As a process, the comparison of tenders for a wooden building is no different from any other construction. What is key is that the criteria for comparison are transparent, as unambiguous as possible and known in advance to the tenderers.

With regard to quality points in particular, it is important already to open up the criteria for scoring in the invitation to tender: What features in references are valued and how many points are available for each criterion? In the evaluation of the tenders, rigorous quality review is particularly important. The reasoning of the working group conducting the quality review must be recorded and becomes public information after the review.

It is also possible to set wood construction as a quality criterion, for example by giving tenderers points in the quality comparison if the load-bearing structures of the building are made of wood. In this case, the invitation to tender facilitates wood construction, but it is not a mandatory minimum requirement. Including wood construction as part of the quality comparison also makes it possible to compensate for the potentially higher costs of wood construction by giving quality points to tenders containing wood construction in the price/quality comparison.

When seeking an innovative building, the price/quality ratio should be a minimum of 50/50. The weighting of quality may also be higher than this. If you want to focus only on comparing quality, you can use a reverse tendering, where the maximum price is indicated and the presentation with the highest quality wins the competition. This can be a good model if the budget constraint is predetermined. On the other hand, the client rarely knows all the possibilities in advance, and locking in the maximum amount of the investment may exclude solutions that would be beneficial in terms of the life cycle from the competition, for example.

6.6 Comparison of implementation options with wooden frames

The comparison of options for the implementation of wooden frames is no different from any other comparison of tenders as such. It is of primary importance that tenders are compared on an equivalent basis in the comparison. In general, it is essential that, in addition to the price, qualitative characteristics are compared in the manner specified in the contract notice. The most important aspect to compare is the quality of the design solution. In addition, many other features discussed in this guide, such as carbon handprint or footprint or, for example, construction time, can be compared. This is a typical tendering method in different types of design-build (DB) contracts.

The procurement may also be divided into lots. This is not to be confused with the prohibited tender splitting done to avoid the obligation of competitive tendering. A key factor in comparing wood-framed options is receiving commensurate tenders, and the role of market dialogues and tender documentation is emphasised in order to enable comparison. Key documents to ensure comparability in, for example, the frame's subassembly delivery, include the contract programme, the contract boundary annex, the specification of the contract boundary annex, the safety document and the client's design instructions, as well as the site's design documentation. When dividing the planning into lots, it is typically necessary to go beyond the reference plan level in order to ensure sufficient accuracy in the delivery content. In practice, when dividing a project into lots, design solutions must be selected before the competitive tendering, so that the tenders can be compared and the different lots can be coordinated. When dividing a project into lots, qualitative indicators are less important than in DB models, but they can still be included in the tender competition, for example in the form of references, recommendations, possible delivery times or other factors relevant to the client.

The third option includes various integrated implementation models, in which the client does not, in practice, invite tenders for a design solution but gathers the best delivery organisation and capabilities for the project. Fee percentage may be used as the price component for the comparison of the tenderer(s). When determining the fee, it must be established what is meant by the fee in different types of contracts and projects. For example, the cost structures of factory manufacturing and construction site operations differ significantly from each other, and the determination of the fee must be carefully reviewed to ensure that the fee percentages offered are comparable. The key idea in integrated models is to have the best and most capable team to meet the client's need. For this reason, competitive tendering should focus on verifying the references and expertise of the construction contractors. Competence can be tested in various scored workshops, preliminary tasks or other similar situations suitable for testing problem-solving skills.

6.7 Comparison of frame structures made from other materials

The principles that apply to comparing different wood options also apply to comparing frame structures made from other materials. However, it is essential to identify the objectives set by the client and to score the implementation of these objectives with various indicators.

When comparing different frame options, it should be noted that it is very rarely sensible to implement an equally efficient solution from different materials with the same reference plan. In practice, a reference plan always favours some construction method or material over others. For this reason, if the intention is to compare frame options made from different materials in the competition, in practice, they all need dedicated plan options. This guides procurement to specific procurement procedures.

When comparing different frame materials, attention should also be paid to the various objectives of the client and their definitions. Specifications other than the frame material may also have a significant indirect impact on the choice of materials. For example, certain choices in building technical systems can lead to different implementation methods, so the client should specify only the factors that genuinely affect its objectives. High-quality market dialogue is key to understanding these indirect effects.

Setting excessive criteria may also lead to a solution that is less favourable to the client. For example, if the target timeframe is set too tight without a specific need, it may lead to a different implementation solution than without a strict target. Therefore, requiring things just to be on the safe side does not automatically increase quality or promote the objectives of the client as a whole.

7 Special characteristics of implementation methods in wood construction

7.1 Choosing implementation methods in wood construction

The implementation method of a construction project is a concept that is broader than that the type of contract. The most important factor in selection the implementation method is the division of tasks between design and construction: who is responsible for designs and is the project carried out in a linear manner or with overlapping design and construction? Implementation methods should therefore be considered as alternative ways of carrying out the project.

The implementation method determines the division of work between the developer, designers, construction company and other suppliers, the roles and responsibilities of the parties, the relationships and forms of participation as well as the principles of risk and benefit sharing. Factors that affect its choice include

- the client's objectives and boundary conditions (financing, schedule, carbon footprint, etc.),
- the object of the procurement (content and scope, functional and technical, requirements, etc.),
- the client's resources and expertise (in-house expertise, outsourced resources and expertise, etc.),
- the client's decision-making (authority and process),
- the market situation (economic cycle and supplier market).

The main options for implementation methods are

- fixed-price contracts,
- methods that include design and construction,
- project management contracts,
- integrated project delivery (IPD).

In addition, different implementation methods can use different payment criteria, such as the total price, unit price, target price, cost-and-fee or open book costing.

In public projects, the choice of the implementation method determines the principles for utilising the market. This is particularly relevant in the emerging wood construction markets.

Figure 3. Implementation models & procurement procedures (Vison Oy)

Implementation method	Suitability	Procurement procedure	Tenderers	Eligibility requirements	Comparative criteria for tenders	Process length	Risks and opportunities	Note:
Fixed-price contracts	• Small and clear projects • Fairly low risks, no need for development • Residential properties, daycare centres, healthcare and social welfare properties, sports halls, etc.	• Open procedure • Restricted procedure	• Construction companies • Suppliers of subassemblies and prefabricated components as subcontractors	• Financial situation • Business references	• Price • Quality	• Tender period 35 days • Procurement 1½–2 months	• Client bears source data and plan risks as well as additional and modification risks • Tenderer bears implementation and price risks • The parties bear their own risks • Market risk: limiting the number of solutions and/or tenderers with predefined plans	• Use of the open procedure may lead to the exclusion of tenderers after the submission of tenders
Methods that include design and construction	• Larger and more demanding projects • Reasonable risks and development potential • Schools, multi-purpose buildings, health centres	• Restricted procedure • Negotiated procedure • Design competition*	• Construction companies • Suppliers of subassemblies and prefabricated components as subcontractors • Architectural and design agencies as subcontractors	• Financial situation • Business references	• Price • Quality, plans	• Applications 30 days • Tender period 30 days • Procurement 3–6 months	• Client bears risks related to the definition of source data and operational and technical requirements • Tenderer bears design, implementation and price risks • The parties bear their own risks • Market risk: the cost of bidding and the number of bidders	• Tender negotiations on contracts and/or technical and operational requirements • Developing plans in design competitions • Often requires the payment of a tender fee

Implementation method	Suitability	Procurement procedure	Tenderers	Eligibility requirements	Comparative criteria for tenders	Process length	Risks and opportunities	Note:
Methods with project management contracts	• Technically or functionally challenging projects • Higher risks and/or development potential • Partial risk-sharing	• Negotiated procedure	• Construction companies • Suppliers of subassemblies and prefabricated components as subcontractors	• Financial situation • Business references	• Project organisation, references • Price, project management fee • Quality, project plans	• Applications 30 days • Preliminary tender period 30 days • Final tender period 2 weeks–1½ months • Procurement 3–4 months	• Client bears part of source data and design risks partly • Tenderers bears risks for implementation planning, implementation and price • Parties partly share implementation and price risks • Market risk: competence in the implementation method and the number of tenderers	• Tender negotiations on contracts and/or the content and quality requirements of plans or development workshops on project development • Requires competence and resources from the client during implementation
Integrated project delivery implementations	• Complex projects • High risks and/or high development potential • Shared incentives • Sharing risks and benefits	• Negotiated procedure • Design competition*	• Construction companies • Design agencies • Suppliers of subassemblies and prefabricated components as subcontractors	• Financial situation • Business references	• Project organisation, references and capability • Price, project management fee • Quality, project plans	• Applications 30 days • Preliminary tender period 30 days • Final tender period 2 weeks–1½ months • Procurement 3–4 months	• Parties mostly share design, implementation and price risks • Market risk: competence in the new implementation method and the number of tenderers	• Tender negotiations on contract bases and/or development workshops, development of the project and/or plans • Co-development phase • Requires competence and resources from the client in the development and implementation phase • Requires a new kind of decision-making
Life-cycle model and leasing model	• In procurements using the life-cycle and leasing models, the procurement planning and implementation are guided by the comparison criteria of the tenders (quality of the plans, price for the right to use or lease, etc.) and the course of the planning and development phase following the procurement decision (project contract and service contract/lease). • When operating with a life-cycle model, a negotiated procedure should be used. • Depending on its content and complexity, a lease project can be put out to tender by any procurement procedure.							

* Design competitions specified in the Act on Public Procurement and Concession Contracts follow the guidelines of the Finnish Association of Architects (SAFA) or the Finnish Association of Civil Engineers (RIL). In these competitions, a design or technical solution is typically put out to tender and can be tendered by, for example, architectural agencies, various syndicates or, for example, designers and subassembly suppliers together.

Photo 8. Little Finlandia, 2022, Helsinki. Building owner/developer: City of Helsinki, Urban Environment Division. Form of contract: Contract for technical solutions.
Architectural design: Jaakko Torvinen, Elli Wendelin, Havu Järvelä, professor Pekka Heikkinen and Architects NRT Ltd, contractor's architect Oy Arkkitehtisuunnittelu Arkitekturum Ab Ltd. Photographer: Tais Griguol

7.2 Implementation methods used

7.2.1 Fixed-price contracts

The fixed-price contract is an implementation method based on designs prepared by the client. The client's designs guide to the desired result and enable cost estimation based on them. The model usually leads to competitive tendering of completed designs based on price and to contracts with fixed contents and prices.

Construction with a fixed-price contract results in the implementation of design and construction in successive phases. The client commissions the designs and puts their implementation out to tender. The price is determined in a tender competition and binds the contractor, which is responsible for the implementation of the project as a whole. Deficiencies in the source data or plans, as well as any changes, are commissioned as additional or alteration work.

The fixed-price contract is a clear choice when the client has the ability to design the desired building and its functional, technical and financial requirements. The client determines what is done and how.

The strengths of the model include a clear linear process, simple contracts and responsibilities, fixed content and price, and controllable interfaces. However, the weaknesses of the model are a long lead time, the interface between design and construction, and the management of changes during construction.

Fixed-price contracts are suitable for clear and simple projects where the client knows what it wants and there is no need to develop or innovate. In wood construction, the client being responsible for design can lead to restrictions of competition and does not necessarily support the diverse utilisation of rapidly evolving markets.

Fixed-price contracts also include construction based on a shared contract or on main and secondary contracts. The client can put different entities within the project out to tender separately, gaining several contractors, or subordinate the different implementations to the main contractor as side contracts.

7.2.2 Methods that include design and construction

Implementation methods that include design and construction are the turnkey project system used in housebuilding and the design-build (DB) model used in infrastructure projects. In addition to design and construction, a longer contract period and responsibility over the building's life cycle can also be attached to the model.

Turnkey construction always leads to the integration of design and construction and wider utilisation of the construction contractor's know-how. The client is responsible for the project and/or sketch planning and the definition of the content and scope as well as the functional, technical and other properties, and puts more detailed design and implementation out to tender. Tenderers draw up their own plans and make their own tenders. The client chooses the most economically advantageous tender on the basis of the quality and price of the plans or just based on the price. The selected construction contractor is then responsible for the design and implementation as a whole.

Tendering design and implementation together enables wider utilisation of the market, comparison of different development ideas and solution options, and utilisation of the construction contractor's production know-how. In addition, overlapping design and construction reduces the lead time of projects. On the other hand, the challenge of the model is the cost of procurement, when each tenderer has to draw up its own design and tender. For this reason, it would also be advisable to pay a tender fee in such competitive tendering to help to make the procurement more attractive to tenderers.

Turnkey construction is suitable for more demanding residential, commercial and office building construction, where different options are desired and where the expertise of the building contractor is also needed. In wood construction, the model enables better use of various technical solutions and utilisation of the know-how of designers specialising in these.

In addition, turnkey construction can be varied in the direction of a quality or design competition. The quality competition can be carried out as reverse tendering in which fixed-price solutions compete. On the other hand, the procurement may also be based on plans that are to be refined during the tendering procedure. A turnkey project can also be implemented as a life-cycle model.

7.2.3 Project management contracts

Implementation methods with project management originate from industrial construction projects, where the construction process is typically defined by the client organisation's business and its requirements.

The starting point for project management construction is usually tendering the project with unfinished designs and continuing the design during construction. The model enables competitive tendering of the construction contract through sketch plans and better management of changes.

In project management construction, the client has project and sketch plans made up to a certain level and, on their basis, invites project management contractors to tender for

them, selecting one to manage the implementation planning and to implement the project. The selected project management contractor is then responsible for both the management and implementation of the project's planning, although design contracts are usually left in the client's name. The contractor is also responsible for subcontracting but makes decisions on these together with the client.

Project management contract tendering is usually based on a target price and a ceiling price, as well as a separately tendered project management fee. Exceedance of the target price is divided between the client and the contractor up to the ceiling price, after which the contractor alone is usually liable. The model can also be based on a target budget, which gives more freedom to control the project's cost estimate, but also requires strong cost control.

The advantages of project management construction include overlapping design and construction, which reduces lead time and facilitates change management and the client's ability to participate and influence things. The challenges of the model are typically the expertise of the client and the sufficiency of resources.

Project management construction is suitable for larger and more demanding projects, in which the client must be prepared for changes during design and construction and in the management of which the client can actively participate. In wood construction, the model supports the implementation of more demanding buildings that involve, for example, development during the project.

Variations in project management contracting include **project management consultancy and project management service.** In project management consultancy and service, the client invites developer consultants to tender, and the selected developer consultant in turn puts all contracts and other assignments out to tender directly on the client's behalf. In project management service, the consultant is also responsible for the management of the construction site and bears the responsibility of the project supervisor. Both models are poorly suited to public construction, as they lead to the splitting of projects and to too many public procurements.

7.2.4 Integrated project delivery

Implementation methods with integrated project delivery (IPD) emerged from the need to manage changes in construction projects, develop them and manage the risks involved. These models are also called collaborative.

IPD models are based on early selection of the parties and wider use of expertise and resources, a common contractual basis and the sharing of risks and benefits. Integrated

project delivery guides the parties to develop the project, simultaneously plan its solutions and the way they are implemented, and to manage its changes and risks. In addition, IPD models involve open budgeting, cost control and open book invoicing.

The **alliance model** is the most advanced IPD application, in which the client organises a tender competition for the key roles in the project and forms a joint alliance organisation with the selected parties. The aim of the tendering is to find the best partners to plan and implement the project together, sharing its risks and benefits. Tender competitions can be carried out on the basis of project planning alone or even without plans. Tenders are usually compared on the basis of the tenderers' capabilities (competence, ability to produce value, etc.) and/or the quality of the tenders (project plans, etc.) as well as the fee (project margin).

In the alliance model, the client and the selected service providers enter into a joint alliance agreement and agree on a common incentive scheme (bonus/sanction) based on the client's objectives. The alliance complies with the general terms and conditions of the alliance established for the purposes of the agreement.

An alliance always has a development phase and implementation phase. During the development phase, the parties determine the content and scope of the project, the quality level, the design solutions and the way they will be implemented, and confirm the target cost. The client then decides separately whether to move to the implementation phase or to discontinue the project. The implementation phase includes construction and the planning of handover and start of use, as well as responsibility for five years after completion.

The strengths of IPD models are better utilisation of the resources and know-how of the different parties, a joint development phase, shorter lead times, commercial conditions that encourage the realisation of common objectives and the management of changes and risks, as well as joint responsibility of designers and contractors for objectives and results. The challenges of the models include the need to adopt a new open contract structure that differs from fixed contracts and to build trust between the parties. The expertise of the client and the sufficiency of resources may also pose challenges.

IPD models are best suited to more complex projects involving product development, risks, opportunities and change management.

One alternative to the alliance model is a collaborative project management contract with a target budget developed from the traditional project management model. In this model, the client first commissions sketch plans and then invites tenders from builders, selecting one based on its ability and/or quality and fee. The client and contractor conclude a traditional project management contract as well as a separate collaboration agreement on the

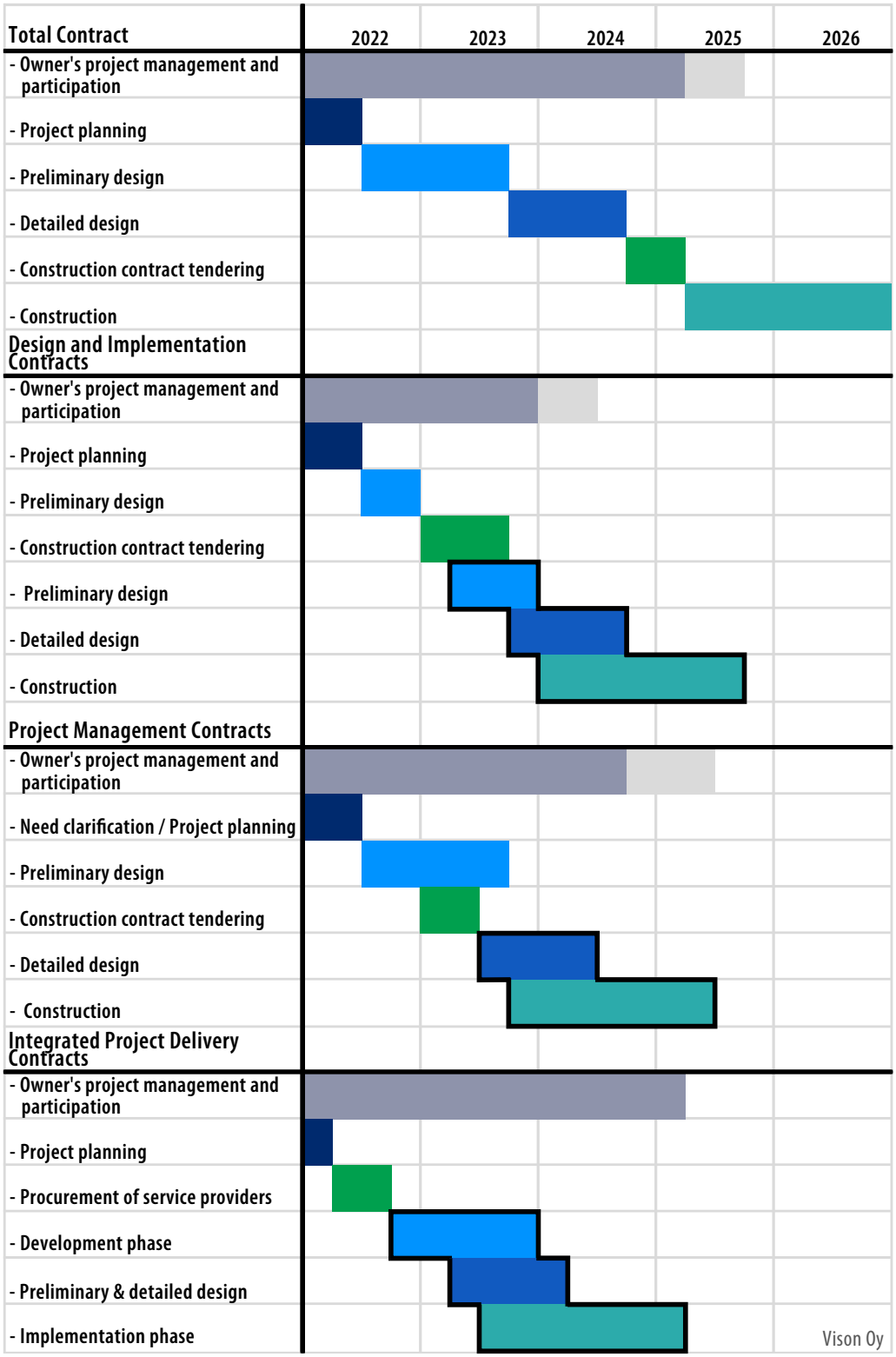
project's operating principles and/or common incentives. The scope and content of the project, as well as the target budget, are determined in more detail during the development phase, at the end of which the client makes a decision on the transition to the implementation phase.

7.2.5 Other implementation methods

Construction projects can also use various combinations of the primary implementation methods. These include fixed-price and turnkey contracts with a joint development phase, which have been tested by the Finnish Transport Infrastructure Agency and some cities. However, the challenge for these hybrid models is reconciling traditional fixed contracts with integrated contractual terms.

The latest implementation methods are tendering based on lease agreements, in which the client invites tenders for the planning, construction and project financing in practice by means of lease agreements. The model is significantly simpler than the traditional PPP model, and its providers can, depending on the client's plans, make very extensive use of different implementation methods.

Figure 4. Effect of the implementation method on the lead time of the project. (Vison Oy).



7.3 Suitability of implementation methods for wood construction

All implementation methods used in construction projects are also suitable for wood construction. It is more important to consider the role and responsibility of the client in the planning. Is it better to plan the project entirely or partially in-house, leave the planning to the tenderer, or plan the solution and its implementation together?

If the client wants to design the building from start to finish, this limits not only the solutions and technology to be used, but also the implementation method. In practice, the process leads to construction with a fixed-price contract, a split contract or main and secondary contracts. The client may, through market dialogues, take the expertise and experience of the industry into account in the procurement, but the construction contractors are not an integral part of the procurement from the beginning.

Implementation models with turnkey delivery and project management contracts based on the client's sketch plans provide the market with more opportunities. With this method, the client may be content to define, for example, the functional requirements and let the tenderers decide on the technology. Definition should pay special attention not only to the investment, but also to solutions during the life cycle. The model allows for more room for manoeuvre and enables more competition, but it also leaves options open. These models require competence and in-house resources from the client.

IPD models are best suited to projects where the client has no plans or only has sketch plans. On the other hand, the selection of service providers for such projects is always guided by their own expertise and resources, that is, the tenderers' expertise in wood construction.

When choosing the implementation method, it is also worth taking into account the desired financing model. Various life-cycle or leasing models also work well in wood construction.

The choice of implementation method and procurement procedure very strongly guide the utilisation of the market, so it is also worthwhile conducting a market dialogue on these choices.

8 Procurement recommendations for wood construction

It is important for the municipality or city to have a common will towards wood construction or otherwise low-carbon construction. The work of officials is made easier if, for example, the municipal strategy includes clear goals for promoting carbon-neutral construction. Guidelines set out in the municipal strategy make it is easy for officials to rely on decisions that have already been made and eliminate the need to justify the decision again for each project.

It is important that the client understands the value chain of industrial wood construction. Understanding the value chain and communicating to potential tenderers at the very beginning of the project allows the client to receive the best possible information on the stage of decision-making at which details must be finalised so that the industry can react, and at the same time the industry can communicate about the progress of projects and is able to make investments and resource production in good time.

Conducting a market survey is of primary importance, as it gives the client an insight into the supply in real time. A market dialogue gives the client a good idea of the boundary conditions of the project from material choices to requirements for designer references or minimum turnover – it reveals what should be required of tenderers and which requirements can be relaxed. This leads to more competitive tenders, as tenderers dare to tender with a lower safety margin, leaving room for new innovations and development work.

Market dialogue should start as early as the needs analysis/project planning phase. The cost estimate calculated based on the project plan is binding, and if wood construction has not been taken into account in the calculations, choosing the material may become more difficult as the project progresses.

Inviting tenders for completed plans may result in not receiving any competitive tenders or in receiving tenders that do not comply with the invitation to tender. If the client handles the planning in-house, the importance of market dialogue increases, as it provides the client with framework conditions for plans and makes providers better able to submit tenders based on the plans.

When selecting a tendering model, the client should simulate how much it will cost providers to participate in the planned tendering phase and assess whether this will affect the quality or quantity of the tenders received.

Clients should use overall consideration in setting requirements for suppliers. Suppliers must be able to credibly implement the project, and the client's risks must be controlled. However, traditional rigid requirements for minimum turnover and references may exclude potential tenderers and innovative new implementation models from the tender process. For example, in the case of references, it must be assessed what kind of expertise or capability the developer wants, and the demonstration of this should be left to the tenderer, if possible, instead of being a rigid requirement. The company may have high-quality experience of construction site operations even if it has not previously done a wooden frame, in particular. It can be considered whether it is sufficient that the general foreman has experience in installing wooden frames or whether the company, in particular, must possess this expertise.

The public developer may order solutions that meet its own objectives. The low-carbon approach and the bold recording and requiring of other objectives also enable suppliers to respond unambiguously to the targets set.

The selection of the right procurement procedure and implementation model are the most important decisions in procurement. The choice must be made as a whole and, in addition to technical solutions, it must take into account the market situation and the public developer's own objectives and resources.

9 Definitions and abbreviations

CLT. Cross-laminated timber.

Life-cycle approach. The basic principle of the life-cycle approach is that the environmental impacts caused by the project are examined in their entirety over the entire life cycle.

Carbon footprint refers to the climate load caused by a product, activity or service, that is, the amount of greenhouse gases generated and released into the atmosphere during the life cycle of the product or activity. The carbon footprint of a product is expressed in terms of weight per unit of measurement most commonly used.

Carbon handprint refers to the benefit that a product or service brings in reducing carbon dioxide emissions. However, the term is not standardised, so the carbon handprint can be used to mean slightly different things. Nevertheless, it is always a positive factor, and wood construction often focuses on long-term carbon storage.

Carbon neutrality. Carbon neutrality means that CO_2 emissions are produced at most to the extent that they can be absorbed from the atmosphere into a carbon sink.

A **carbon sink** is an ecosystem or part thereof that is capable of absorbing and sequestering CO_2 from the atmosphere.

Carbon reservoir. Carbon reservoir refers to stored carbon that is not in the atmosphere.

Engineered wood product. Engineered wood product refers to structural components made of wood. The most typical products used in Finland are logs, cross-laminated timber (CLT), laminated veneer lumber (LVL) and glued laminated timber (glulam).

Circular economy. The circular economy refers to a production and consumption model where existing materials and products are utilised as much as possible by borrowing, renting, reusing, repairing, renovating and recycling. This extends the lifespan of products.

Turnkey. Turnkey construction.

Service class. Structures are divided into service classes 1, 2 and 3. The service class system is mainly intended for the breakdown of strength values and for the calculation of deformation under specified environmental conditions.

LVL. Laminated veneer lumber.

Market survey refers to market research carried out prior to the commencement of a procurement procedure to prepare for the procurement and to provide information to suppliers about the upcoming procurement.

Market dialogue. Market dialogue refers to dialogue between the client, suppliers and end-users before, during and after the procurement process.

Transformability. Transformability means the ability to transform a building or part of a building for different operating situations and circumstances.

Fire class. A building is given a fire class P0, P1, P2 or P3 based on its properties.

SME. Small and medium-sized enterprises (SMEs) are defined as enterprises with fewer than 250 employees and an annual turnover not exceeding EUR 50 million or a balance sheet total not exceeding EUR 43 million, which are considered independent enterprises according to the definition of Statistics Finland.

Wood products industry. The wood products industry consists of several wood-processing sub-industries that can be broken down by degree of processing or end-use. Statistics Finland's Standard Industrial Classification (TOL 2008) places the wood products industry in division 16.

A **reference plan** is a plan that sets certain objectives or requirements for a planned building or part thereof, independent of the implementation method.

Solid wood building. In this guide, solid wood building refers to a building with a load-bearing frame that mainly consists of solid wood products, such as CLT, LVL or log.

Prefabricated panel. In this guide, prefabricated panel refers to all different types of panel-shaped prefabricated products. These can be various large panels, floor slabs, suspended floors, wall panels or other similar prefabricated panels.

Prefabricated module. For the purposes of this guide, prefabricated module refers to all prefabricated sections or boxes that are manufactured off-site. Prefabricated modules consist of different sub-components and prefabricated panels.

Subassembly delivery. Subassembly delivery refers to a subassembly in which the supplier is responsible not only for the manufacture of the products of the delivery, but also, at minimum, for the design of the products.

DB. Design and build contract.

10 References

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