SUSTAINABLE SCHOOL BUILDING RENOVATION

promoting timber prefabrication, indoor environment quality and active use of renewables

Schulzentrum Neumark (AT) | Photo: Georg Ott | Architecture: Arch+More ZT GmbH

school's financial signpost

RENEW SCHOOL

www.renew-school.eu

Previous research projects showed that **time and cost optimized** as well as high-quality application of prefabricated elements in building retrofit depends less on technological availability than on frictionless project progress with unimpeded action chains and optimized work-flows.

Communication channels, information flow, interface management and a clear definition of rights, responsibilities and obligations are crucial aspects to achieve this [1][2][3].

Prefabrication offers a lot of opportunities compared to current applied standards, but the retrofit reality is lagging behind the technological options. Additionally, the initial high investments required for deep renovation of schools is one strong barrier.

Therefore the Renew School project aims to learn from practice and to gain a new understanding by a so-called «bottom-up approach»[1] in order to support practice.

This learning from practice is being investigated through a **comprehensive survey, interviews with key actors** (main contractor, architect and building owner), and an **international workshop**.

In total 14 renovated schools and kindergartens as **practice best examples – the Renew School frontrunners** were analyzed from the Renew School partner countries: Austria, Belgium, Denmark, Italy, Norway, Poland and Slovenia. The **survey questions** (24 respondents) were not only focusing on collecting relevant information on the case studies but also on the conventional practice of financing school renovations in the participating city/regions, since it was acknowledged important to gain an understanding of the wider context where the case studies are located. Furthermore, an **international workshop** "Successful Cooperation Models in Sustainable School Renovation" was held on 19th November 2015 in Stuttgart, Germany, in which during moderated round tables focus topics discussed were "the enablers for change" in financing, cooperation, process and prefabrication technology for school renovations.

The applied **cooperation models** and **financial methods** in the best practice case studies gave deeper understanding on how they work as well as an insight into the reasons of those involved to choose for **timber prefabrication technology**, what were the key decision makers in it, and the experienced barriers and advantages as lessons learnt.

Special attention provided in this 'Signpost' document is the results from exploring the financial methods used for the renovation of the featured school and kindergarten examples. This included description of specifics in financing of each renovation case study as well as, on a broader level, what is the conventional practice of financing advanced renovation of schools in their corresponding city/region. Moreover, focus was given on highlighting novel ways /methods which, through this report, can be shared to school building owners and other stakeholders.

In short, **in this document** one can read about: description of methodology and means used to learn from practice of frontrunners, overview of the general findings, then about the financing methods in the Renew School frontrunners, conventional practice and wider available financing opportunities for sustainable school renovation. Furthermore, about the key findings on the cooperation models and action chains (process) as well as key findings on using timber prefabrication technology. Finally, lessons learnt are presented. **Aim is to be a useful guide to school building owners and stakeholders.**

[1] Geier Sonja, et al. (2013). p 8-9.

INTRODUCTION

SCOPE AND CONSTRAINTS

Advanced school building renovations using prefabrication technology is a complex process. The scope of the investigation presented in this report was first to distil an understanding of the financing methods and the cooperation models including the action chain (process), and then on the aspects affected by use of industrial method with timber prefabrication.

Therefore, it was deliberately chosen as 'out of scope' to investigate all possible social, environmental, economic and construction related aspects of the building process in the case studies, as well as not to investigate aspects affected by chosen renovation measures, the user and architectural aspects. The diagram below illustrates this narrowed scope.

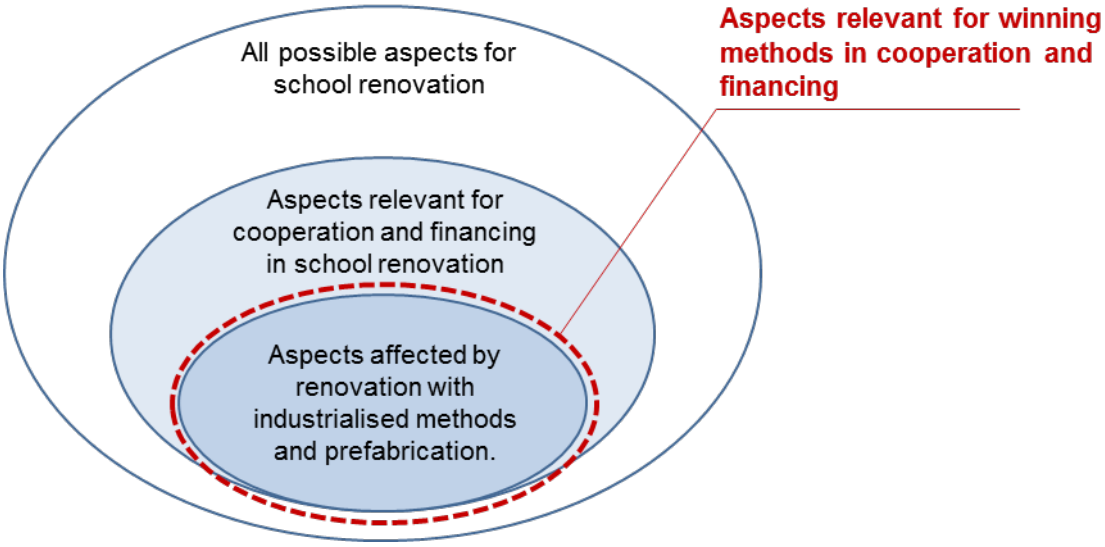

Figure 1: Scope of the Renew School Survey; Source: Sonja Geier

MAIN OBJECTIVES

- Investigate the way the Renew School frontrunner examples were financed
- What is the conventional practice of financing school renovation within the Renew School participants, and
- Highlighting novel ways /methods of financing that can be of interest to school building owners and other stakeholders.

Two additional objectives were to:

- Identify strengths and weaknesses in the cooperation model in the frontrunner examples, and
- Find out the experiences with the use of prefabricated timber technology.

METHODOLOGY AND MEANS USED

To reach the above objectives, data from identified frontrunners of the Renew School project was collected to get an in-depth understanding of the composition of funding sources as well as complexity of cooperation models, renovation process and experiences with the use of prefabricated timber technology. To this end, tools used were: **survey questionnaire, individual interviews and visualization tools**.

The **survey questionnaire** (see Annex I) was suitable in order to generate data on the frontrunner cases by asking different key actors involved (project manager or owner and investor, architect – planner and the main contractor). Additionally, the **interviews** were appropriate to get an understanding of the unique approach/ experience of each project.

The survey was accessible on-line via 'Survey Monkey'. Completing the survey and the interviews were anonymous, strictly confidential and in accordance with the privacy law.

The survey questions were not only focusing on collecting relevant information on the total of 14 selected front runner projects with in total 24 respondents from the Renew School partner countries, but also on the conventional practice of financing in their consequent city/region, since it was acknowledged important to gain an understanding of the wider context where the case studies are located.

The selection of the case buildings (frontrunners) was done as part of WP2, Task 2.1 "Collecting Frontrunners" of the Renew School work plan, where it came apparent that due to lack of completed advanced school building renovations using prefabricated timber technology in some Renew School participating countries, the scope had to be widened to include educational buildings in the wider sense (e.g. kindergartens) and to new buildings using timber prefabricated technology.

In total, twenty four respondents answered the survey and interview questions and were consequently analyzed.

The data was analyzed by the WP3 leader PHP together with the external expert Sonja Geier, Switzerland.
The analysis findings were consulted with the Renew School partners.

Additionally, a desk research was done on the available financing opportunities at EU level, such as financing channels that building owners could apply for to finance sustainable renovation of schools. Also, desk research was done on the concept of Energy Performance Contract (EPC) with an Energy Service Company (ESCO) and few possible solutions to increase the impact of EPCs.

GENERAL FINDINGS

REASONS TO RENOVATE

The majority of the participants to the survey and interviews were school owners and main contractors (38% and 33% respectively), followed by the architects 24% and facility managers and project coordinators 5% each.

Main reasons to renovate were to: Improve thermal comfort in winter (found in 71% of the answers), followed by improve indoor air quality and degradation of components and installations (58% in both cases).

Followed by reduce energy costs, environmental awareness and improve thermal comfort in summer. Moreover, in 58% of the cases there were specific requirements on conditions (indoor air, thermal, visual comfort).

Least important was to: improve the image of the school, improve visual comfort (daylight/shading) and improve acoustical performance.

In 70% of the frontrunner cases the energy conditions were demanded as integral part of the renovation. Interestingly, this was expressed in different ways: requirement such as reaching the passive house standard or through a more general sustainability requirement without specifying an energy standard.

This demonstrates different pathways that the front runner cases had as main reasons for advanced renovation using prefabrication technology.

Regarding use of public tenders, the Figure 2 below shows the importance of the criteria in evaluation. The results demonstrate priorities of investment costs (88%), followed by quality (53%) and experience of the tender applicant (47%). Operating cost and technical merit were 35% and 29% respectively. Least important were the methodology, CO_2 emissions and life cycle cost.

It is somewhat surprising that for these front runner buildings, the importance of CO_2 emissions and calculations based on life cycle were not more prominent.

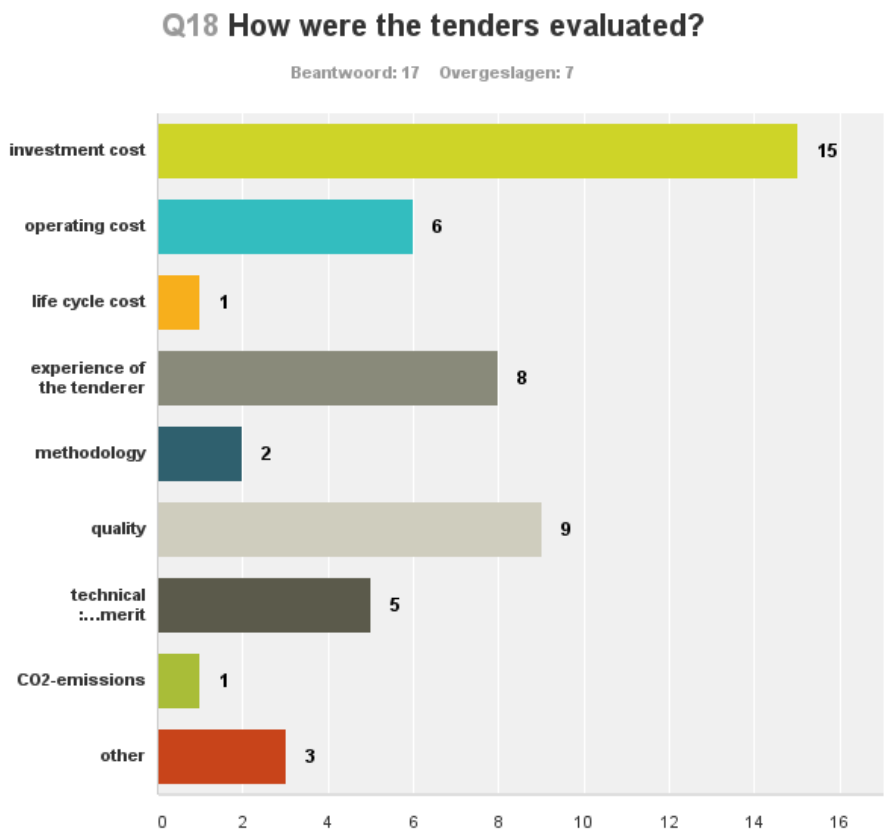

Figure 2: Renew School frontrunners survey: overview of responses.

FINANCING METHODS IN THE FRONTRUNNER SCHOOL RENOVATIONS

Typically the municipality / school owner pays the energy bill of the school/kindergarten out of the yearly operating budget, and this is the case before and after the renovation.

The majority of financing came from funds, subsidies and grants, followed by preferential loan programmes and VAT reductions. Importantly, novel forms of financing were used, although in small number of cases, as third party financing ESCO Energy Service Company and energy guarantees (7%).

This shows that typically in the frontrunner cases, the funding was obtained from a combination of sources: majority of which as public capital, and increasingly with private capital (preferential loans), to which further private capital such as third party financing with its form of ESCO formula and guarantees was a complementary enabler for achieving the necessary renovation budget.

In more detail, an EFRO funding, regional development funding or an eco-funding were accessed to supplement the budget of a province/municipality where the school is located. Also, national funding and research funding as grants were used.

The case buildings often represented the 'first off' in, for example applying an energy standard such as the passive house or implementation of innovative technologies (e.g. lighting, LED systems, control systems) for which research grants were applied.

Private financing was also used in form of private bank funding (typically with preferential loans at 2% interest rate or lower). Finally, VAT reduction where possible was also used.

Looking into the experiences of what were the **positive and negative aspects** with the used financing method and possible ways for improvement revealed:

- Disadvantage with the traditional banks that could give a loan (although with the guarantee of the government) under unfavourable conditions. Ethical bank gave better conditions.

- Advantage with the municipality as being only "one owner", for calculation of construction and maintenance costs.

- Those using EU grants experienced positive aspects as was the systematic approach with good organization, yet negative was the complex procedures that can result in delays or even non-use of already appropriate funds.

- A lot of effort needed to convince the regional government of the comprehensive way of renovation resulted with additional hours of work.

It became apparent that majority of the frontrunners had to combine several financing sources, each of which had their own requirements, with an overall picture of fragmentation due to these various "side objectives".

In reflection to the financing of frontrunner buildings, the respondents were also asked to explain **"How school renovation projects are typically financed in their city/region (or nationally if applicable)"**?

The answers provided showed that typically funding comes from the municipal budget or the city budget where the school is located. To this funds operated by central government is in cases linked.

New direction reported by one responded is preparations on PPP-Energy Performance Contracting (City of Warsaw) for up to 30 schools that need retrofit, in which certain level of energy savings should be guaranteed by the private partner the Energy Performance Contractor.

As to what are the main advantages of the commonly used financing models in their cities/regions, the respondents placed "one owner" (typically municipality) benefiting from the energy savings directly in the budget.

Negative aspects were that, should the intended project go beyond the valid building codes, the municipality must on its own obtain additional funds that would come from different sources, including EU funds.

When own funds of the city were used, this resulted to faster and simpler investment process. **The disadvantage here is that the related lack of requirements as to the environmental effects of the investment leads to maintaining common bad practice if school managers do not consider decreasing energy costs to be a critical issue.**

A barrier is also reported when there is no separate available funding for thermal retrofits, so application of these measures to school retrofit must compete with other maintenance actions such as removal of asbestos and works on water installations, for example.

Basically, any financing model was an aggregation of different sources. Each source was bound to requirements, for instance: application of innovative or sustainable technologies or materials, achieving comfort criteria, etc. Nearly in all projects the time needed to develop the financial model took several years! At this time the renovation project was not fixed and the planning effort had to be kept as low as possible. Thus, a team that would have been necessary to streamline all activities in financing and target-setting for the renovation did not exist in the early design phases.

THE EXAMPLE OF NEUMARKT, AUSTRIA

An exemplary case study from Austria provides an insight into the financing scheme and typical procedure:

In the **case of Neumarkt**, financing the school renovation came from the "school maintenance contributions" as share with 7 adjacent municipalities, the Styrian provincial government, Neumarkt with own funding from loan of low interest and own direct resources (as illustrated below).

Interestingly, the loans of low interest were contracted with local banks for 20 years from 2011 with an annual interest of 1.5% to 1.7%.

In addition to the money from the Styrian provincial government and the municipalities themselves, money also came from the Federal Ministry of Transport, Innovation and Technology which has been given for setting a *best practice example in energy efficiency*.

Also, the managing contractor which carried out the renovation was organized as a limited commercial partnership ("Kommanditgesellschaft", short "KG" in German) which claimed 20% VAT reduction. The KG contracted all the other branches of the renovation works directly, but only coordinated them.

This resulted with obtaining the budget as: originally planned costs 4.9 Mio EURO; final costs ca. 7 Mio EURO.

It has to be stated that in this and also in other cases where originally planned costs have been exceeded, the reasons have not been higher costs for the prefabricated elements. Mostly higher costs came from structural-problems with the construction or from the completion of the interior etc.

Conclusions

All in all, school renovation funding is not an easy thing for the mostly public authorities because there is a big effort needed which has to be done on splitting the financial requirements into years and branches over the renovation process.

Without advice of financial consulting and the knowledge of experienced municipal employees this could be one great barrier for performing such renovation actions.

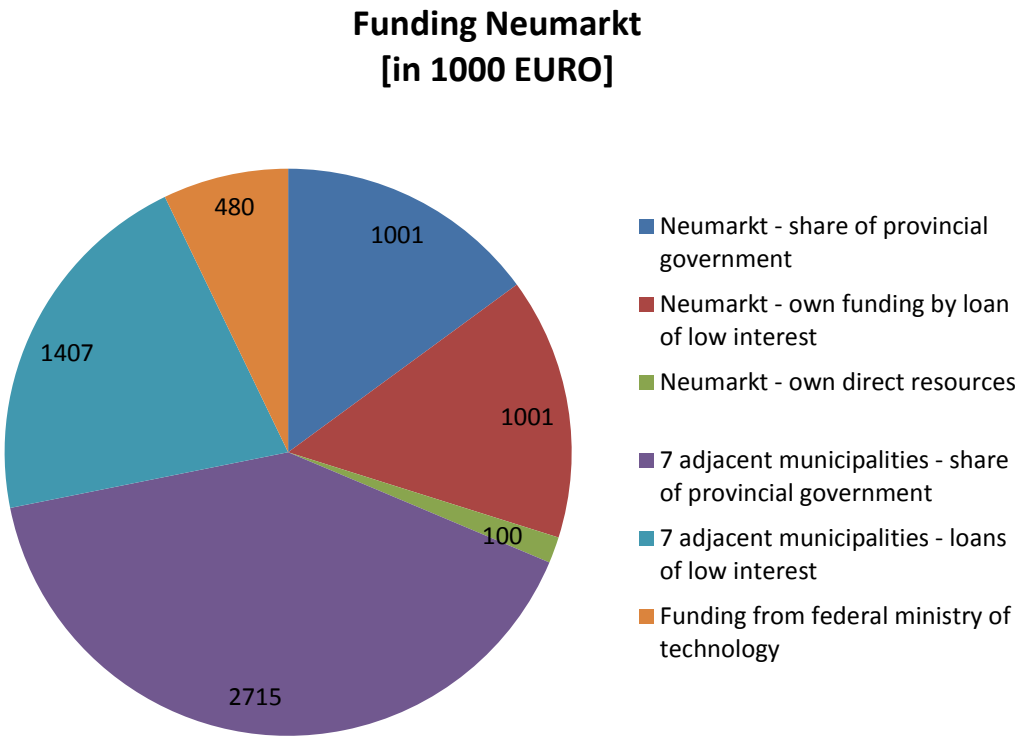

Figure 3: Funding in Neumarkt. Source: AEE INTEC

The above findings from Austria clearly demonstrate the necessity of building owners to combine various sources of financing including own direct resources, own loans, in combination with public funding at provincial or federal level and additionally, whenever possible, use funds supporting best practice example.

Difficulties arising show that each funding source is bound to own requirements, long time is needed to acquire and develop appropriate financial model resulting in organizational burden and costs.

Therefore, it is necessary to streamline all activities in financing and target-setting for the renovation from the early design phase of the school renovation.

General Austrian way of funding school renovations: Currently there is more or less one way to finance a school renovation of a public Austrian school:

Getting a share of more than 50% of money from the provincial or federal government, the rest paid by the school owner which could be the municipality, the provincial government or the affiliate "BIG" (http://www.big.at/ueber-uns/unternehmen/facts-figures/) of the federal government or educational institutions with public status. In case of some primary and secondary schools a number of municipalities together pay for the renovation as a syndicate, sending pupils together in one school. All use loans of low interests from regional or national banks to finance their share of the budget.

THE EXAMPLE OF STORZEK, SLOVENIA

Another exemplary case study from Slovenia provides an insight into their financing mechanisms used:

In the **case of Storzek Kindergarden**, the main reasons to renovate were improvement of the degraded components and installations, improvement of thermal comfort in summer and winter, improvement of indoor air quality and reducing energy costs. The kindergarten was an old, energy wasteful and no longer met the norms prescribed for kindergartens. The kindergarten is owned by the local municipality where the building is located, therefore energy bills are paid from the municipal budget before and after the renovation.

The main reasons to choose for prefabricated modules were energy saving, integrated natural and renewable materials (wood, speed of construction), as well as possibility to obtain subsidy from the Slovenian Eco Fund.

Financing the renovation works shows similarly to other frontrunner cases, a combination of sources. In this particular renovation, own financing by the owner the local municipality was through a loan (under favourable conditions) and subsidies by the Slovenian Eco Fund and the Slovenian Regional Development Fund. **In fact, it was the available subsidies that made possible that the municipality could finance the construction of a better, more energy efficient kindergarten with better quality for the children and staff.**

Energy performance conditions were tied in with the use of the Eco Fund, encouraging the passive house standard. Namely, the average thermal transmittance of opaque part of the thermal envelope must be maximum U-value lower than 0.12 W/m2K and installation of external joinery with triple glazing with Uw lower than 0.90W/m2K. Additionally, space ventilation requirement with heat recovery exhaust air efficiency at least 80%. The total subsidy was 420,000EUR and the municipality investment was 2.800,000 EUR.

Interestingly, in this renovation the tender was evaluated on basis of investment cost, operating cost, experience of the tender as well as quality and life cycle cost.

As to the prefabricated elements they included insulation, air-tightness measures, window frames and glazing and electrical pipes and electrical boxes.

The experience with the use of prefabrication technology was rather positive. It did lead to shorter execution time on site, higher quality, less burden on site and better comfort. The cost was not evidently lower.

CONVENTIONAL PRACTICE OF FINANCING SCHOOL RENOVATIONS

To get a broader view on the methods of financing school renovations, the survey participants in Renew School were asked to describe **how school renovations are typically financed in their regions/municipalities?**

Financing from the municipal budget is most frequently mentioned. However, in the city of Warsaw, Poland, four main financing sources are used:

- Own funds of the city of Warsaw and funds of the each of the 18 city districts;
- Funds operated by the city of Warsaw represented by its Environmental Protection Department;
- Funds operated by the central government's institution the National Fund for Environmental Protection and Water Management;
- The Thermal Retrofits and Renovations Fund operated by the Bank Gospodarstwa Krajewego and 12 banks cooperating with this bank.

Interestingly, the city of Warsaw in coordination with the Infrastructure Department is undergoing (2015) the first Private Public Partnership with Energy Performance Contracting (EPC) for retrofitting 30 schools. This will result in certain energy savings being guaranteed by the private partner through the energy performance contracting scheme.

What are the positive and negative experiences of the most commonly used financing method?

The received responses create a picture for positive aspect of "one building owner –the municipality - is the decision maker for the financing". Therefore, the energy savings due to renovation have a positive effect on the municipality budget (no split-incentives issue).

When using own municipal funds, the advantage is that there is no need for application process to obtain external funds, resulting in an investment process being simpler and faster.

Specific disadvantage related to the typically available funds pointed out is also the relatively small amount with no separate funding for thermal retrofits, therefore thermal retrofit application must compete against e.g. applications of removing asbestos or connection to sewage system.

Point of attention with the PPP-EPC financing is that the building owner to a large effect loses control over the management of the renovated schools for the duration of the EPC contract.

Other reported obstacles were the limited funds/ budgets that municipalities have for renovation and lack of focus to renovate existing buildings with more attention given to new buildings. This leads to necessity to raise awareness amongst politicians on the need for renovations combined with allocating more available financing to the municipality's operational budgets.

WIDER AVAILABLE FINANCING OPPORTUNITIES FOR SUSTAINABLE SCHOOL RENOVATION

ELENA – EIB

www.eib.org/products/advising/elena/

European Local Energy Assistance run by the European Investment Bank (EIB), funded through the European Commission's Intelligent Energy-Europe programme.

Many EU towns and regions lack the necessary technical expertise and organisational capacity to implement large energy efficiency and renewables investment programmes. Such an investment programme could be for example include on deep renovation of a large portfolio of school buildings.

ELENA covers up to 90% of the technical support cost needed to prepare, implement and finance the investment programme. This could include feasibility and market studies, programme structuring, energy audits and tendering procedure preparation. With solid business and technical plans in place, this will also help attract funding from private banks and other sources, including the EIB.

ENERGY PERFORMANCE CONTRACTING (EPC)

www.managenergy.net/lib/documents/868/original_3-221-13_Bullier_-_Alternative_financing.pdf

An EPC is an integrated contract in which an Energy Service Company (ESCO) designs and implements energy conservation measures, and guarantees the energy savings for the duration of the contract. The energy savings are used to repay the upfront investment costs, after which the contract usually ends.

EPC is identified as the key instrument to finance investments on buildings. However, it is rarely used today to finance investments in deep renovation of buildings. EPCs have historically developed on short term contracts focusing on measures generating low savings such as energy management and lighting, and to a lesser extent HVAC (Heating, Ventilation and Air-Conditioning) systems.

The major players in the EPC sector are companies selling measurement devices and/or lighting equipment; they pre-finance such contracts because the payback is quick and they mostly sell their devices, with little technical risk. Deep renovation requires investment on the building envelope with a longer payback time.

Most construction companies do not have a culture of building management: their core business consists merely in building, but very few are involved in maintenance. **However, construction companies are an emerging player in the EPC market for deep renovation.**

Another emerging player on EPC markets could be the **utilities**, seeking to take profit of and develop their contractual relationship with their clients, including selling them energy savings instead of energy consumption.

Public contracts are awarded according to public procurement rules. In order to procure an EPC, a traditional call for tenders is not very adapted due to the impossibility for the client to define beforehand the technical solutions, the duration of the contract and the level of savings.

Two other solutions exist to procure an EPC:

- **In a negotiated procedure**, the client preselects one candidate ESCO based on its general skills and/or a potential offer, and negotiates with the ESCO the content of the contract; this solution is quite flexible, but provides less guarantees for the client to obtain best value for money, as the preselected ESCO has no incentive to make the best offer;
- **In a competitive dialogue**, the client preselects at least 3 candidate ESCOs, and negotiates with them in parallel over a several stages procedure. Competitive dialogue provides better value for money, but entails higher costs for the competing ESCOs which can repel them from competing or force the client to offer a fee for covering part of these costs.

COMPETITIVE DIALOGUE

AN EU PUBLIC PROCUREMENT AS A POSSIBILITY FOR SCHOOL RENOVATION PROJECTS

Source: *www.eipa.eu*

Competitive Dialogue was created by the 2004 Public Procurement Directives as a new and more flexible solution for public authorities wanting to award contracts for complex infrastructure projects.

It is now firmly established in Europe as a means of awarding public contracts, with more than 3000 award procedures launched.

It is meant to allow a public entity which knows what outcome it wants to achieve in awarding a public contract but does not know how best to achieve it to discuss, in confidence, possible solutions in the dialogue phase of the tender process with short listed bidders before calling for final bids. This can often occur in the case of complex and high value infrastructure projects. (Full explanation can be found at: Art. 1(11)(c), Directive 2004/18 defines Competitive Dialogue.)

The use of the Competitive Dialogue procedure by public authorities wishing to award "particularly complex" contracts is very explicitly (though not exclusively) linked with the implementation of Public Private Partnerships (PPP).

Why was the Competitive Dialogue procedure needed?

Prior to the introduction of the Competitive Dialogue procedure, Contracting Authorities faced a dilemma in determining how to conduct a contract award for complex contracts. Even if Contracting Authorities had a good idea in advance of the award process of the precise shape of the key features and the strengths and weaknesses of potential solutions to their needs, and often they did not, there were practical difficulties in enabling them to remain open to the development of their ideas to improve those solutions. They faced the choice between the Restricted Procedure and the Negotiated Procedure.

Competitive Dialogue has started to be used widely within the EU, following the transposition of the Public Procurement Directives into national law due to be completed by 31 January 2006.

The current methods of conducting the dialogue phase may be summarised as follows:

- Inviting several solutions, then narrowing the differences between them towards a single merged solution i.e. to use the early part of the dialogue phase to develop a hybrid solution (one based on the best features of the solutions proposed by the different participants).
- Inviting outline solutions and then one or more progressively more detailed solutions.
- A consecutive approach i.e. dialogue first on technical/ operational aspects and then on financial aspects of the offer.
- Starting from a provisionally preferred solution of the Contracting Authority and inviting bidders to comment on it by marking up the solution as the basis of the dialogue.

If properly applied, Competitive Dialogue leads to the detailed planning necessary for effective procurement of infrastructure. However, Competitive Dialogue has been applied in several different ways so far but not all of them are equally effective in achieving value for money.

Further information on the Competitive Dialog and its advantages and limitations can be found at:

http://www.eipa.eu/files/repository/eipascope/20100114121857_Eipascope_2009_2_Article2.pdf

AN EXAMPLE OF EPC WITH AN ENERGY SERVICE COMPANY (ESCO)

A NEW BUSINESS MODEL FOR RENOVATION OF SCHOOLS IN ANTWERP, BELGIUM

The Cleantech & Sustainability service of EY (previously known as Ernst & Young) developed an Energy Performance Contracting (EPC) business model which is part of their sustainable advice activities in Flanders, Belgium.

It is a pilot project called "EPC-coaching" on potential cooperation on an EPC-contract between an Energy Service Company (ESCO) and four school centers in Antwerp, Belgium. The core idea is that an ESCO does a sustainable investment in schools resulting in their energy use reduction with guaranteed savings.

The pilot project is based on the idea of Energy Performance Contracts (EPC), whereby due to undertaking energy saving measures in buildings, there is a guaranteed % of reduction in energy use.

The Energy Service Company (ESCO) is the party that does the upfront investments in the renovation measures which are paid back over time through reduced energy costs of the renovated buildings in use. Needed here is a good 'null-measurements' so differences in energy use before and after renovation can be easily determined.

The investments in renovation measures can be on the building envelope such as replacement of windows and doors, roof insulation, etc. and in installations such as replacement of the heating system and regulations, even in installing renewable systems (e.g. PV).

The ESCO proposes the renovation measures and their economic viability. The building owner must then decide on the measures to take in for the buildings renovation and the time scale for the contract. Typically, the investments in the building envelope have longer return on investments however they lead to higher level of energy savings.

Many building owners would like to invest in sustainable renovation however they do not have the financial means for the large investments. Here the ESCOs come in place to do the necessary investments and the return of investments capacity is guaranteed due to ESCO's responsibility that lead to reduction in energy use costs.

The ESCO does also the maintenance of the building for the duration of the EPC contract, which can be prolonged after the end of the EPC contract for an energy efficient maintenance contract.

Point of attention with the ESCO-EPC financing is that the building owner to a large effect loses control over the management of the renovated schools for the duration of the EPC contract.

Before starting an EPC contract with an ESCO, it is advisable to look for an EPC-Facilitator. The tasks of the facilitator are as follows:

- Propose to the client possible options for an EPC contract.
- Collect technical information.
- Prepare the scope of the project: which buildings to focus on (in case of larger building portfolio).
- List the output specifications: which renovation measures are feasible, comfort requirements and the use pattern of the building.
- Advise on the choice of an ESCO on basis of the proposed renovation measures and basic energy savings guarantees.
- Calculate possible savings.

Importantly, working with an ESCO-facilitator is necessary for a building owner in order to clarify potential barriers of juridical and accountancy nature.

The cooperation between building owners and an ESCO is a win-win situation. The ESCO gets undertaking of agreed renovation measures and maintenance and investments. The building owner has advantages of lowered energy costs, having its building renovated without need for initial investment and a renovation resulting in higher property value.

Ideally, cooperation with an ESCO should be for a pool of buildings, whereby the commercial risk for the ESCO is spread including the administrative burden.

Indeed, the investment costs must match the capacity for payment return. Typically such contract is 4 to 9 years.

AN EXAMPLE OF POOLING

PUBLIC PRIVATE PARTNERSHIPS (PPPS) IN THE ALSACE AND CENTRE REGIONS, FRANCE

Source: *www.managenergy.net/lib/documents/868/original_3-221-13_Bullier_-_Alternative_financing.pdf*

In 2009 and 2010, two major PPPs (Public Private Partnerships) have been signed by two French regions for the retrofit of high schools.

In Alsace, 14 high schools retrofitted for an investment of €30 m, leading to 35 % energy savings and 65 % greenhouse gases emissions reduction (as a result of the implementation of biomass boilers and PV panels); the contract duration of 20 years, and implemented by Ecolya, an SPV composed of Cofely (selected bidder) with additional capital from the public bank Caisse des Dépôts and FIDEPP, a branch of the private bank BPCE.

In the Centre region, a similar contract was signed in 2010 with Eiffage for 15 years, leading to €30 m of investments, 40 % energy savings and 50 % greenhouse gases emissions reductions.

AN EXAMPLE OF BUNDLING DIFFERENT CLIENTS

THE PROVINCE: OF HUELVA, SPAIN

Source: *www.managenergy.net/lib/documents/868/original_3-221-13_Bullier_-_Alternative_financing.pdf*

Bundling aims at aggregating different building owners in order to reach a critical mass where municipal projects become bankable for an ESCO acting as a third-party investor.

The province of Huelva in Andalusia, Spain comprises a large number of small municipalities. In the IEE-funded project **MLEI Accelerate** (*ec.europa.eu/energy/intelligent/projects/en/projects/accelerate*), the Province and the provincial energy agency are working to put together bundles of municipal investment projects which will be tendered to ESCOs.

The Province is investigating the best procurement procedures and contractual arrangement in order to make the contract attractive, and to keep the transaction costs as low as possible.

It is complicated for municipalities to sign a contract where they are jointly liable with other municipalities, and they are usually reluctant to do so, although this would be the most attractive for ESCOs.

If individual contracts are signed in the end, with different levels of savings and durations, a possibility is to select the ESCO on the basis of a few case studies, and to customise the offer to each municipality after the ESCO has been selected.

LESSONS LEARNT ON FINANCING METHODS

FUNDING POSSIBILITIES

- The '**lowest price and conditions within**' still pointed out as main evaluation criteria in tendering procedure (with highest priority: investment costs, quality and experience of tender applicant, respectively).
- Financing deep renovations consists of **aggregating different sources**. Typically, majority are public capital, and increasingly combined with private capital (preferential loans), to which further mechanisms of private capital such as third party financing with its form of ESCO formula and guarantees has been complementary enabler for achieving the necessary renovation budget.
- Also **used are VAT reductions, grants** from for example European Fund for regional Development (EFRO), regional/national funds.
- Being '**best practice' examples helps** frontrunner renovations to attract additional funding through research / innovation, demonstration funds.

NEW FINANCING

- The use of ESCO with EPC for upfront financing has a barrier as one school is too small to be interesting for ESCOs. Possible emerging solution is through either **pooling several schools of one owner, or bundling schools of different owners** (currently at experimental phase from wider EU examples).
- Before starting an EPC contract with an ESCO, it is advisable to **look for an EPC-Facilitator**.

ENABLERS FOR FINANCING

- Possible enabler can be c**onsidering prefab renovation modules as 'stock products'** that are tendered through framework contract for multiple projects that are to be executed in the coming years by the school owner. This has advantages well for the master plan for deep renovation, creating market volume and demand, economy of scale and assured work for the contractor.
- **Competitive Dialog** as a European tendering procedure could be also an enabler for high quality school renovations using prefabrication technology.
- Frontrunner school renovation examples show, in cases, that **advice with financial and technical consulting** can overcome the barrier of lack of experience and know-how of the municipal decision makers and employees.
- **Best results** are achieved when activities **in obtaining finances and target-setting** (including use of prefab modules) for renovation is **streamlined** and addressed from the early design phases.
- Making high initial investments to get better results on the long term although logical is still hindered with the practice of lots of small investments spread over lots of schools.

GENERAL ADVICE, FINDINGS, REQUIREMENTS

- **Main reasons** to decide for deep renovation is to improve thermal comfort, improve indoor air quality and reduce running costs.
- Deep renovation requires large upfront investments and obtaining funding from different sources is **time consuming, extra working hours, know-how needed** of the municipal staff or facilitator to assist.
- Point of attention with the ESCO-EPC financing is that the **building owner to a large effect loses control** over the management of the renovated schools for the duration of the EPC contract.
- Typically, funding for school renovation comes from the municipal budget where the school is located. Advantage is that that one owner (municipality) benefits directly from the energy savings due to renovation. Therefore, **the energy savings have positive effect on the municipality budget** (no split-incentives issue).
- Difficulties are when renovation aspirations go beyond "business as usual", in which case the **municipality must on its own obtain additional funds** that would come from different sources.
- Regarding the use of public tenders, typically the main criteria is the priorities of investment costs, followed by quality and experience of the tender applicants, then the operating cost and technical merit. **Rarely used criteria in typical public tenders are the methodology, CO_2 emissions and life cycle cost**.

COOPERATION MODELS IN THE FRONTRUNNER SCHOOL RENOVATIONS

WHAT ARE THE STRENGTHS AND WEAKNESSES IN THE COOPERATION MODELS IN THE FRONT-RUNNER SCHOOL RENOVATIONS?

The table below summarizes the survey findings from the 14 Renew School case studies.

COOPERATION MODELS STRENGTHS

1. Internal driving forces (e.g. motivated persons) pushed the project and innovative ideas (such as prefabrication) for a long time in order to realize renovation.
2. Extended design phases provide optimization options.
3. A central source of data proved to be beneficial for the project processing.
4. Personal meetings and dialogues in the beginning foster mutual cooperation in the team that is necessary for thorough information handling and frictionless procedures.

COOPERATION MODELS WEAKNESSES

1. Communication and information management between partners was lacking behind expectations.
2. Experts (passive house/timber manufacturing/ HVAC) were not integrated from the beginning.
3. No standardized documentation for the building itself and possible 'learning curves'.
4. The introduction of the users after renovation was dominated by technical experts less experienced to explain the functions in an understandable way.
5. Lowest price principle typically used as a main driver for the designation of cooperation partners (especially of the contractors).
6. Less importance given to the architectural design.

Further below, explanation in detail is provided on the different **Strengths** and **Weaknesses** identified.

STRENGTH 1: INTERNAL DRIVING FORCES

Nearly in all demo projects that applied successfully prefabricated elements had a strong driving force behind the project, pushing it forward but without having the security that it can be financed and carried out finally. Most often it was the **mayor of the municipality** (or a representative of a public administration) with a high personal engagement. It was this internal 'motor' who opened the path and pushed the vision to an innovative renovation project.

STRENGTH 2: EXTENDED DESIGN PHASE

An example. The renovation of the **Søreide primary school** from Norway was an interesting in terms of cooperation to optimization. The project was based on a PPP model, the competition criteria were the costs, the application of wood, reaching the passive house standard and the design. The prefabrication idea was established in the competition where 6 teams took part. The winning proposal was based on a cooperation of the contractor and the architect. In an extended design phase 'Planning and detailed planning' after the contracts were established (see 'P' and 'C' in Figure 4) the architect, engineers and contractors optimized the prefabricated elements and the solution set.

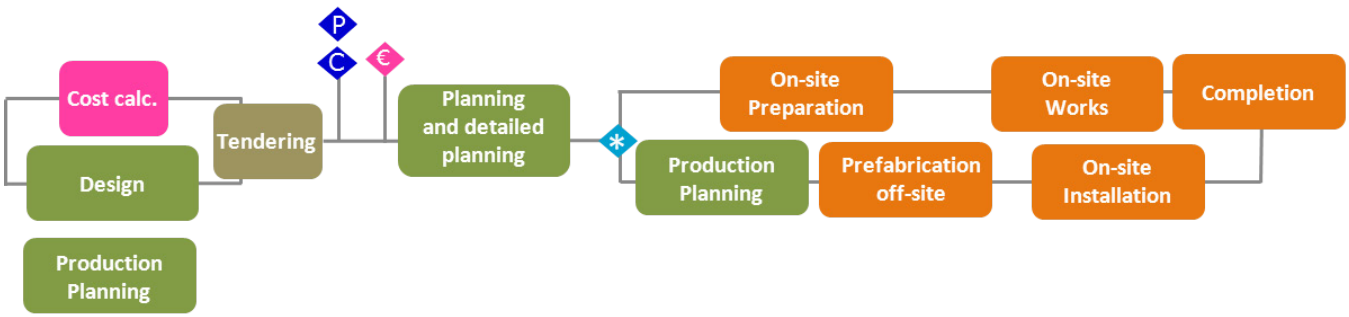

Figure 4: Action chain of the renovation in Søreide (primary school in Norway)

STRENGTH 3: CENTRAL SOURCE OF DATA

Two respondents pointed out that the information management either due to the usage of '**central information sharing system**' or '**cloud programme**' for the project management proved to be beneficial for project progress and cooperation.

STRENGTH 4: PERSONAL MEETINGS

Personal meetings and dialogues enabled a better mutual understanding and induced consequently a better atmosphere of trust and confidence. As far as problems and challenges came up - the problem-solving was facilitated.

WEAKNESS 1: LACKING COMMUNICATION

Some respondents claimed that information and communication was lagging and that the communication between the cooperation partners would have needed improvement and another understanding of cooperation:

- *"Exchange of info between main and prefab-elements contractor […] could be better".*
- *"The communication between the architect, the main contractor and the engineering company was suboptimal".*
- *"I suggest more mutual listening and finding the best possible solution irresistible of the profit of each contractor".*
- *"Less mutual listening".*

WEAKNESS 2: LATE INTEGRATION OF EXPERTS

The information flow between design and execution or the early integration of experts in early planning phases was addressed directly in many answers. **In fact, the survey showed the challenge of getting all actors necessary for planning and implementation together hindered by the barrier of how the financing models could be established.**

- *«Better architect + contractor collaboration earlier is strictly necessary»*

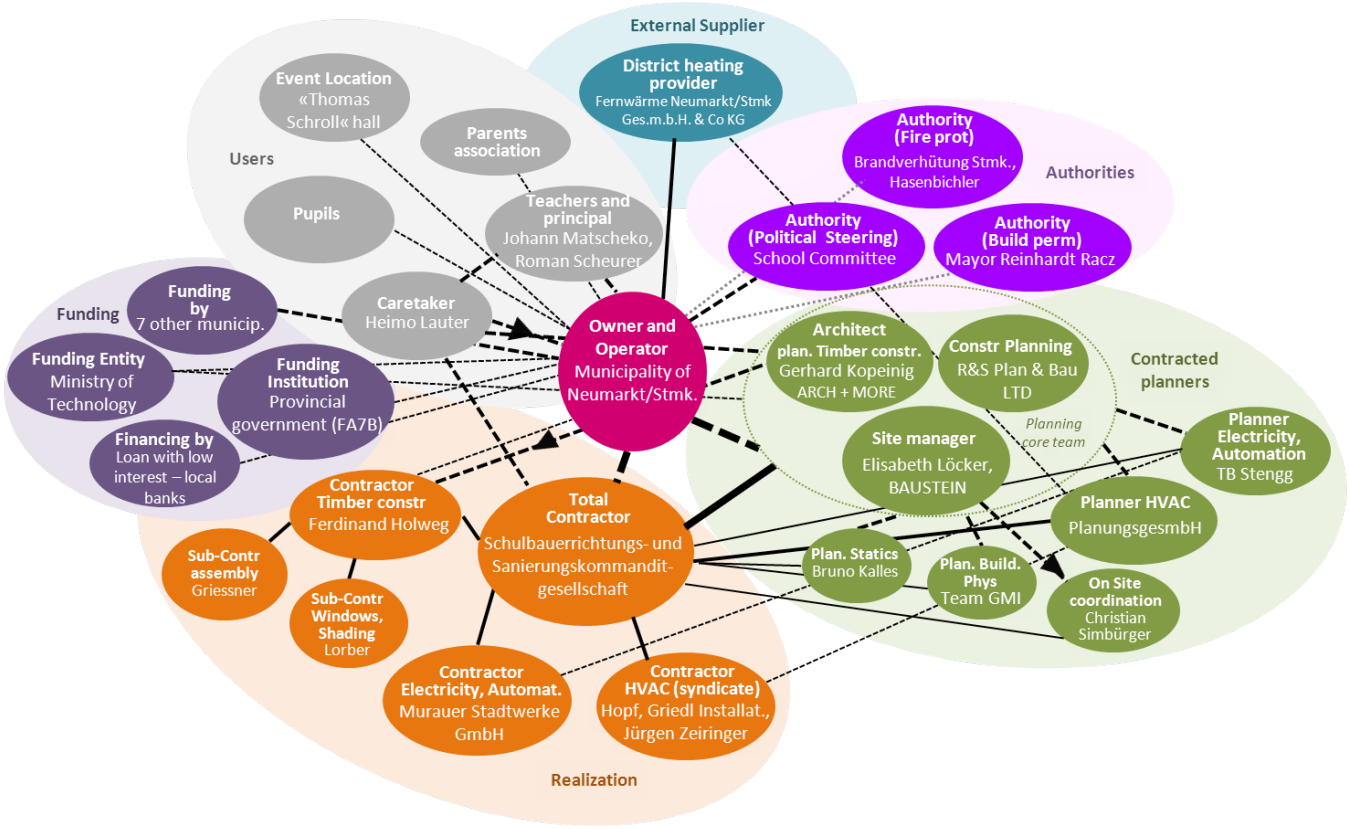

Figure 5: Cooperation model of the school renovation project in Neumarkt, Austria.

This is visible in the team set-up of the 'Neumarkt' school renovation (see Figure 5). The design and planning team (green ellipses and background) was working along the entire planning phases without knowing who will be the executing contractor!

In Neumarkt the architect was very experienced in prefabrication from previous projects. Nevertheless, the public procurement regulation hindered them to optimize the elements in terms of production capabilities given by the manufacturer. **Hence many of the implemented cooperation models had to neglect possible (and radical) optimization options.**

WEAKNESS 3: NO STANDARDIZED DOCUMENTATION

Two respondents proposed that renovation projects in future should take care of a better and more precise documentation. Especially public buildings are very sensitive regarding their further operation and maintenance regarding a proper documentation.

However, who is responsible? In case of the architect being the coordinator, it is him to bring all documentations together. On the other side, it is also the duty of the owner`s representative taking care of wrapping up everything in the end.

WEAKNESS 4: HANDOVER

It is only possible to take advantage of a high quality renovation if the users in the end are enabled to use the building in the right way. Most often technicians are responsible to introduce the technologies to the users. However, two respondents claimed that this introduction should be done by people who are able to speak the 'language of the users'.

WEAKNESS 5: LOWEST PRICE PRINCIPLE

All demo projects were driven by the 'lowest price' principle. This was due the obligation of the public procurement. The tender should identify the bidder being able to realize the solution proposed by the design team to the lowest possible price. Hence, there was less room to think about an alternative solution that might be even easier to realize.

WEAKNESS 6: ARCHITECTURAL DESIGN LESS IMPORTANT

What was also interesting in the answers is that the architectural design had less importance. Either it was due to those providing the answers (owners and investors are more interested in economic aspects as they are responsible to bring up the money), or it is a most likely neglected aspect as the financing model is dominating. Only one quote pointed out that there was an architectural competition in the beginning.

The current cooperation models lack sufficient (and professional?) information and communication management. On the one side, the project responsible (from the owners' side) is most likely a mayor (in case of small municipalities). On the other side, in cities or in case schools that are administered on an aggregated level, there are most often professional setting up a financial model and the cooperation model right from the beginning.
Nevertheless, the design and planning procedures afterwards are vastly characterized by ambiguities concerning clear and target-oriented planning procedures. As prefabrication depends on a finalized planning before production may start, any uncertainty in the design and planning before influences the result in terms of time and quality (and money too).

LESSONS LEARNT ON COOPERATION MODELS

- The implemented cooperation models (Renew School cases) **neglected possible optimization options.**

- **Room exists for improvement in development and optimization** of cooperation models.

- Typical cooperation **hurdles: un-optimized information and communication** between cooperation partners.

- Recognized challenge (in the Renew School cases) of **getting all actors for planning and implementation to cooperate efficiently together**.

- In cases, the design and planning team worked together without knowing who will be the executing contractor. This causes problems. It is **important**, especially when prefabricated elements are used, **that contractor's capabilities are known** by design and planning to avoid possible mismatch.

- Uncertainties during design and planning phase have an influence on the construction phase and cost time, quality and money.

TIMBER PREFAB TECHNOLOGY IN THE FRONTRUNNER SCHOOL RENOVATIONS

WHAT WERE THE REASONS TO CHOOSE FOR PREFABRICATED TECHNOLOGY?

- **Short time of construction on site and higher quality of construction**, as well as the advantage of having precise cost for planning for this structure.
- **Time problem with renovating** schools (i.e. short renovation time available during summer), as reason to opt for prefabricated technology.
- Advantage on **using local craftsman'**s quality.
- Using prefabrication was one of the **factors to obtain additional funding** for the advanced energy efficiency measures (e.g. eco Fund, the European Regional Development Fund).

The used prefabrication method **has led to limiting execution time**, whereby speed on site is seen as biggest advantage, followed by improving quality, lower burden on site. **Less evident is that the project management is easier and lower cost is achieved**.

WHO AND WHAT HAD A DECISIVE ROLE IN THE PREFAB DECISION PROCESS?

Highlighted was the role of the mayor and local politicians, then the municipality with the public tender/call and the investor and /or building owner. In cases hen the municipality had little experience with advanced energetic renovation, advise was sought from a consultant in low energy buildings, upon which the municipality took decisions.

In more detail:

- In most cases, the **main decisions** regarding technical issues with the prefabricated modules were taken by the **main contractor and the architect**.
- In some cases, the **main initiative** for the use of prefabrication technology came from the **architect and the contractor, or through the tender offer** that was selected which had prefab solution although that was not specifically asked in the tender requirements.

This shows that initiators for use of prefabrication in school renovation projects can be by different actors and in most cases from the very start of the project and from the preliminary design.

Those who have experienced working with prefabricated technology have provided the following insights into what were the legal constraints:

- **Transportation restrictions** on module dimensions
- **Fire safety regulations** and requirements **due to use of timber** whereby additional documentation was needed to prove that wood works in terms of fire protection.
- It was also reflected on the possible problems with the **static to fix timber prefab elements** into existing brick/concrete walls.

LESSONS LEARNT ON USING PREFABRICATED TIMBER FACADE ELEMENTS

- Agreed perception amongst Renew School cases interviewed architects, main contractors and building owners **that using prefab elements** led to **reduced on-site execution and improved construction quality**.

- **Less evident: lower total construction costs achieved and easier project management** (especially for unexperienced actors of the deep renovation process and with use of prefab façade elements).

- **Driving force to opt for prefabricated solution is a mayor or a municipal representative or an energy consultant** advising the school owner (typically a municipality).

- Majority of the renovated school cases used prefabricated facade systems with **integrated insulation, air-tightness, windows and electrical cables**. Minority integrated ventilation ducts, heating, sanitary hot waste and rain pipes.

- Most advanced prefab solutions additionally i**ntegrated shading system or prepared first internal finish layer and came with fixation points ready**.

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ANNEX

Example of survey questions

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