Streamer
European research on energy-efficient healthcare districts

D4.5 IPD contract recommendations and best practices

Final version

Streamer - Optimised design methodologies for energy-efficient buildings integrated in the neighbourhood energy systems.
The Streamer project is co-financed by the European Commission under the seventh research framework programme FP7.EeB.NMP.2013-5 ; GA No. 608739)

D4.5 IPD contract recommendations and best practices

Issue Date	September 2016
Produced by	NCC
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Version:	Final
Reviewed by	TNO, BOU, DMO
Approved by	TNO
Dissemination	Public

Document history

Version	Date	Status	Produced by	Comments
1.0	12-07-2016	Draft	Bektas, E., Brouwer J.	First full draft, for review by reviewers (BOU, DMO)
1.1	23-08-2016	Final draft	Rempling, R., van Meerveld, H.	Reviewers remarks (received on 29-07-2016) addressed
1.2	25-08-2016	Final draft		Approved by WP4-leader
1.3	28-08-2016	Final Draft ready for Submission		Revised addressing remarks of technical coordinator

Colophon

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Publishable executive summary

This report deals with the new aspects of and recommendations for participatory design process of structures, more specifically the applicability of the design and construction process called Integrated Project Delivery (IPD) on Energy-efficient Buildings (EeB) at mixed-use healthcare districts. The report as its whole sets a framework for IPD in EeB projects and answers the main question *"Is IPD a suitable design process for EeB projects in Health Care Districts in EU?"*.

Integrated Project Delivery is a design and construction process based on partnering that promises to deliver a better product faster. The main idea of IPD is to bring all key partners (owner, designer, builder, etc.) - that are desirable to adequately manage the project - to the design table as early as possible. While the main idea is to get the right people to the project, the two main components of IPD are shared risk and shared reward which are controlled by the so-called IPD-contracts. Today, there are standard contracts available from the American Institute of Architects.

The choice of design and construction process is made by the Client, who follows the public procurement regulations when asking for companies to realize an idea. In EU, public procurement is governed by the European directive on public procurement (Directive 2014/24/EU), which mainly states that the process should be open and transparent.

Some years ago a new type of energy service was introduced with the incentive to not only sell energy, but also earn money by saving energy; this type of company is called Energy Service Company (ESCo). These companies' business was initially in the facility management area and not in the design of buildings. This created difficulties to make the most effective energy savings. Thereby, the current idea is to combine ESCo with IPD and establish an Integrated Energy Contract. An Integrated Energy Contract that is included in the early design stages would provide the Integrated Project Team with valuable design criteria and thereby the design will be coupled to the energy supply and use.

So, is IPD suitable for design of energy-efficient health care districts in EU? The answer given in this report is not concrete. The main reason for this is that the autonomous states of Europe have to a large extent very different working traditions in the early phases of design. In addition, the local procurement laws of the EU states are still divergent. Though, within the construction sector there is a strive for increasing the number of participatory design projects – a strive that makes contracts that ensure collaboration necessary, it is not appropriate to point out that Integrated Project Delivery implemented on an EU level is the main path to follow contractually.

However, the core elements of IPD, collaboration, early involvement of parties, sharing of risk and reward, and the use of ICT, are important for the construction of energy efficient health care districts and should be pursued. The main advantages of applying these core elements are betters product and quality.

List of acronyms and abbreviations

- **BIM** : Building Information Modelling
- **EeB** : Energy efficient Buildings
- **IPD**: Integrated project delivery
- **DB**: Design and Build contract
- **DBB**: Design – Bid – Build contract
- **AEEG** - The Italian Energy Authority
- **AGESI** - Italian Association of Energy and Facility Management
- **AGORIA** - GreenBuilding platform
- **APES** - Association of Energy Services Companies of the Czech Republic
- **AssoEGE** - Italian Association of Energy Management Experts
- **ASSOESCO** - Italian Association of ESCO
- **BELESCO** - the Belgian association of ESCOs energy service providers
- **BOOT** - Build-Own-Operate-Transfer
- **CEM** - Contract Energy Management
- **CoM** - The Covenant of Mayors
- **DC** - Delivery Contracting
- **EC** - European Commission
- **EU** - European Union
- **EEB** - Energy Efficient Building
- **EED** - Energy Efficiency Directive
- **EEE-F** - European Energy Efficiency Fund
- **EESI** - European Energy Service Initiative
- **EMEEES** - Evaluation and Monitoring for the EU Directive on Energy End-Use Efficiency and Energy Services
- **EPC** - Energy Performance Contracting
- **EPCC** - EU Energy Performance Contracting Campaign
- **ESC** - Energy Supply Contracting
- **ESCO** - Energy Services Company
- **ESCOROM** - The Romanian Association of ESCO Companies
- **ESD** - The European Savings Directive
- **EPRP** - Energy Performance Related Payments
- **EVO** - Efficiency Valuation Organizations
- **FEDERESCO -** Italian Federation of ESCO
- **FP** - Framework Programme
- **IEC** - Integrated Energy Contracting
- **IEE** - Intelligent Energy Europe
- **IPD** - Integrated Project Delivery
- **JRC -** Joint Research Centre
- **SEAP** - Sustainable Energy Action Plans

- **TPF** - Third-Party Financing

Contents

1. Introduction and scope

This report summarizes part of the work carried out in the Task 4.3 “EeB IPD framework” (Work Package 4). The main research question was: “*Is IPD a suitable design process for EeB projects in Health Care Districts in EU?”*. Trying to answer this, the work has been focused on the following sub-questions:

- How have the responsibilities of project delivery evolved over time?
- Why do we need support in project delivery?
- What is Integrated Project Delivery?

The scope of the report is to carry out a literature review in order to try to define the current state-of-the-art of Integrated Project Delivery. Outcomes of this work will contribute to the development of a multi-party collaboration framework as well as indicate possible options for health care clients.

After a brief history of the development of project delivery over time and the responsible actors, chapter 2, we look at the Integrated Project Delivery in Chapter 3 and its characteristics. Chapter 4 discusses formal and informal aspects of the delivery scheme. Chapter 5 explains public procurement. Chapter 6 introduces Energy Service Companies and Chapter 7 addresses contractual issues of IPD.

Within this this deliverable, we are making a distinction between (1) project delivery methods and (2) procurement. The two aspects are highly interrelated but are essentially different as well: We will use the following working definitions within this deliverable:

- A **project delivery method** essentially determines divisions of tasks, roles and responsibilities in a project’s delivery. It essentially determines what contract or works is outsourced to one or more external organizations. There are many forms available in literature and practice. Their main distinguishing features are the variations in division of major tasks associated with construction projects (design, construction/build, maintenance, finance, operation).
- A **procurement** process describes the approach taken to select a tenderer and bid for the contract/works that have been determined by the choice of project delivery method. This includes the formal procurement procedure (tender).

As mentioned above, the two are highly related and need to be considered holistically and not in isolation.

2. The evolving roles of design and construction

The earliest known reference to the singular responsibility for design and construction is in the Code of Hammurabi (c 1754 B.C.). King Hammurabi was the ruler who established the greatness of Babylon, the world's first metropolis. By far the most remarkable of the Hammurabi records is his code of laws, one of the oldest known examples of a ruler proclaiming publicly to his people an entire body of laws. The code regulates in clear and definite terms the organization of society. The Code consists of 282 laws, with scaled punishments, adjusting "an eye for an eye, a tooth for a tooth" (*lex talionis*) as graded depending on social status, of slave versus free man. Nearly one-half of the Code deals with matters of contract, establishing, for example, the wages to be paid to an ox driver or a surgeon. Other provisions set the terms of a transaction, establishing the liability of a builder for a house that collapses, for example, or property that is damaged while left in the care of another.

The parts of the code that address the work of the builder do not distinguish between the responsibility for faulty design and the liability for improper construction. Most probably, design was not mentioned because most utilitarian structures of the day were "designed" and built according to traditional trial-and-error means and methods. Uniqueness and originality were not considered necessary for any but the most public structures, such as palaces, temples, and tombs for royalty.

The codes clearly imply that the builder must know the appropriate design for the required structure, and must then build it according to those traditionally accepted materials and forms. Any deviations from these "designs" would literally risk the builder's or his family's life and limbs.

For design knowledge to be captured, organized, and disseminated, the practice of architectural and engineering design must first be defined, and then to make the transition from innovative to routine. Since the time of Roman Emperor Augustus, or even earlier, handbooks were the popular means of doing this. One of the best known handbooks of that time was written by Vitruvius, a Roman engineer, architect and writer, around 40 B.C. Vitruvius' *De architectura libri decem* (10 books on architecture) carefully describe existing practices, what are today thought of as engineering disciplines and not only the design and construction of buildings. His writing is prescriptive and gives direct advice: "I have drawn up definite rules to enable you, by observing them, to have personal knowledge of the quality both of existing buildings and those which are yet to be constructed."[2] As a handbook, De architectura libri decem was successful in establishing design and construction management as learned professions. At this time era, Roman architects practiced a wide range of disciplines that can be described, in modern terms, as a combination of being engineers, architects, landscape architects, artists and craftsmen. One single individual was at this time responsible for both design and construction.

Vitruvius' advice was followed for centuries. The first known record of the intentional separation of the art of architecture from the craft of building was in Italy around mid-fourteen hundred. Leon Battista Alberti's (1404–1472) *De Re Ædificatoria* was the first printed work on architecture of the Renaissance. This work and writings helped to establish the art of architecture as a profession distinct from the science of engineering and the craft of building. After the fifteenth century and well into the nineteenth century, architects continued to hold responsibility for both design and construction, if not always physically at least administratively.

Prior to the Industrial Revolution, which began in Britain in the late 1700s and spread throughout regions of Europe and to the United States the following century, manufacturing was often done in small scale, using hand tools or basic machines. The introduction of industrialized methods, more high technology machinery, factories, new materials and mass production was a radical shift that influenced all sectors. The Industrial Revolution had a profound effect on the manner in which design and construction were organized. Productivity and technical efficiency increased radically, in part through the systematic application of scientific knowledge to the manufacturing process. These new facilities of mass production included different machines and the factories to house them, new sources of power and energy and the infrastructure needed to support them, new materials and methods to use them —all of which put new and increased demands on designers and builders. Because of the relative complexity, design expertise and specialization were required of the designers, but not to the same degree from the builders.

More and more people moved from the rural areas into urban communities in search of industrial work. This created a need for new housing, governmental buildings, and support facilities. The expanding market for design services, which did not have to be performed locally, encouraged its separation from the builders, who had to work on or near the building sites. The designers' requirements for construction could now easily be communicated to remote builders by a standardized system of drawings and written instructions (specifications).

One important idea to the Industrial Revolution was that work changed because of the division of labour. This idea called for dividing the production process into basic, individual tasks. The apparent difference between the intellectual process of design and the physical act of construction made the design and construction industry a likely target for work segregation.

The Industrial Revolution encouraged and rewarded entrepreneurship in the formation of businesses and industries. Architectural and engineering design, by definition, is the science of reducing risk in the construction and use of physical facilities. Design practitioners were, by nature and training, risk-adverse. Builders, on the other hand, because the new factory owners required some degree of advance assurance of performance and cost, had to routinely take considerable contractual risks.

Because the Industrial Revolution was caused by, and relied on, new and powerful machines and factories, it created a need for large amounts of capital. The money markets of Europe and North America responded to this need by organizing collective ownership by nonparticipating owners (stockholders). The

construction industry, with its new machinery and large number of labourers, needed this capital, whereas the design professions, with no machinery and small numbers of skilled workers, did not. Additionally, the design professions, with their ethic of individual professional responsibility, could not consider nonparticipating partners.

Whether it was the king, the pope or a private investor, organizing on how to deliver the project has always been an important issue. As has been discussed above, historically, the professions responsible for the design and construction have varied. In modern time, as long as buildings remained relatively simple, the separation of design professionals from the balance of the construction industry posed no serious obstacle to owners attempting to acquire cost-effective facilities. With the arrival of technically more demanding building systems (e.g., air conditioning, elevators, curtain walls) and systems for the concealed distribution of power, lighting, and telephones, responsible design required architects and engineers to coordinate their efforts with manufacturers, vendors, and builders. The post–World War II building boom put a severe strain on this voluntary participation within the design and construction industry. This led to the creation of the discipline of construction management (CM). The CM model offered building owners additional assurances that the designs developed by their architects and engineers were, for the most part, practical and cost-effective. However, the CM process still lacked the single point of responsibility that owners sought. Private owners could resort to commercial building developers, and industrial clients could avail themselves of the products of the “package builders” to provide that single source. However, public owners were locked into a rigid framework of public contract laws that demanded absolute separation of design from construction, with the owner responsible for the coordination between the two, where the owner guarantees to the builder the accuracy of the architect’s plans and specifications.

The cost and the complexity that are characteristics of typical health care construction projects present unique challenges for the health care providers whom often find themselves with decreasing resources and limited in-house expertise. While many of the staff has some construction experience, they may still lack access to current market information and effective tools to predict and steer the financial results. While this expertise is provided by the hired constructor and design consultants, lack of a clear insight into the actual daily work carried out and the final realization of the project.

Furthermore, the health care facilities are amongst the most technical and logistically advanced and complex projects that are built today. These buildings demand well-detailed and integrated architectural and engineering drawings and specifications, and, additionally, a lot of specified detailed information about medical equipment. Another challenge is that the innovation rate within the medical technology often surpasses the time needed to build the health care facilities. This creates coordination nightmares for the design consultants and will be a major source for cost over runs as the design solutions may become obsolete because of new technology and praxis.

Additionally, the lack of coordination between architects and engineers, due to accelerating project plans and limited specialist’s fees, can lead to large information gaps in the project’s construction drawings which, in turn, will lead to change orders, delays, claims and other unforeseen costs.

New delivery schemes have appeared, such as design-build, project alliances and project partnership. While Design-Bid-Build is still the delivery method most frequently used, by many clients now favour methods that facilitate communication and collaboration earlier in the process. Rather than engaging in traditional means for collaboration, actors in the construction sector are instead looking at a new form of project delivery method called IPD (integrated project delivery).

3. Integrated project delivery, IPD

3.1 The definition of Integrated Project Delivery

While the definition of Integrated Project Delivery (IPD) may vary slightly from organization to organization and country to country, AIA (2014) has defined IPD as

”a project delivery method that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction”.

Many claim to work according to the IPD method. To check the validity of this, the Integrated Project Delivery method should contain, at a minimum, all of the following elements:

- Continuous involvement of owner and key designers and builders from early design through project completion
- Business interests aligned through shared risk/reward, including financial gain at risk that is dependent upon project outcomes
- Joint project control by owner and key designers and builders
- A multi-party agreement or equal interlocking agreements
- Limited liability among owner and key designers and builders

The fundamental reasons for considering which project delivery option to use are still there: changes in the building market, the need for specialized services, accountability, risk management, and the complexity of buildings themselves. However, the method chosen, or variation thereof, seems to be less directed by logic than by a desire to try an approach that avoids the pitfalls experienced with other delivery methods.

To further distinguish IPD from other types of project delivery schemes, four additional statements, with their explanation, could be made:

Integrated Project Delivery (IPD) is a project delivery method: IPD is a project method that is different from Design-Bid-Build, Design-Build, CM at Risk, and Multiple Prime. The aim is that all benefits for innovation and efficiency return to the project team as opposed to the individual firms. All parties agree to the business terms to share the financial savings for optimizing the Owner’s business case.
Compared to the other project delivery methods (described in chapter 2), IPD has many similarities with alliancing and partnering. In an alliance or partnering as project delivery methods, owner and contracted parties become jointly responsible for the main tasks of design, build, etc. The definition of IPD provided suggests such an approach with early and continued involvement of owner and key designers and builders; aligned business interest through risk/reward sharing; joint project control.

Integrates people, systems, business structures and practices: The foundation for IPD is the development of a virtual project organization. The organization of “the firms” includes the individual team

members for the owner, designer(s), consultants and builder(s). The project organization's mission and responsibilities are committed to "best for project" decision making, and this commitment is supported by alignment of the firms' business interests through shared risk and reward.

Collaboratively harnesses the talents and insights of all participants: The primary purpose of the virtual organization is collaboration. The project firms and individuals are committed to create a team culture of joint decision-making. Team members are formally organized in multidisciplinary clusters responsive to the project goals. Team members are individually accountable to contribute alternatives to design and construction issues. Builders' input is not left until the construction phase, when it is typically too late to benefit the design.

Reduce waste and optimize efficiency: IPD incentivizes minimization of waste. In addition to integration and collaboration, the method utilizes formal tools to achieve maximum results. Typical tools include: Building Information Modelling (BIM), prefabrication, manufacturing of larger integrated units, process improvement metrics and LEAN design and construction techniques.

3.2 The phases of IPD

The phases of an Integrated Project differ from traditional phases (Schematic Design, Design Development, Construction Documents, etc.) in order to take advantage of two critical factors:

- In addition to the design expertise of a traditional design team, expertise in construction aspects (cost, scheduling, material performance and availability, means and methods, etc.) is available throughout the design process.
- Building Information Modelling (BIM) tools and processes enable the team to integrate this broader range of knowledge in order to provide effective support for design decisions.

These factors enable the team to make better-informed design decisions earlier in the process and to optimize the design for construction means and methods. In essence, how and who are addressed much earlier in the process, enabling elimination of the traditional overlap of what and how with realization that is typically a source of expensive changes and rework during construction.

This is not to suggest that there is a rigid, sequential order to phasing in an integrated project. The expanded knowledge base and enhanced collaboration tools in an integrated team allow a great deal of flexibility in the sequencing of the design effort. A major advantage of the integrated approach is that the team makes the decisions regarding this sequencing. In traditional projects design decisions are often deferred - sometimes even until after start of construction - at the sole discretion of the designers, without complete knowledge of the impact on construction. However, in an integrated project, the availability of both design and construction expertise enables the team to sequence the design effort to better accommodate such issues as fast-track delivery or procurement of long-lead items.

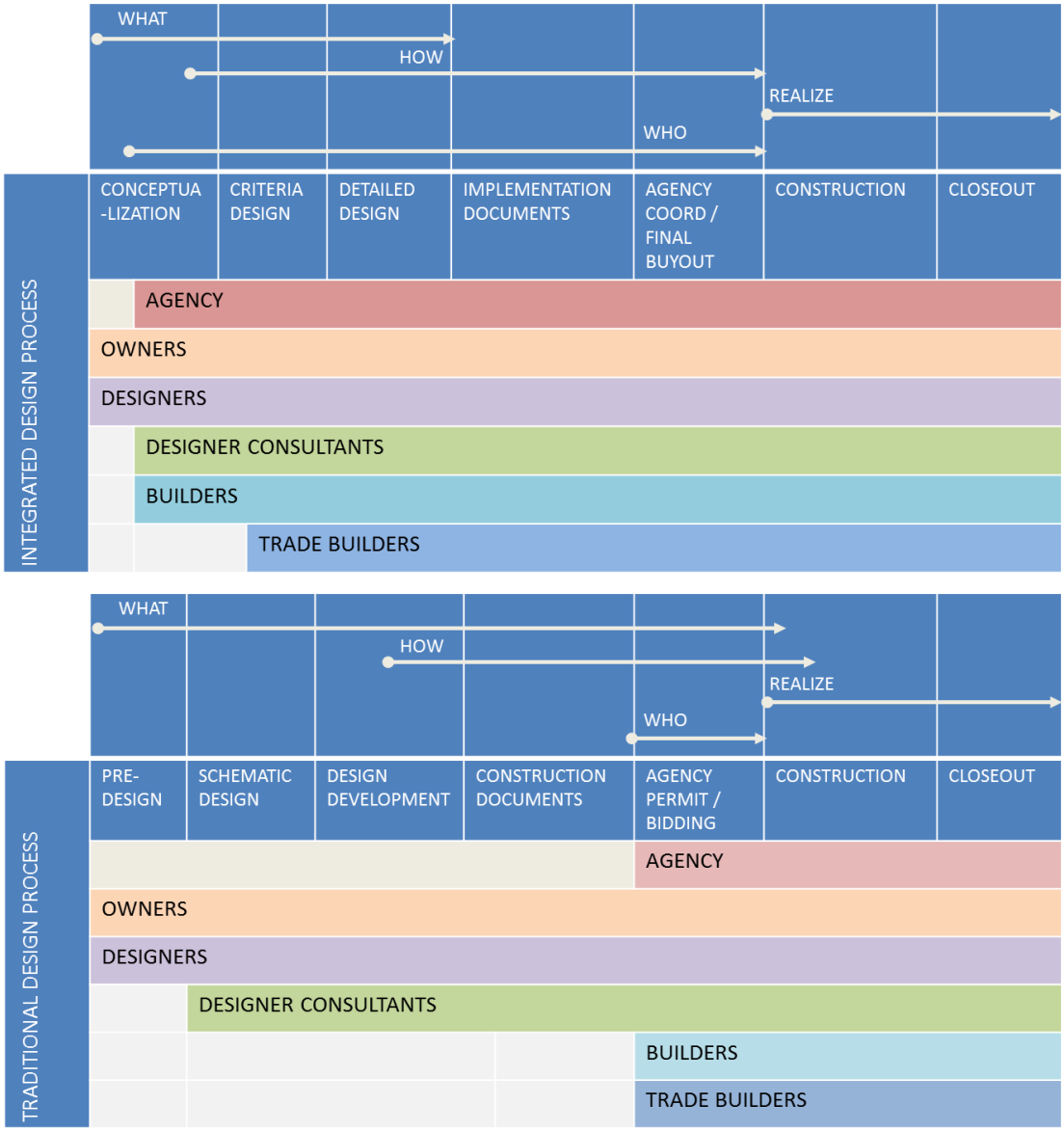

Figure 1 Integrated design process versus traditional design process, a schematic overview

3.3 Lessons learnt from best practice examples

In the following Chapter, lessons learnt from best practice examples extracted from (AIA 2011; AIA 2012; Ghassemi & Becerik-Gerber 2011; Becker & Murphy n.d.; Ashcraft 2014; Darrington, 2010) are summarized and associated with the minimum required elements explained in Chapter 3.2. The summary is based on the reviewed publications and structured into different topics: IPD-results, IPD-hindrances, IPD-personnel, IPD drivers, and tools for decision support and information sharing. The reviewed publications cover a broad number of building types, such as: hospitals, new office-buildings, renovation of office-buildings, hospital expansions, and health care centres.

3.3.1 IPD results

In this Section, experience gained regarding the results of using IPD are summarized

Early common goals that are accepted are of great importance for the success of complex projects.
The IPD project results in an early setting with a high potential to establish project goals that are common for project partners. The common goals define joint commitment rather than shared commitment between partners and the success is measured by the degree to which common goals are achieved rather than individual goals. Nevertheless, it is important that parties *understand the other's individual goals and strive to synchronize them with the common goals*.

In several case studies it is underlined that the capital investment is protected from risk with the use of IPD. This risk reduction is made up by agreements on sharing risk in various ways. In this way, In this way, the project partners are avoiding shifting risk among themself. In addition, the shared risk also promotes a collaborative project culture. One concrete example of sharing risk is a risk pool. The risk pool is constructed by 25% of each partner's fee and is used to cover cost overruns. The threshold for cost overruns is calculated as an estimated maximum price (EMP). The EMP is developed jointly by the owner, designers, prime contractor and other major trades. Together, they estimate the collective construction cost of the project.

Trust and respect for project partners is according to the sources studied of fundamental importance for a successful implementation of IPD. However, trust is difficult to develop among the parties. Some factors help to develop trust:

- Early collaboration
- Communication that is coordinated
- Confidence in team and individual team members
- Transparency and honesty in the project

Of course, long term relationship across projects that has been successful helps in developing trust.

An important result of IPD is the breaking down of traditional barriers and shifting of traditional roles. It is said that the contractual arrangement, management tools, early involvement and co-location are catalyst in this transformation.

3.3.2 IPD hindrances

In this Section, lessons learnt regarding hindrances for the success of using IPD are summarized

Integrated approaches need contractual arrangement to become effective. Individual collaboration is often not considered to be a hindrance, but the individual can often be hindered by having one's hands tied by the rules of the organisation. IPD use contracts to give collaborative freedom and different organisations have developed standard contract templates that are not IPD specific. The lesson learned from the case studies is to not approach integrated contractual arrangement by modifying a standard non-integrated contract form as this has shown to be difficult and increase the cost of reaching an agreement.

The standard IPD contract developed by AIA includes a “no-sue clause” agreement. Excluding “no-sue” clause in contract is common in the case-studies, but at the same time it is not uncommon to have some kind of specific limit on liability. To the authors’ knowledge, there are no standard contracts developed in the European countries, nor on the level of the European Union.

The last IPD hindrance learned from the case studies is the repeating uncertainty in setting the initial phase of the project. “There is no manual, how should we do this?” is a common question raised by parties involved in the early stages. Inexperienced owners that set out on an IPD contract should seek assistance in organising all the formal requirements.

3.3.3 IPD personnel

In this Section, the consequences, in the form of “what comes with the package” of IPD - with regard to choosing personnel that will work in the collaborative teams and how the teams should integrate - are summarized.

Difficult to communicate or unwillingness to communicate to company employees the contractual arrangement in a correct and detailed way is an obvious risk for the collaboration. At the same time, the company must communicate that the project is an integrated project and that collaboration is expected from the appointed personnel. It is shown in the studies of the cases that it is highly negative that people go on and off the project with a negative impact on the effectiveness of the team. Therefore, it is essential to find the right personnel and communicate the efforts expected of the individual. In some cases, this has been driven so far that the “high-performing team” is created by enlisting the right person for the right function regardless of employer.

But, who is the right person? In the studies it is pointed out that it is important to find those who are “innovative thinkers and has an entrepreneurial spirit and an element of leadership”. This can seem to be challenging, but in the studied cases only few persons out of hundred that did not fit the collaborative culture.

In order to facilitate the integration, co-location of the team is very important. Short/reasonable turnaround times enabled by continuous involvement are facilitated by co-location. It also boosts the team spirit by developing a temporary social organisation.

3.3.4 IPD drivers

In this chapter, a set of IPD drivers derived from the examined cases are given attention. These are drivers that motivate the use of IPD.

Predictability of the time schedule is not an obvious driver, but many witness the superior scheduling advantages of having all team members coordinating the project. Especially in hospital projects, where the

given project is within an existing facility that is in use, the logistics, and scheduling are both complex and critical to maintain the hospital in operation.

Market position as a driver has been used in several cases, some to more extent than others. One main reason for market position for several companies is to assess the advantages of the process in order to transition to using IPD exclusively. A second market position driver is the fact that there are not many projects that use IPD in their projects. Therefore, the companies see the benefit of being first and thereby take market shares early.

Cost predictability is of course a high motivator for any company trying to continuously review the estimation of costs. Doing this estimation process in a collaborative form and with a shared gain in meeting the costs are the main differences and the feeling is that the estimations are more accurate than in other comparable situations.

Risk management can be a critical factor to success in some projects and if the partners are mutually interested in handling the risks, as they are bound by contract to share the risks, the possibility to be creative and proactive towards the risks increases.

3.3.5 IPD Supportive tools

The collaborative aspects create a need for supportive tools. In this Section, the lessons learnt regarding the need for supportive tools are summarised.

Need for a transparent decision support tool is evident in IPD project setup. The team faces mutual challenges that should be dealt with in collaboration. The use of dashboards has been fruitful in the projects because of the transparency and interoperability they provide. By the dashboard the team can face and discuss problem from different perspectives. This common ground makes the discussion fair play compared to operating in disciplinary software.

Information sharing tools leveraged by co-location becomes important as the need for exchanging, viewing and discussing solutions increase in a collaborative project. The most explaining example is the correlation to cost estimation. Always, the cost estimation is based on a specific idea and can this idea be shared via a common information sharing interface it is easy to discuss and say “if it done this the cost will be this, but if it is done in that way the cost will be this”.

3.4 Applicability of IPD in current practises

As part of the task, a questionnaire was performed among the STREAMER partners to identify the familiarity with IPD in hospitable or healthcare projects. It was concluded that within Europe, there are few experience with IPD or alliance like project delivery methods with the healthcare building projects. There are some examples of alliance type delivery methods such as the undergoing project for the new central

hospital in Kainuu, Finland[1]. Most dominant approaches are traditional design-bid-build or integrated delivery methods such as design & build (sometime including maintenance).
This proposes challenges in cases where owners may opt for an alliance approach, but lack the experiences to start such an endeavour. Lack of such experiences should be included in the decisions to start and 'true' IPD project.

The AIA discusses that the principles of IPD can still be applied in different project delivery methods, although it does consider alliancing one of the best way to integrate owners and key designers and builders. In general the AIA discussed that owners need to seek for opportunities to involve key designers and builders into the process early on (if possible).

- This may particularly be possible in integrated project delivery methods such as design-build.
- Delivery methods such as design-bid-build offer few opportunities for involving constructers into the process early on, although there are variations where this is possible (e.g. contract management, multi-prime)

[1] http://move.sweco.fi/en/Finland/Services/Project-management-and-construction-management/Care/New-hospital-project-alliance-Kainuu--/

4. Formal and informal aspects

4.1 Collaboration

Healthcare projects are associated with many uncertainties. These uncertainties include changes in demography, medical/technical development, political changes and financial pressures. Given the aging population and the increasingly stressed budget situation in Europe, there is a need for a more efficient health care system. For individual hospitals, the demographic developments cause changes to the catchment population and changing patterns of demand. Governments and health care providers are constantly seeking measures to decrease the rapidly increasing health care costs. Flexibility is, therefore, believed to be a key success factor to health care (*Bygballe et al., 2013*).

Obviously, the core business of a hospital is its clinical services but due to the abovementioned uncertainties, the need for flexibility has become increasingly important. This means that in order to meet current and future supply and demand, the strategies of the real estate management must exhibit a greater amount of flexibility. While flexibility means opportunities for many involved stakeholders, for a contractor this often means increasing risks which will be reflected in the pricing. A well-thought balance should therefore be aimed at as excessive flexibility may generate costs that may outweigh the benefits.

It is generally agreed that the construction sector must move from the traditional adversarial focused behaviour towards more collaborative and integrated strategies to deliver more predictable results to clients and to improve the project performance. Therefore, it is not surprising that project partnering, project alliancing and IPD have received increasingly interest lately.

Lahdenperä (2012) observed that IPD, project alliancing, and project partnering are often used interchangeably, and even if they have their differences, “early involvement of key parties, transparent financials, shared risk and reward, joint decision-making, and a collaborative multi-party agreement are some of the features incorporated in all the arrangements to a varying degree” (p. 57). Consequently, these models are often based on relational contracting principles (Rahman and Kumaraswamy, 2004), incorporating both the formal contract and the relational mechanism for enhancing the collaboration.

Several studies have highlighted that establishing and maintaining collaboration between project members are complex processes and that contractual arrangement and individual attitudes do not always necessarily interact naturally (Kadefors, 2004; Laan et al., 2011). Behavioural studies have shown that external awards and punishment can undermine or prevent intrinsic motivation (Deci et al, 1999, Frey and Jegen, 2011). In IPD contracts, different economic incentives such as target costs and forms of pain share / pain gain or risk / award arrangements are common. Apart from the formal contractual structure, there may be other arrangements to stimulate collaboration or team cooperation. Other technologies, such as BIM and Lean Construction are approaches that can encourage a better collaboration (e.g. Matthews and Howell, 2005). Other examples include co-location of team members and the use of shared administrative

systems. Furthermore, Dewulf and Kardefors (2012) have shown that the formal (IPD) contract and the informal relation, trust, interact. After having signed the contract, a process starts where the partners gradually together start to understand what the relationship means, both in terms of contractual agreements and behavioural. This proves the argumentation made by Cicmil and Marshalls (2005) that structural measures, such as employment contracts, are not sufficient to handle the internal paradox between the relation between the result of the project and control on one hand and the processes for collaboration, cooperation and learning on the other, as well as the complexity of the project. Similarly, Bresnen and Marshall (2002) concludes that Partnering basis its success on the relation between formal and informal aspects.

4.2 Feasibility of the IPD's BIM-based approach with semantic-driven participatory design process

This Section discusses the building information modelling in a participatory context. First, a background is given then a description of BIM and the different stages. Today, it is still a goal to combine BIM and IPD and the research is circulating around the consequences and legal aspects of this combination.

The Architecture and Engineering Industry has been seeking ways for improving productivity, increasing quality and reducing down the project costs in the last years. The industry, which is fragmented by its nature, is undertaking unique projects that includes various participants such as client, architect, contractor and other specialists (Isikdag et al., 2007). The issues arise due to the lack of communication and coordination between these players, and cause cost over-runs and schedule delays in many projects (Eastman et al., 2011). Thus, the industry is searching new methods to provide better collaboration between project stakeholders, and include the expertise of all participants from the beginning until the handover which will lead to better results. New technologies and contractual relationship are emerging that will eventually help these aims.

Starting from the shift from traditional paper based drawing towards Computer Aided Design (CAD) in second half of the 20th century, critical transformations has taken place in designer's work in the last decades (Czmoch & Pękala 2014). Being the leader of a project, architects were regarded as a "walking database" including all the project information needed and being responsible for all the errors and collisions to be solved (Czmoch & Pękala 2014). Just like the transition from manual drawing to CAD tools, the industry is experiencing the emergence of an advancement in Information Technology (IT) which is Building Information Modelling (BIM) (Kiani & Alerasoul 2015) . Nevertheless in today's world where CAD is widely implemented across the industry, BIM is fast climbing the ladders and will be the next milestone (Czmoch & Pękala 2014) and seen as a solution to the industry's fragmented and unconnected behaviour (Arayici et al. 2010)

National Institute of Building Sciences (NIBS) (2007) defines BIM as "a digital representation of physical and functional characteristics of a facility, which serves as a shared knowledge resource for information about a facility that forms a reliable basis for decisions during its lifecycle from inception onward". BIM is being adopted to provide an information centre for the whole lifecycle of a project, (Halttula et al., 2015).

Thus, the model is aimed to act as an information source and storage, and allow the continuous use of data by project participants (Czmoch & Pękala 2014).

Succar (2009) defines the three stages of BIM maturity with “the minimum BIM requirements - the major milestones that need to be reached by teams or organisations as they implement BIM technologies and concepts”.

- BIM Stage 1: object-based modelling
- BIM Stage 2: model-based collaboration
- BIM Stage 3: network-based integration

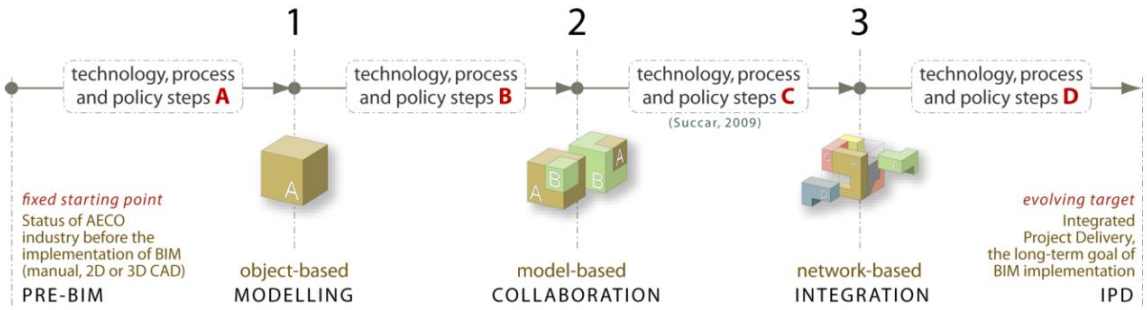

Figure 2: BIM Maturity Stages (Succar, 2009)

Stage 1 indicates organisations that has adopted object based modelling tools but working in silos and generating project deliverables relating to their discipline separately such as design drawings or fabrication details. Thus, collaboration between various stakeholders are not present.

At Stage 2, collaboration starts to take place between project participants. This collaboration could be realised with exchange of interoperable models or partial models via non-proprietary formats such as using IFC. Due to the fact that, document based workflow is being substituted by model-based communication, contractual agreements are for this exchanges are demanded. (Succar, 2009).

At Stage 3 network based integration “semantically-rich integrated models are created, shared and maintained collaboratively across Project Lifecycle Phases” appears. The idealized vision for BIM is a single integrated model representing not only design information, but also including construction details, cost and schedule. (Thomsen et al., 2009)

The increasing demand for BIM has also affected the emergence of new contractual agreements, of which IPD is one of the well-known. (Kiani & Alerasoul 2015) IPD is a project delivery method which is highly dependent on efficient communication and collaboration, which leads to the need of an adequate IT support. (Azhar et al., 2014) According to Azhar et al. (2009) the requirements for such a system defined as “receiving, storing, retrieving, and coding information to maintain the internal and external informational management needs for both real and virtual environments”. Due to this fact, BIM is being recognized in the construction industry as a comprehensive and sustainable Information Technology (IT) support through project life cycle, which is a prime requirement for integrated approaches (Sebastian 2011) BIM is

considered to revolutionize the industry due to its promise in providing better collaboration between various actors that needs to design and construct a building (Becerik and Kent, 2009). Although that BIM could be adopted with project delivery methods other than IPD, and IPD could be selected without the use of BIM, utilizing the potential benefits to a maximum level is only possible when they are implemented together. (AIA, 2007)

As the project progresses, BIM evolves from project initiation to handover (Sebastian 2011). The model which was initially created by designer to making better decision develops into an crucial tool that is also supporting other project stakeholder's practice, in addition to these providing environmental, maintenance and operational information of the effects a project contains by simulations (Halttula et al. 2015). Figure 2 demonstrates BIM uses identified according to the main project stages. BIM provides a variety of solutions for practitioners to support design, construction and operation.

Figure 3: BIM Use Cases (AEC3,2015)

Even though it offers a wide range of applications, the key feature of BIM highlight that is highly adopted by the industry is design coordination. Various discipline models created by architects and engineers are merged in order to a coordinated model in order to check for design errors and collisions, which will decrease the number of change orders and leads to cost reductions. Another use of BIM in design stage, which is embraced by owners, is the space programming to ensure the client's requirements are met. In addition, code validation is getting popular among practitioners due to its ability to assist designers to perform checks against building regulations and improve design quality. Moreover, designers are able to produce much quicker quantity take off in early design phases and provide owners more design alternatives. As well as cost estimation, phase planning done in early stages of design that brings contractors knowledge on construction methods to design phase, contributes to beneficial earnings in terms of cost, time and quality. Contractors also gain significant benefits from trade coordination, in which field conflicts are detected and resolved before execution with the consultation from the designers.

Construction planning with BIM allows more precise and accurate schedules than using traditional techniques which does not include spatial aspects and logistics into consideration. At the end of construction stage, as-built documentation could be done as handing over BIM models or one single model containing all project information, instead of drawings, to the owner for facility management purposes. Later on, this model would be used for managing the facility for renovation and repair, space management and maintenance scheduling purposes. Thus, it is also important to get information from the facility managers in respect to design solutions, in addition selection of the materials and equipment that will be used in the project.

As discussed before, BIM supports IPD principles, as well as IPD provides a project environment which is suitable BIM to develop better. As Figure 3 depicts, the ability to impact cost and functional capabilities is more at the beginning of the project, and goes down moving towards construction stage. Therefore, bringing the expertise of the participants as early as possible also effects the outcomes of BIM uses. The process of selecting from the design alternatives is not trustworthy without the consideration construction professionals' and facility manager's perspectives. As explained, BIM uses are enabled by the information provided by various participants. Contractual agreements as IPD that guides stakeholders towards the same target and incentives are helpful to allow transparent information and better collaboration, eventually supporting BIM uses to nurture. BIM uses which supports the project management activities such as cost estimation and construction planning are not fully utilized without collaboration.

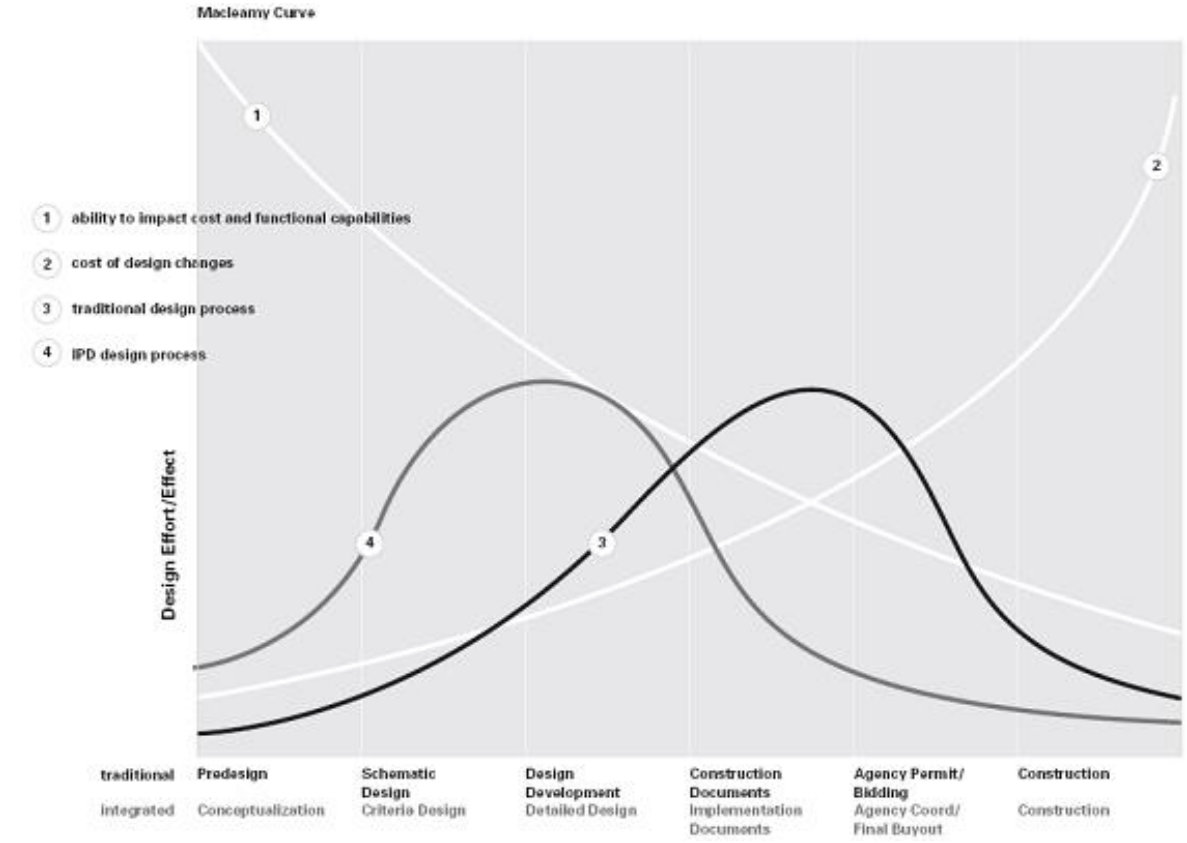

Figure 4: McLeamy Curve (AIA, 2007)

Despite the fact that, the promises of BIM are perceived by the industry already, the legal risks associated with BIM are one of the major barriers for companies in implementation of BIM (Becerik-Gerber & Kent, 2009). To overcome these legal issues the protocols has to be determined at the beginning of the project. (Azhar et al. 2014). Since the collaboration based practices transform processes into an information based workflow, a report suggests that information management protocols should be established considering aspects regarding project information as “ownership, format of representation, access, responsibility and accountability” (Azhar et al. 2014). All the participants contribute to the models in respect to their specialised fields and at the end the model contain information from various stakeholders. Parties should understand that these contributions are their copyright needs to be discussed in the contract documents specifically (Wickersham 2009) Both Wichersam (2009) and Stewart (2015) emphasizes that determining the liabilities of project stakeholders is one of the important issues. A project’s success is increased by enabling actors access information and contribute the models (Wickersham 2009). Thus, questions arise in respect to address the responsibility in case of a failure, and to choose the liable party accountable of integrating data (Wickersham 2009). Designers should not be responsible for the issues related to construction methods, whereas contractor cannot be accountable for design errors.

Some contractual agreements to solve these problems related to BIM implementation have been issued. Building Information Modelling Protocol Exhibit (Document E202) was published by AIA to provide a standard agreement between project parties, contains conditions of model ownership, model requirements and model management, in which also the information requirements of LODs according to uses is defined (AIA, 2008). Furthermore, Construction Industry Council has provided Building Information Modelling (BIM) Protocol which provides guidance on “BIM models that are required to be produced by members of the Project Team and puts into place specific obligations, liabilities and associated limitations on the use of the models” (CIC,2013).

Regardless of the participation degree of stakeholders on the development of models, implementing BIM comes with the contractual issues, which yet not captured standard contract forms (Wickersham 2009). According to Stewart (2015) despite the efforts being made to prepare contractual agreements, these documents is becoming “user friendly” instead of “legally sound” which proves the legal challenge in composing such documents.

J. Wickersham made a summary of contractual issues that arise with the use of BIM to create documents and the employment of IPD methods. His main conclusion is that contracts for BIM-IPD projects need to define rules for the creation, revision and use of the different models by different members of the project team. These rules must be debated in the contract negotiation process. Wickersham more specifically points out five contractual implications of BIM:

- Digital data protocols
    - Which specific software and hardware should be used, and who can create, modify, use parts/models.
- Coordination and reliance
    - To what extent can team members rely on the contributions to the models.
- Project responsibilities and risks
    - Ensure that partners do not perform tasks outside their scope and insurable risk.

- Copyright / use of documents
    - Contributions to the models are potentially copyrightable, therefore there is a need for specifically negotiate the use of the contributions.
- Contractual privity; waivers and indemnities
    - The contract must clearly state that participation in creation of information does not give rise to contractual privity among participants that have not entered into agreement.

Moreover, he address available contracts that could be used as a starting point for a, either AIA's E202 BIM Protocol Exhibit or the ConsensusDocs 301 BIM Addendum form (Wickersham 2010).

To conclude, integrated project delivery is based on standard contractual agreement between the core partners. The contracts treat many aspects of project delivery, but the main aspects are the shared risk clauses. When it comes to BIM and IPD contracts there are currently no standard contracts. However, it is strongly advised by the research community to include in the IPD contract specific obligations, liabilities and associated limitations, as well as clarifying the ownership of information in the models.

5. PUBLIC PROCUREMENT

5.1 Introduction

A procurement process describes the approach taken to select a tenderer and bid for the contract/works that have been determined by the choice of project delivery method. This includes the formal procurement procedure (tender procedure). As mentioned in the introduction, the procurement process and procedure are highly dependable on the project delivery method that is chosen. This chapter discusses various aspect related to procurement such as procurement procedures, criteria for qualitative selection, selection criteria, award criteria.

The main source for this discussion is drawn from the European directive on public procurement (Directive 2014/24/EU). Many hospitals are run by government or they are controlled by government or public law. In these cases, these public authorities need to comply to the EU directives on public procurement and any national procurement law that is applicable to these organization.

The Europeans directive includes several principles resulting that public procurement needs to be:

- Open (e.g. a procurement is aimed at stimulating completion and procurement may not be unnecessarily limit companies to compete)
- Fair and non-discriminating (e.g. public procurement may not distort competition)
- Transparent

5.2 Procurement procedures

In the following paragraphs, several topics are addressed. For each topic, the approach is discussed from the point of view that IPD is applied in its 'truest' form (alliance type project delivery method). However, also other considerations are discussed that would apply to other project delivery methods. The EU

directives provide public authorities a range of procedures that can be used in selecting and awarding contracts. Some examples of procedures are:

- Open procedure
- Restricted procedure
- Competitive procedure with negotiation
- Competitive dialogue

In most public tenders, the open procedure or restricted procedures are used. In an open procedure, any interested company may submit a tender (bid) in response to a call for competition. The tenders are evaluated to check if the tenderer is meeting the qualitative criteria, before the tender itself is evaluated on meeting the specification set by the public authority and to determine which of the tenders is best using the set award criteria. In a restricted procedure, any interested company first submits a request to participate in the tender procedure. After qualification and selection, the selected companies are then invited to submit their tender (bid).

IPD and appropriate procurement procedure

IPD is usually employed in alliance type project delivery methods. As discussed in Chapter 7.1, alliance type project delivery methods may be preferred in cases where the project:

- is large in size;
- Contains a high degree of complexity;
- Involves a lot of (mainly technical) risks that are hard to classify and manage prior to the start of a project.

In cases where risks are clear, other project delivery methods (e.g. design-build) may be preferred as they provide the opportunity to specifically allocate the risks to specific organization (the organization who can best manage it). However, such allocation is difficult when the associated risk are more complex, there are needs for innovative solutions for the problem, there will likely be scope changes, and time is available. In such cases, having all key partners (owner, designer, builder, etc.) is desirable to adequately manage the project.

In this situation it is unwise to opt for an open or restricted procedure. Such procedures imply that the client is able to formulate the specifications in detail including the risks that are associated. This is not possible in the abovementioned situation. The public authority therefore requires a procurement procedure that provides opportunities for information exchange with the tenderers. Such opportunities are provided by the competitive dialogue and the competitive procedure with negotiations.

The competitive dialogue is similar to the restricted procedure, but allows for one or more dialogue rounds with the selected tenderers before the tenderers are asked to submit their tenders (bids). The competitive procedure with negotiation first requires tenderers to submit their bids before negotiations start. According to the Directive 2014/24/EU, public authorities may apply a competitive procedure with negotiation or a competitive dialogue in one or more of the following situations:

- Needs of the contracting authority cannot be met without adaptation of readily available solutions.
- They include design or innovative solutions

- The contract cannot be awarded without prior negotiations because of specific circumstances related to the nature, the complexity or the legal and financial make-up or because of the risks attaching the hem.
- The technical specifications cannot be established with sufficient precisions by the contracting authority.

Particularly the competitive procedure with negotiation seems to be well suited for alliancing. It offers opportunities to negotiate the various contractual arrangements such as target pricing, fees, risk/reward formulas, and various clauses involving the cooperation. This process can also be considered to be part of the teambuilding phase that is suggested by the AIA. There are examples of these kinds of procedures, for example in Australia where there is more experience with alliancing in public works contracts.

In cases of other project delivery methods (e.g. design-build), other procedures may be more favourable. However, given the fact that there are many uncertainties involved in healthcare building projects, there will likely be a need for information exchange in the procurement procedure. In such cases, the competitive dialogue may be an interesting procedure to apply.

Note that besides the choice of procedure, the contracting authority can also organize market consultations prior to starting the procurement procedure. This also allows the share of information and collecting input from market parties regarding the project.

5.3 Criteria of the procurement process

5.3.1 Qualitative criteria

Qualitative criteria are minimum requirement that apply to the tenderer, not the tender. The tenderer is required to meet all qualitative criteria that are set by law or the procuring agency. Any criteria that is set has to be related to the subject matter of the contract. Examples of criteria that may apply to (IPD) projects are:

- Experience with IPD, alliance type projects.
- Experience with healthcare building projects (design, build).
- Experience with integrated project teams.

5.3.2 Selection criteria

Selection criteria are similar to the qualitative criteria discussion the previous subparagraph. They too only apply to the tenderer and not the tender. Selection criteria are used in procurement procedures that have a selection procedure included (e.g. restricted procedure, competitive dialogue). The purpose of applying selection is to limit the number of contenders for the contract, cutting down on transaction costs. The selection is aimed to select the tenderers that are most likely to succeed in providing a good solution to the public authorities' requirements.

Any criterion that is set has to be related to the subject matter of the contract. They are often similar to the criteria used by the qualitative criteria (e.g. experience with IPD projects).

5.3.3 Award criteria

Contrary to qualitative and selection criteria, award criteria only apply to the tender (not the tender). The award criteria reflect what the procuring agency considers important in the bid, next to the specification it

has provided. There are many criteria possible, and the choice depends on the project and goals at hand. From the perspective of employing IPD (alliance), some criteria may be:

- The proposed pricing for fees and risk/reward (perhaps proposes as a percentage)
- Vision on the principles, goals and structure of the alliance.
- The quality and experience of the personnel assigned to the project[2].
- Quality of the proposed plan.

In cases where other project delivery methods or procurement procedures are applied, other award criteria

		Advantages and Disadvantages of Procurement methods		
Criteria	Objective	Design-Bid-Build	Design-Build	IPD
Large project	Determine the need for project organisation	◇	◆	◆
Complexity	Technical advanced, highly complex structure	◇	◆	◆
Undefined risk	Distribute risk	◇	◇	◆
Defined risk	Allocate the risks to specific organization	◆	◆	◇
Information exchange	Solve uncertainties during procurement	◇	◇	◆

◆ Advantages ◇ Disadvantages

may be more appropriate. Such criteria could involve:

- Sustainability of the solution
- Energy performance
- Lifecycle costing
- Etc.

5.3.4 Summary of advantages and disadvantages of procurement methods

The procurement methods that are discussed in this Chapter: Design-Bid-Build, Design-Build and Integrated Project Delivery have advantages and disadvantages as explained above. In order to summarize and to view the advantages and disadvantages from the perspective of procurement methods, a table is presented below. Table 1 highlights the criteria and the objectives of the criteria and assesses the procurement methods against these criteria.

5.4 Example of procurement used in case studies San Luca

This Chapter gives a view of a recent tender process with the objective to verify the current situation of procurement of Hospital intervention in Europe. The chosen project is situated in Italy and consists of three buildings (Figure 5).

Table 1: Advantages and Disadvantages of procurement methods with regard to different criteria.

[2] Strictly, this applies to the tenderer and not the tender. Still, there are examples where the courts ruled that this may be directly linked to the subject of the project and therefore may be allowed.

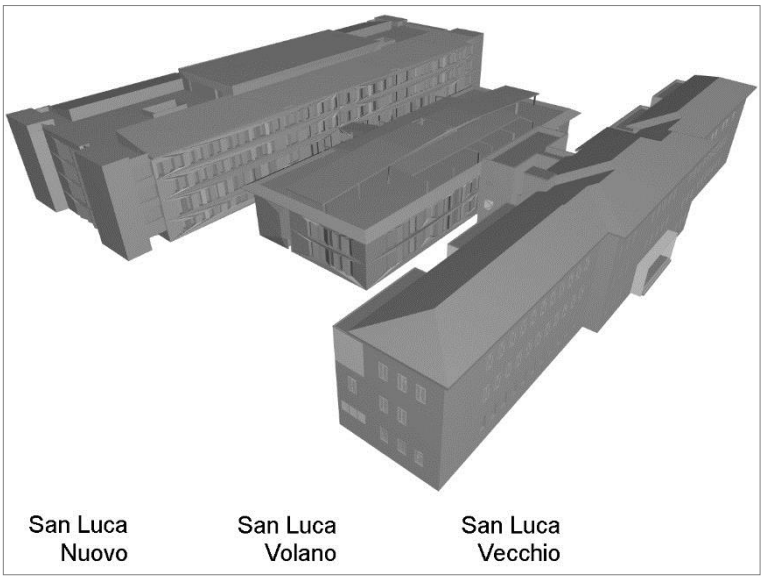

Figure 5: Italian case study: San Luca complex

The first of the three buildings, the San Luca Vecchio, has been built in the 60's and is arranged according to a three-fold plan layout on three floors. It accommodates medical departments (named DAI in AOUC) such as Vessels and Heart Department, A&E-emergency and general surgery medicine department, Biomedicine Department and Oncology Department in addition to welcoming facilities and spaces. It counts 278 space units and 57 beds within 3,615 m^2.

The second one, the San Luca Volano, connects the other two buildings together. It has been inaugurated in 2013 and it is arranged on four floors. It accommodates Imaging Diagnostic Department, Oncology Department and seven operating theatres on the first floor, in additional to technical areas. It counts 242 space units within 4.662 m^2.

The third building, the San Luca Nuovo, has been built around 15 years ago. The plan layout is similar to the San Luca Volano' s one but on six floors. It accommodates the Heart and Vessels Department, the Medical and Surgical Specialties Department, A&E Department, General Medicine and Surgery Department, Imaging Diagnostic Department and Oncology department. It counts 817 space units, and 219 beds within 13,784 m^2.

Initially, the San Luca Complex included three equal buildings (Figure 6). These were organized according to a simple body layout plan, and they defined the model upon which the former plan for all Careggi was designed around 1920. The first two buildings of the San Luca complex were built around 1930, while the last one, which corresponds to the one still existing today, was completed after the Second World War.

Figure 6: *San Luca complex aerial view before the demolition of two buildings*

The constructions have been subjected to many refurbishment interventions and changes, which brought to the demolition of two of the buildings of the complex. Indeed, the San Luca became the key area for the demolition and reconstruction interventions in order to release space to accommodate new buildings (according to the “New Careggi” Plan, the strategic plan addressed to the reorganization of the healthcare district). The new buildings were supposed to accommodate all the healthcare functions that were provided for by different phases of the refurbishment design project. Therefore, as already described, the complex as it is today includes the San Luca Nuovo building, the so-called San Luca Volano and the San Luca Vecchio. Inside the San Luca Vecchio an access to a “tunnel” that connects together all the three buildings can be found. This path ends with an opposite access, which represents the access to the emergency route with the “hot” space (Figure 7).

Figure 7: San Luca complex aerial view today

A general outline of the decision-making process normally implemented by AOUC is useful to understand the type of contracts adopted by the Careggi Hospital for the design and construction of the three buildings of the Italian case study.

Since the hospital district is made up of buildings completed in different ages, it can be considered a representative example of the Italian reality concerning the following type of:

- Interventions (often fragmented and usually related to retrofitting instead of new buildings),
- Procedures (any legislation constraints),
- Actors (public and private),
- Contract (services, works and supplies).

In the past, Careggi planned the new interventions on the basis of a 10 years Master Plan. However, this program could not keep up with the fast changes of the political and medical requirements (due to the fast evolution of the technique).

Starting from 2007 the management (CEO of the University of Florence, CEO of the Careggi Hospital and the Councillor of the Regional Health Department) makes use of a new method for the prevision of the future hospital: the Plan of investments. It is always related and attached to the prevision balance, but it's not descriptive. His Implementation Plan is the Triennial Plan.

The Technical Area/Office - handling the Plan of Investments - is made up of different Operative Units (OU):

- Planning and supervision (planning and scheduling the works)
- Design (design and validate the works)
- Construction (to complete the works)
- Facility (carrying out the maintenance interventions).

The Technical Area has got skilled staff capable to handle all phases of the building process.

That is why the AOUC does not always need to involve external professionals to arrange the different levels of the design process.

On the contrary, Careggi always refers to external contractors for the implementation of any kind of works, even for ordinary maintenance.

As long as the Public Procurement code changed significantly on 2016 compared to the code in force since 2006, the type of contracts used by the AOUC up to now are:

- Tender on the basis of the preliminary or final design made in-house by the Technical Area, concerning SERVICES;
- Procurement contract of works, concerning the WORKS;
- Design and build procurement contract on the basis of the final design made by the Technical Area concerning both SERVICES and WORKS;
- Procurement contract for SUPPLIES and furniture.

The Architectural competition is not used at all.

During the whole process, from the design phase to the execution, the AOUC's role, represented by the professionals of the Technical Area, is decisive and constantly active. The Technical Area is responsible starting from the programming and preliminary design (which the procurement contract is based on) up to the supervision to the end of works.

San Luca Vecchio

The construction of San Luca Vecchio dates back to the sixties and no data are available regarding the design and procurement used.
Over the years, some wards dedicated to the hardcopy archive have been reorganized and adapted to comply with new regulations.
The most recent interventions refer to the following wards: Toxicology on the second floor and Bone Marrow Transplantation (BMT) on the first floor.

2011-2013

Technical and structural adaptation of the cryopreservation rooms in BMT.
Design: Construction design in-house
Execution: Procurement contract of works

2012

Smoking room in the Toxicology ward.
Design: Construction design in-house
Execution: Procurement contract of works

San Luca Nuovo

In 1999, the design phase (Final and Construction design) of the new building was awarded to a temporary association of professionals. The procedure was a tender on the basis of the Preliminary design made by the Technical Area.

The design included the functional arrangement and expansion of the Department of Medicine of the hospital. The construction involved the demolition of two of the three pavilions (the third is the current San Luca Vecchio) and the connection between the buildings.

In 2000 the procurement contract of works was awarded to a temporary association of companies through a restricted procedure.

Works completed in 2005.

Later, furniture and equipment have been assigned with a specific procurement contract of supplies.

In 2007 the complex needed urgent works of renovation and adaption to the systems of the Endoscopy ward on the ground floor level. The selected type of procurement contract was “design and execution of works” on the basis of the Final Design made by the in-house UO (operative units). Services and works were awarded to the most economically advantageous offer.

Also in 2007, the construction of a logistic and technological connection between the kitchens and San Luca Nuovo was assigned to the best offer based on the lower price. However, the procedure was based on the Construction design developed in-house.

Over the last ten years the facility required other interventions.

2009-2011

Upgrading to the air-conditioning system on the 3rd floor.

Design: in-house Construction design.

Execution: Procurement contract of works.

2010-2012

Integration to the electrical system of the recovery ward on the 2nd floor

Design: in-house Construction design.

Execution: Procurement contract of works.

2013

Transfer of Department of Urology and retrofitting works to locate the Intensive Care unit on the first floor.

Design: in-house Construction design.

Execution: Procurement contract of works.

San Luca Volano

The implementation of the facility known as Volano has not been linear and fast, but it was achieved in stages using different types of procurement, for design services and for the execution of works.
The reasons are both economic (due to the availability of funds) than related to the changing needs and priorities of the AOUC.
In 2003 Careggi published a tender for the design and execution of works. The object of the procurement was the Construction design (including the Health and safety coordination during the design phase) and the execution of works to implement two new buildings. The first building was dedicated to an intermediate sanitary building located between San Luca Vecchio and San Luca Nuovo, including the connection of the two pavilions. The second one included offices and services of the Technical Area.
Indeed, the AOUC quite often comprises different kind of works in the same procurement contract.
The award criterion was the most economically advantageous offer.
During the implementation, in 2009, the building required some changes to the Construction design and an additional financing to the completion of works. The new Construction design, made by the same temporary association of professionals winner of the contract, predicted (and realized) the following changes:

- The expansion of the existing building and the construction of a third level. The construction of a connection between the San Luca Volano and the adjacent San Luca Nuovo,
- The completion of the second floor in order to let it work, leaving in the meantime the basement and the first floor unrefined,
- The completion of the building envelope and the external areas,
- The construction of a new volume placed in the basement between San Luca Volano and San Luca Nuovo. It was required to locate the sub-station of MEP systems.

In 2010, when the building was still under construction, a tender was announced to complete the Final Design of the basement. This area should accommodate the Radio diagnostic department. It was made up of two X-ray rooms, one CT scan room, two rooms for ultrasound and a specific area with two rooms for Interventional Radiology surgeries and one room dedicated to lithotripsy.
The interventions include the setup of new partitions, pavements, ceilings and painting, furthermore the supply of systems and biomedical equipment.
The above Final design was placed as the basis of an open tender. The design and execution procurement contract used the selection of the most economically advantageous offer criteria. The construction completed during 2013.
Finally, in 2011, the Final design for the completion of the technical area on the roofing and the first floor, dedicated to the Operational Theatres, was awarded by a tender for services.
This Final design was placed as the basis of an open tender. The design and build procurement contract used the selection of the most economically advantageous offer criteria. The construction completed in 2013.

5.5 Conclusions

The European directives offer various opportunities to apply IPD in projects. There are suitable procurement procedures that allow for interaction between owner and potential bidders. Other procurement aspects such as selection and award criteria can be tailored to fit the goals of the projects. One should note however, that the preparation and execution of procurement procedures can require many resources such as time and money. The effort put into the procedure has to be proportional to the gains that are expected. Moreover, some procedures may be unknown to the owner and will mean there is little experience with coordination such an procedure. Such aspect need to be considered in the choice in both the project delivery method and the procurement approach.

6. THE ROLES OF ESCO IN AN IPD PROJECT

6.1 Introduction

In the last years many initiatives and strategies have been promoted in order to develop the use of alternative sources of energy or other energy efficiency improvement measures. At the same time many European directives have defined the tools to support this new energy politics (the first community legislation was put forward by the EN 15900 standard in 2010). In this regard the main innovation is represented by a new type of company able to provide energy services thought new forms of contract. The new type of company is called ESCO (Energy Service Company). The Energy Efficiency Directive (EED, 2012/27/EU) defines an “energy service provider” as a “natural or legal person who delivers energy services or other energy efficiency improvement measures in a final customer's facility or premises”. In this way the new type of energy company ESCO provides different energy efficient improvement measures and it’s focused to providing all other services aimed to guarantee energy savings. The company so defined, accepts a certain level of financial risk because the payment of clients shall be based on energy efficiency improvements and on the achievement of other agreed performance criteria.
An ESCO is a company that provides integrated energy services, offers guaranteed performance contracts whose benefit is linked to the energy savings achieved (energy performance contracting - EPC). The company works with third-party financing (TPF), both providing its funding to the intervention and by facilitating the access to credit by customers thought specific bank contracts.

An ESCO must be able to manage the whole energy efficiency process offered to the customers. Hence ESCO is bound to perform various activities, including the following:

- energy audits;
- verification of compliance of energy systems with the legislation and technical regulations in force;
- techno-economic feasibility studies;
- design and realization of interventions;
- equipment operations;
- maintenance of the energy efficiency measures;
- systems monitoring the supply and energy consumption;
- technical support for the acquisition and/or management of funds;
- management of: incentive, tenders notice, public funding;
- training and information;
- building energy certification.

An ESCO can provide all the above activities and services but may delegate some services in outsourcing (for example the realization of equipment and its maintenance), in any case at the end of the period required to return on the investment and to reward the activities of the company, the plant is generally purchased by the customer but the management is left in charge to the ESCO. Typically ESCOs are profit-oriented private organizations (sometimes public), but in the last years non-profit arrangements have been started. An ESCO may be set up, run and owned by a community, a so-called “community ESCO”. It

shouldn't require any profit, but would reinvest its gain in the local energy system. Anyway the profit overrides in this type of organization, even if it's aimed to pursue sustainable development, climate goals and other socially and environmentally benevolent goals.

6.2 Role of ESCO in an EEB project

ESCO concludes Energy Performance Contracts (EPC) with clients, the core of the agreement is a performance guarantee. At the same time, EPC can be drawn in various sub-forms. In Italy the D.lgs 102/2014 defines the EPC as "contractual arrangement between the beneficiary or whoever exercises the negotiating power and supplier of a measure to improve energy efficiency, monitored and improved during the life time of the contract. The investments made are paid according to the level of improvement of energy efficiency established by contract or other agreed energy performance criterion, such as financial savings". There are different forms of contracts, the best known are:

- **Shared saving:** the ESCO provides financing for the investment and the parts agree on the division of profits. Just a portion of the proceeds helps to payback the investment. There is no standard split of the share of the ESCO vs. the client, as it depends on the length of the contract, the payback time and the risk taken.
- **First out:** the ESCO pays 100% of the energy savings until the project costs are fully paid. In other words all cost savings resulting from the energy efficiency are used to pay back the initial investment. The exact duration of the contract will depend on the level of savings achieved: the greater the savings, the shorter the contract. Generally this form of contract is shorter than a "shared saving" contract: typically 3-5 years.
- **Guaranteed savings:** the client usually provides the project budget and he sings the loan with a lender. The ESCO is paid by the client only if a certain performance level has been achieved, otherwise ESCO will pay the difference to the client. The client will pay for the services of the contractor and for the performance guarantee, usually given in the form of energy savings.
- **Pay from savings contract:** This form of contract is similar the guaranteed savings, the difference is that the payment to refund the loan is not constant over time, but it's tied to the savings achieved.
- **Delivery contracting (or Supply contracting or Energy supply contracting (ESC)):** This form of contract is in contrast to EPC. Since it's based on the supply of a set of energy services, mainly via outsourcing of the energy supply, the fee for the services is normally calculated on the basis of the client's existing energy bill.
- **Chauffage:** This type of contract is similar to the delivery contracting, and is one of the most common contracts in Europe. In a chauffage contract arrangement the fee for the services is normally calculated based on the client's existing energy bill minus a certain level of savings, with a guarantee of the services provided. Alternatively, the costumer may pay a rate per square meter. Chauffage is equivalent to **heat supply contracts** ("servizio calore" in Italian), and it's substituted by **Energy services plus contracts** (servizio energia plus) that also includes a

commitment by the provider to reduce the consumption of primary energy for winter heating by at least 10% with respect to what is indicated in the building certificate.

- **Comfort contracting:** This form of contract is used in Nordic countries and is similar to the delivery contracting. The provision of the level of comfort or level of services is outsourced to the ESCO firm. This contract goes beyond the provision of energy for the level of comfort and takes care of the full maintenance, including a healthy indoor environment, aesthetics, etc.
- **Integrated energy contracting (IEC):** This is a new form of contract that combines EPC and DC, increasing the amount of energy costs savings. During the design phase of the project, demand side measures are planned as a priority and the remaining level of energy needs are covered by more energy efficient supply. Therefore an IEC combines the benefits of the demand and supply side measures and consequently reaching higher cost-benefits.

In general, depending on the type of contract, the benefits for clients operating with an ESCO are various. Definitely ESCO offers turnkey services and serves not only as a simple contractor, rather as a project manager, guarantor, financer, etc. Moreover examples of the benefits include that ESCO has direct contacts with subcontractors and the client just takes care of the successful choice of one single company. It means a quicker and simpler contractor selection. In any case the most important benefits for the client are:

- absence of financial risk (in case of bad investment, not rewarding, ESCO assumes all responsibility);
- opportunity to make interventions even in absence of their own financial resources or in case of difficulties in raising external financing;
- absence of problems related to the management and maintenance of the system;
- ability to achieve significant energy-environmental benefits, since the profits of an ESCO are proportional to the efficiency of the system.

An ESCO project is beneficial from several viewpoints, even beyond the participants. Since ESCOs are not the universal remedy for energy demand growth and sustainable development, they definitely have an important role to play in the energy efficiency markets and in achieving micro and macro level goals.

6.3 European legislation

The legislation of ESCO projects begins almost 20 years ago by the European Commission. Since then several studies, rules and programmes to implement to role of the ESCO in the management of energy efficiency programme across the European countries have been activated. The first initiative was in 1988 when the European Commission adopted a Recommendation to Member States to promote ESCOs, defining TPF and describing how ESCOs operate. Subsequently, in 1992, the European Council Parliament adopted a Directive (93/76/EC) to invite Member States to design and implement programmes to use TPF in the public sector. In 1996 two different base contracts were published: one for the buildings and the other for the industry. In 2002, the European Commission's GreenLight program identified ESCOs operating in the lighting field, and in this moment was created a preliminary list of ESCOs. In June 2011, the EC proposed a new Directive that brings forward legally binding measures to step up Member States

efforts to use energy more efficiently at all stages of the energy chain, from the transformation of energy and its distribution to its final consumption.

In the recent years various documents have been issued by the EU in order to increase the European and national efforts of ESCO markets, in particular through:

- Directives ESD (2006/32/EC), EED (2012/27/EU);
- prEN15900 standard: energy efficiency services – definitions and requirements;
- EU Energy Performance Contracting Campaign (EPCC);
- European Energy Efficiency Fund (EEE-F);
- ESCO market research;
- ESCO Database (JRC and Transparense);
- IEE projects (such as Eurocontract, EMEEES, ChangeBest, Permanent, Transparense, EESI, EESI2020, Combines, etc.);
- FP7 projects: good examples, business model.

At the same time with the European Commission work, across the Europe countries have been activated a lot of national and local actions.

The EU has activated several programs and measures to improve the market of ESCO, the principal activated programs are:

- **The EU Energy Performance Contracting Campaign (EPPC):** This program was activated in 2012, and it is one of the key activities of the EU Commission. The campaign aims to enable country-specific discussions and the capacity building of core stakeholders. However it's directed to strengthen the use of EPC, combining it with energy planning and understanding its role in the implementation of Sustainable Energy Action Plans (SEAP) as a part of the Covenant of Mayors. The campaign consists of targeted capacity buildings seminars organised in various locations across the EU. Furthermore, training materials, guidance documents and best practise are made available and shared.
- **The Covenant of Mayors (CoM):** The Covenant of Mayors is "the mainstream European movement involving local and regional authorities, voluntarily committing to increasing energy efficiency and the use of renewable energy sources on their territories". The signatories of CoM have to submit a Sustainable Energy Action Plan and report about its implementation. Promoting ESCO market can be chosen as a key action to be able to reach these targets.
- **Intelligent Energy Europe (IEE):** Intelligent Energy Europe is a group of projects to vitalize energy performance contracting, a lot of these programmes have targeted the use of EPC in the public sector. The project activated by IEE are: **Eurocontract**, that produce documents and guides, propose innovative financing alternatives, quality standards, and explored the link between White Certificates and EPC; **Esoli, E-street,** and **Butk,** these projects helped municipalities switch to energy efficient lighting technologies in the frame of innovative energy services contracting.
- **The European Energy Services Initiative (EESI):** ESI organized local and regional capacity-building through national online-help desk, frequent training events for local authorities,

companies and multipliers, as well as consultancy for applying and advancing EPC-standard procedures and instruments in concrete pilot projects.

- **The Changebest project:** This project operates for the intensification of the energy efficiency service market through country analyses, experience exchange, general strategy concepts and bilateral dialogues with individual companies on their business plan and product developments.
- **The Permanent project:** The aim of Permanent project is to enhance the rate of investment in energy savings projects by addressing the lack of trust through the development and testing of harmonized and integrated approaches for end users to measure and verify their energy savings, based on instruments used by the Efficiency Valuation Organizations (EVO).
- **The Combines project:** The Combine project was organized to maximize energy savings through effectively defining and interconnecting activities of public subsidy programmes with the implementation of energy savings.
- **European Energy services initiative (EESI2020):** EESI2020 is a project addressing the EU 20% saving objective by a significantly broader use of EPC. This project is a continuation of the activities of EESI by supporting large cities and metropolitan regions integrate long-lasting EPC implementation schemes in their energy plan.
- **Transparense project:** The transparense project is to increase the transparency and trustworthiness of Energy Performance Contracting markets throughout Europe. The project is developing a European Code of Conduct, assists in the establishment of ESCO association in the partners' countries, where this was deemed necessary or proactive, and will provide training for the various market stakeholders.

6.4 ESCO market in the EU Member state

Although ESCO exists for some time, only in recent years the spread of ESCO had greater growth. The market growth is due to some trends that have occurred within the EU countries.

The trends that we can identify are:

- The knowledge of the ESCO concept increased, where potential clients started to consider energy efficiency services more as business as usual. The awareness and understanding of energy efficiency services increased and mistrust decreased. These were based on the growing importance of energy consumption cost efficiency due to rising energy process and growing "environmental awareness.
- The European Energy Services Directive (2006/32/EC) aimed to removing restrictive public procurement rules that conflict with ESCOs, public procurement rules and evaluation criteria in the public tendering process remained the main barrier for ESCO project development in the public sector.
- As imposed by the Energy Services Directive (2006/32/EC), the public authorities got increasingly active in supporting the development of an ESCO market in some countries.
- The financial crisis economic and downturn had important positive and negative impacts on the initiation and development of ESCO projects that in some cases counterbalanced each other on the same market. The economic downturn made ESCO clients more unstable due to the reduced

activity increasing the difficulty of ensuring energy savings and raising the risk on insolvency. The economic downturn had also raised the importance of resilience, raising the desire in clients of stipulating more flexible contracts. Moreover, the financial crisis and economic restrictions had increased the attraction of achieving cost reductions through energy efficiency measures and taking advantage of the flexible financing mechanism offered by ESCO.

The following table shows information about the ESCO market in the European countries (data based on: "Bertoldi Paolo, Boza-Kiss Benigna, Panev Strahil, Labanca Nicola, (2014), *ESCO Market Report 2013*, Joint Research Centre - Science and Policy Reports, European Commission").

ESCO market in the European countries

	Number of ESCOs	ESCO market size and potential	ESCO market trend	ESCO association	Typical ESCO projects	Main type of contract
AUSTRIA	>50	- 15-20 € million annual investments - Unknown	halted, after a decent growth until ca. 2010	Dachverband Energiecontracting Austria	space heating air conditioning control and automation, lighting building envelope projects public sector buildings	EPC
BELGIUM	4 public ESCO 10-15 private firms	- 1-5 € million turnover - 500-1000 € million	Slow growth	BELESCO: the Belgian association of ESCOs energy service providers AGORIA GreenBuilding platform.	public sector building private industry facilities	public energy service contracts without guarantees EPC and SmartEPC
BULGARIA	ca. 50 ESCO 7-12 operate currently	- N/A - 500-900 € million	Stagnation	None	public sector buildings public lighting	energy supply contracts some EPC
CROATIA	1 public 10 companies	- 100 € million - N/A	Increasing since 2012	None	refurbishment of building envelope heating systems and indoor lighting in public buildings improvement of heating system in public buildings public lighting	energy service contracts based on fixed fee very few EPC contracts
CYPRO	0	- 0 - N/A	stagnation, though first pilot project being organised	None	lighting improvement	N/A
CZECH REPUBLIC	10 companies	- 10-20 € million - 100-500 € million	slowly growing, with moderate market transformation and growth of complexity and institutionalization	Association of Energy Services Companies of the Czech Republic (APES)	public sector buildings	EPC with guaranteed savings
DENMARK	15-20	- 140-150 € million - 1-7 € billion	Strong growth	None	municipal real estate street lighting industry and residential housing projects	EPC with guaranteed savings
ESTONIA	2-3	- N/A - Unknown	Stagnation	None	private tertiary and industrial buildings, HVAC	N/A
FINALND	5-8	- Unknown - 100-200 € million	Slowly growing in volume	None	Public sector buildings	EPC
FRANCE	350	- 3.2 € billion - 250-500 €	stable, with market	Several	Public sector buildings, HVAC	chauffage, but EPC's role is

	Number of ESCOs	ESCO market size and potential	ESCO market trend	ESCO association	Typical ESCO projects	Main type of contract
		million	transformation and growth, and extension to new target areas			becoming larger though still incomparable
GERMANY	500-550	- 3.5-5.0 € billion - 20-30 billion/year	slightly increasing and restructuring with more large ESC suppliers and more utilities being involved	Numerous	public sector public lighting, control and automation industrial processes, industrial cooling, motors, inverters, indoor lighting, air conditioning and ventilation, building shell and whole building refurbishments	EPC IEC
GREECE	2-5	- 0 - 5 € million	Largely unchanged	None	tertiary buildings industry and integrated projects in buildings	EPC with TPF
HUNGARY	6-10	- Unknown - Unknown	Drastic decrease	None	industrial sector public buildings hotels residential bloc-houses	Chauffage Facility management contracts, BOOT EPC
IRELAND	>5 (large ESCO) >10 (small ESCO)	- Unknown - Unknown	Strong growth	None	public and private tertiary sectors	EPC EPRP LESC
ITALY	50-100	- 500 € million - 1-10 € billion	Slow growth	AGESI ASSOESCO FEDERESCO AssoEGE	public hospitals schools industrial sector offices cogeneration heating management efficient lighting	Heat Service Contracts/chauffage Facility management contracts BOOT some EPC
LATVIA	8	- 2-3€ million/year - 100-150 million	Largely unchanged with minor transformation	None	residential building heating	EPC
LITHUANIA	3-5	- Unknown - Unknown	Unchanged	None	District heating boiler houses	BOOT CEM Leasing
LUXEMBURG	3-6	- Very small - 5.1-6.2 million	Growth	None	N/A	N/A
MALTA	0	- Very small - 1.6-1.8 million	Unclear	None	N/A	N/A
NETHERLANDS	50	- Unknown	slowly increasing	ESCoNetwerk.nl	public and commercial	EPC

	Number of ESCOs	ESCO market size and potential	ESCO market trend	ESCO association	Typical ESCO projects	Main type of contract
		- 30 € million/year	and getting off the ground		sector new public buildings special private constructions	CEM
POLAND	ca. 30	- 10-25 € million - 25-75 € million	Getting off the ground	None	space heating air conditioning control and automation lighting building envelope public sector buildings	BOOT Outsourcing
PORTUGAL	15-20 active 100 registered	- Unknown - 100-200 € million/year	Slowly increasing	APESEnergia	industry hospitals restaurants public buildings	EPC CEM
ROMANIA	15-20	- Unknown - Unknown	Slowly increasing	ESCOROM – The Romanian Association of ESCO Companies	industry hospitals hotels retail public buildings RES boilers public lighting	BOOT Energy Supply Contracting EPC
SLOVAKIA	6-8	- Unknown - Unknown	Slow growth	None	space heating control and automation lighting industry public sector buildings	CEM EPC
SLOVENIA	5-6	- 3 € million/year - 15 € million	Slowly increasing	None	Municipal buildings	EPC BOOT Supply contracting
SPAIN	20-60	- 500€ million/year	Strong growth	AMI ANESE A3E	industry public lighting private tertiary public buildings	Public-Private Cooperation Agreement energy and services supply contracts chauffage leasing EPC
SWEDEN	6	- 60-80 million/year - 300 € million/year	Slow growth	Association EnergiEffektiviseringsFöretagen	Public sector buildings	EPC Energy supply Contracting Chauffage
UK	30-50	- Unknown - 1 € billion	Balanced growth	Various trade (e.g. ESTA, EMA)	industrial sector public buildings hospitals schools offices social housing	CEM BOOT EPC

	Number of ESCOs	ESCO market size and potential	ESCO market trend	ESCO association	Typical ESCO projects	Main type of contract
					public lighting	
Other European countries						
NORWAY	5-10	- Unknown - Unknown	Slow growth	None	Public buildings	N/A
SWIZERLAND	6	- Unknown - Unknown	Slow growth	SwissESCO	industry social housing private tertiary and residential	Chauffage BOOT EPC
ALBANIA	0	- Not available - Not available	On ground	None	No ESCO project	Not available
BOSINA	0	N/A	Preliminary development stage	None	Energy efficiency improvement of district heating in municipalities and central space heating in residential buildings	Chauffage
KOSOVO	0	Not available	No existent market	None	No ESCO project	Not available
MONTENEGRO	0	No data	No data	None	No ESCO project	No contract
SERBIA	2-3	No information	Getting off the ground	None	rehabilitation of energy supply in industry on-site power generation space heating air conditioning control and automation indoor lighting refurbishment of building envelope.	EPC BOOT
TURKEY	30	No data	Getting off the ground	None	rehabilitation of energy supply system in the industry, installation on site power generation space heating air conditioning in door lighting for commercial buildings refurbishment of building envelope	BOOT EPC
ARMENIA	11	No information	Slightly increase	Association of Energy Service Companies of Armenia	rehabilitation of heating supply system for public sector indoor lighting street lighting refurbishment of building envelope	EPC BOOT
BELARUS	3-4	N/A	Increasing since	None	Heating supply	Simple

	Number of ESCOs	ESCO market size and potential	ESCO market trend	ESCO association	Typical ESCO projects	Main type of contract
			2012		systems reconstruction improvement of heating system in public buildings public lighting	partnership agreement (SPA)
MOLDOVA	0	No information	On the ground	None	No ESCO project	N/A
RUSSIA	>100	- 100 € million/year - 2.8-7 € billion	Growth since 2009	None	Refurbishment of building envelope External lighting and street lighting Rehabilitation of district heating systems	Shared savings contracts
UKRAINE	ca. 30	- 100 € million/year - Unknown	Increased since 2011	Several	rehabilitation of energy supply system in industry, i power generation reconstruction of district heating systems and street lighting in cities space heating air conditioning in door lighting in residential buildings refurbishment of building envelope	EPC BOOT

6.5 ESCo and IPD

Of course, an ESCo would be a core partner in an Integrated Project Delivery team. The benefit has been well explained in (Bleyl-androschin 2010). The ESCo would serve as a general contractor and would be responsible for coordination and management of the individual components and interfaces of the service package against the customer. The International Energy Agency has highlighted that the two main business models of an ESCo: Energy Supply Contracting (ESC) and Energy Performance Contracting (EPC) excel in delivering a reduction of final energy demand and the ESCo criteria could be incorporated in an IPD. One mean of incorporation of ESCo in IPD could be the developed Integrated Energy Contracting, Figure 8, that takes into account both ESC and EPC (Bleyl-androschin 2010).

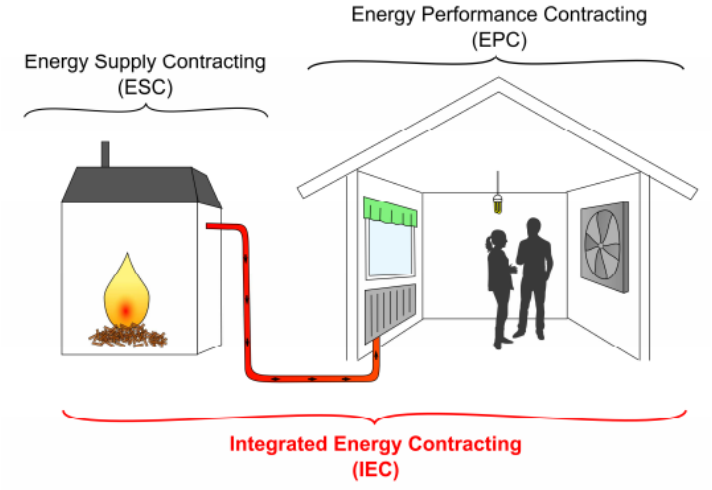

Figure 8: Definition of Integrated Energy Contracting. Source: J. Bleyl, Grazer Energieagentur

7. CONTRACTURAL AND ORGANIZATIONAL CONDITIONS FOR USING IPD IN EEB PROJECTS IN THE EU

7.1 When is IPD appropriate?

It should be noted that there is not any one project delivery method suited for all projects. The best project delivery method should be determined on a project to project basis. Still there are some circumstances in which IPD may be particularly valuable.

As mentioned in chapters 2 and 4, healthcare building projects are faced with several challenges. Some of those challenges might be best faced by owner and key designers and builders to be jointly responsible for project delivery (e.g. forming a project alliance). Still, alliance type project delivery methods such as IPD might be especially suited when the project:

- Are large in size;
- Contain a high degree of complexity;
- Involve a lot of (mainly technical) risks that are hard to classify and manage prior to the start of a project.

In cases where risks are clear, other project delivery methods (e.g. design-build) may be preferred as they provide the opportunity to specifically allocate the risks to specific organization (the organization who best can manage it). However, such allocation is difficult when the associated risk are more complex, there are needs for innovative solutions for the problem, there will likely be scope changes, and time is available. In such cases, having all key partners (owner, designer, builder, etc.) is desirable to adequately manage the project.

7.2 Contractual Conditions for using IPD

STREAMER should propose an EU Integrated Project Delivery framework, which is eligible for the broad implementation of energy-efficient buildings, especially in the context of healthcare districts. Integrated Project Delivery is a contractual form of increasing the integration in early stages, as well as during the project delivery.

This chapter wants explain the contractual issues related to Integrated Project Delivery. The basis for the chapter is the American Institute of Architects (AIA) transitional agreements. The transitional agreements incorporate three agreements organized on the basis of agreement between core project partners:

- AIA Document A195™–2008, Standard Form of Agreement between Owner and Contractor for Integrated Project Delivery.
- AIA Document B195™–2008, Standard Form of Agreement between Owner and Architect for Integrated Project Delivery.

- AIA Document A295™–2008, General Conditions of the Agreement for Integrated Project Delivery.

The main difference between Integrated Project Delivery and other closely related project delivery schemes (Project Partnering and Project Alliances) is the core component of intensify early planning supported by ICT and with the objective to increase the smoothness and productivity of the process, i.e. fluency of the information flow and information availability in general. In addition, two main clauses are used in the contracts:

> The design professional and contractor are required to provide their services at cost with any potential profit tied to the achievement of project-related goals that the parties mutually establish. The first form of potential profit is tied to the Target Cost. If the Actual Cost of the project as delivered by the design professional and contractor is below the Target Cost, any savings is shared in accordance with the contract. The second form of potential profit is tied to specific Project Goals the parties agree upon at the time the Target Cost is established. If the design professional and contractor achieve any of the Project Goals, they are entitled to receive compensation as set forth in the Agreement. If any Project Goal is not achieved, the parties do not receive any compensation related to that Project Goal regardless of who was at fault.

> To the extent damages are covered by property insurance, the Owner and Architect waive all rights against each other and against the contractors, consultants, agents and employees of the other for damages, except such rights as they may have to the proceeds of such insurance as set forth in A295–2008 as modified. The Owner or the Architect, as appropriate, shall require of the contractors, consultants, agents and employees of any of them similar waivers in favour of the other parties enumerated herein.

7.3 Conditions for using IPD on EU level

According to the partners of the Streamer project, the party who manage the project in the early phases differs a lot. It ranges from the client to the contractor and architect, as well as a dedicated project manager. This is believed to be related to traditions in the different countries and the traditional position and mandate of the professions. These peculiarities are common hinders for companies operating over border and project success is dependent on well-established company connections and understanding of culture. The different forms of contracts used in the European countries also underline this. Design-bid-build is the most common in EU, but the number of contracts based on partnering is increasing.

It is foreseen that there is a great wish to work in an integrated manner and the number of contracts of this form is increasing. However, it is not seen as an appropriate way to point out Integrated Project Delivery as the main path to follow. Due to the diverging financial systems and construction culture of the EU

countries, it is difficult to say that IPD could be implemented on an EU level contractually. However, IPD features very attractive components such as collaboration, early involvement of main actors, shared project goal and the use of ICT, and these components are well worth considering applying in the design process of health care construction projects.

8. CONCLUSIONS AND FURTHER RESEARCH

8.1 Conclusions

This report has been performed as a literature review with the purpose to answer the question "*Is IPD a suitable design process for EeB projects in Health Care Districts in EU?"*. The work has focused on three sub-questions:

- How have the responsibilities of project delivery evolved over time?
- Why do we need support in project delivery?
- What is Integrated Project Delivery?

In the following sections, the state of the art of Integrated Project Delivery is concluded by answering the research questions.

How have the responsibilities of project delivery evolved over time?

The post–World War II building boom caused the creation of a new discipline, construction management (CM). The CM model offered building owners additional assurances that the designs developed by their architects and engineers were, for the most part, practical and cost-effective. However, the CM process lacked the single point of responsibility that owners sought. Public owners were locked into a rigid framework of public contract laws that demanded absolute separation of design from construction, with the owner responsible for the coordination between the two, where the owner guarantees to the builder the accuracy of the architect's plans and specifications. With increasing complexity of designs and construction methods a great need for competence within the public sector was needed with large administrations as a consequence.

The cost and the complexity are characteristics of typical health care construction projects and present unique challenges for the health care providers whom often find themselves with decreasing resources and limited in-house expertise. Furthermore, the health care facilities are amongst the most technical and logistically advanced and complex projects that are built today. The lack of coordination between architects and engineers, due to accelerating project plans and limited specialist's fees, can lead to large information gaps in the project's construction drawings which, in turn, will lead to change orders, delays, claims and other unforeseen costs.

To tackle the lack of coordination, new delivery schemes have appeared, such as design-build, project alliances and project partnership. While Design-Bid-Build is still the delivery method most frequently used, many clients now favour methods that facilitate communication and collaboration earlier in the process. Rather than engaging in traditional means for collaboration, actors in the construction sector are instead looking at a new form of project delivery method such as the investigated IPD (Integrated Project Delivery).

Why do we need support in project delivery?

It is generally agreed that the construction sector must move from the traditional adversarial focused behaviour towards more collaborative and integrated strategies to deliver more predictable results to clients and to improve the project performance. Therefore, it is not surprising that project partnering, project alliancing and IPD have received increasingly interest lately.

Lahdenperä (2012) observed that IPD, project alliancing, and project partnering are often used interchangeably, and even if they have their differences, "early involvement of key parties, transparent financials, shared risk and reward, joint decision-making, and a collaborative multi-party agreement are some of the features incorporated in all the arrangements to a varying degree" (p. 57). Consequently, these models are often based on relational contracting principles (Rahman and Kumaraswamy, 2004), incorporating both the formal contract and the relational mechanism for enhancing the collaboration.

In IPD contracts, different economic incentives such as target costs and forms of pain share / pain gain or risk / award arrangements are common. Apart from the formal contractual structure, there may be other arrangements to stimulate collaboration or team cooperation, such as:

- BIM and Lean Construction are approaches that can encourage a better collaboration (e.g. Matthews and Howell, 2005),
- co-location of team members and the use of shared administrative systems.

Furthermore, Dewulf and Kardefors (2012) have shown that the formal (IPD) contract and the informal relation, trust, interact. After having signed the contract, a process starts where the partners gradually together start to understand what the relationship means, both in terms of contractual agreements and behavioural.

What is Integrated Project Delivery?

American Institute of Architects has defined IPD as *"a project delivery method that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction"*.

In practice, five elements have been identified as a minimum to claim that a project is an IPD-project:

- Continuous involvement of owner and key designers and builders from early design through project completion
- Business interests aligned through shared risk/reward, including financial gain at risk that is dependent upon project outcomes
- Joint project control by owner and key designers and builders
- A multi-party agreement or equal interlocking agreements
- Limited liability among owner and key designers and builders

The main difference between Integrated Project Delivery and other closely related project delivery schemes (Project Partnering and Project Alliances) is the core component of intensify early planning

supported by ICT and with the objective to increase the smoothness and productivity of the process, i.e. fluency of the information flow and information availability in general

Is IPD a suitable design process for EeB projects in Health Care Districts in EU?

The increasing complexity of projects - integrating building envelope, structure and the use of the facility together with an increasingly strive for cost effectiveness in all phases: design, construction and maintenance - puts the healthcare building project developers with several challenges. Many of these challenges are best faced by owner and key designers and builders jointly. These projects are most often characterised by:

- large size;
- high degree of complexity;
- involvement of a lot of (mainly technical) risks that are hard to classify and manage prior to the start of a project.

Clients that own other constructions, such as a public road administration, use more often collaboration as a part of their procurement strategy and the number of contracts of this form is increasing. However, IPD still has some identified hinders to be implemented on an EU-level. Main hinders are the diverging financial systems and construction culture of the EU countries.

However, the core elements of IPD, collaboration, early involvement of parties, sharing of risk and reward, and the use of ICT, are important for the construction of any future facility, but especially for energy efficient health care districts. The main advantages of applying these core elements are a better product and quality, developed from the needs of the client and delivered with a jointly shared responsibility.

8.2 Further research

This report points out the need for more investigation of the integration of procurement method, integrated delivery methods and energy efficiency.

Currently, the structure of research is organised in their specific fields. In order to reach even further, research need to be organised so that a larger perspective can govern the research, and integrated research can be performed.

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