Joint Public Procurement and Innovation
Lessons Across Borders

Innovation in public procurement is essential for sustainable and inclusive growth in an increasingly globalized economy. To achieve that potential, both the promises and the perils of innovation must be investigated, including the risks and opportunities of joint procurement across borders in the European Union and the United States.

This in-depth research investigates innovation in public procurement from three different perspectives. First, leading academics and practitioners assess the *purchase of innovation*, with a particular focus on urban public contracting in smart cities involving meta-infrastructures, public-private partnership arrangements and smart contracts. A second line of inquiry looks for ways to *encourage innovative suppliers*. Here, the collected authors draw on emerging lessons from the US and Europe, to explore both the costs and the benefits of spurring innovation through procurement.

A third perspective looks to various *innovations in the procurement process* itself, with a focus on the effects of joint and cross-border procurement in the EU and US landscapes. The chapters review new technologies and platforms, the increasingly automated means of selecting suppliers, and the related efficiencies that "big data" can bring to public procurement.

Expanding on research in the editors' prior volume, *Integrity and Efficiency in Sustainable Public Contracts: Balancing Corruption Concerns in Public Procurement Internationally* (Bruylant 2014), this volume builds on a series of academic conferences and exchanges to address these issues from sophisticated academic, institutional and practical perspectives, and to point the way to future research on the contractual models that are emerging from new procurement technologies.

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CHAPTER 8
From Works Contracts to Collaborative Contracts: The Challenges of Building Information Modeling (BIM) in public procurement

BY

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1. Introduction

Technology has deeply changed the procurement sector, as data analysis and data modelling can now play a crucial role within any phase of the procurement cycle. From a legal, economic, and technical standpoint one of the more promising resources in this regard is Building Information Modeling (BIM).

BIM has been described as a methodology allowing "the digital representation of physical and functional characteristics of a facility". It can be regarded as a resource providing shared knowledge and information about a particular facility, constituting a reliable basis for decision making all through the facility life cycle, from its planning onwards.(1)

This design method enables the user to complete more analytical and effective evaluations than those possible relying on traditional design methods (such as computer-aided design). Furthermore, better design quality can be obtained at reduced costs and with shorter implementation times.

BIM is mainly used to implement "a more efficient planning, design, construction, management and maintenance process using a standardized information model in digital format for each new or existing building. That model contains all the data, either created or collected, on the building in question, in a format that can be used by all stakeholders during the whole life cycle of the building".(2)

(1) National BIM Standard – United States.

(2) National Institute of Building Sciences (NIBS) at National Building Information Modeling Standard (NBIMS), cited in T.A.R. Lombardia, Milan, 3 May 2017, No. 1210; G. Di Giuda, S. Maltese, F. Re Cecconi and V. Villa, *Il BIM per la gestione dei patrimoni immobiliari. Linee guida, livelli di dettaglio informativo grafico (lod) e alfanumerico (loi)*, Milan, Hoepli, 2017.

From a legal point of view, it is important to observe that information modelling may foster an optimal collaboration among the various actors involved in the design work because there is an increasing awareness of the need for an open and reusable data infrastructure. From the organizational and functional point of view, information modelling can ensure better coordination and monitoring at all times, from the planning phase to the contract award and execution phases. What is more, it can limit the possibility of modifications during the execution phase, which may be critical within a legal framework of alliances and cooperation. In that respect, information modelling may become an indispensable tool to create added value in any procurement procedure and, consequently, in the contracts deriving therefrom. On their part, contracts may become the key for project teams to get the best out of BIM insofar as they appropriately regulate the following issues: (i) deadlines and interfaces in respect of submission and approval of design information and other data; (ii) clash detection, early warning and risk management; (iii) intellectual property rights.(3)

Technology can even be used for drafting so-called 'smart contracts' (*i.e.*, contracts based on the blockchain methodology), in which data and information are collected in a chain of blocks and made available forever. These contracts can actually be like a ledger recording everything related to the parties involved.(4)

The BIM acronym has different meanings.

First, it can identify a 'model'. In this case, BIModel is understood as a digital representation of the physical and functional characteristics of a building, and consists of digital objects with all relevant information.

Second, it can identify an E-modelling tool where BIModeling represents a methodology, the ensemble of all the collaborative processes required for creating and using an electronic model of a particular building.

Third, it can identify a management tool. In this case, BIManagement is a building management and control means, implying the use of a digital model for sharing information among all the subjects involved in the entire life-cycle of the asset in question.(5) Digital tools allow users to collect more precise information and better process that information so as to increase the effectiveness and rationality of the public administration's response to the collective needs of their communities. They also allow planners to minimize doubtful information giving rise to uncertainties and interpretative problems, which

(3) *See Enabling BIM Through Procurement and Contracts – A Research Report by the Centre of Construction Law and Dispute Resolution*, King's College London, 2016, p. 11.

(4) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, Naples, Editoriale Scientifica, 2018.

(5) *See Journal of Building Information Modeling*, 2012, pp. 23 and ff.

often affect the completion of projects designed through traditional techniques, as errors and gaps wise in the execution phase, thus generating conflicts, extra costs, and/or delays.(6)

From a legal standpoint, the possibility of sharing information is the most important factor for ensuring the efficiency and integrity of the procurement process – from the definition of the public requirement through the contract award and management phases. Using BIM may produce an exceptionally positive outcome as meeting fundamental principles in public procurement, for instance transparency of the activities undertaken by public authorities, and control and containment of public expenditures.(7) BIM methodology allows access to common data that can be easily shared among the contracting entity and the different economic operators during the award procedure and with the chosen supplier that will implement the contract. This way, the coherence of data could really become an extraordinary instrument for ensuring efficiency and integrity as it will put an end to the discussion on material amendments, mainly due to gaps in the project phase.(8) In particular, considering the positive interactions existing between the use of the BIM model and the core principles on public procurement, the employment of a BIM-based project as a basis for tender of works contracts appears to be promising. Likewise, the use of BIM methodology for the development of a project in a public procurement procedure could be strategic, *inter alia,* for the assessment of the most economic advantageous tender.(9) Since the implementation of BIM methodology assures the rationalization of public procurement, it reduces risks and costs, as well as information asymmetries. The requirement of a BIM-based project and its enhancement through the tender assessment could foster the pursuit of adequate quality standards supported by technical specifications and high-quality works. Thus, permitting the choice of the better suppliers, thence optimally suited to their needs.(10) To this end, the BIM project planning should be endorsed by a BIM-design strategy report explaining key elements of the project plan (such as the risk management

(6) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3.

(7) *Ibid.*

(8) G.M. Racca and R. Cavallo Perin, "Material changes in contract management as symptoms of corruption: a comparison between EU and U.S. procurement systems", in *Integrity and Efficiency in Sustainable Public Contracts. Balancing Corruption Concerns in Public Procurement Internationally* (G.M. Racca and C.R. Yukins eds), Brussels, Bruylant, 2014, pp. 247 and ff.; *See* also F.J. Vázquez Matilla, "The modification of public contracts: an obstacle to transparency and efficiency", in *Integrity and Efficiency in Sustainable Public Contracts. Balancing Corruption Concerns in Public Procurement Internationally*, *op. cit.*, p. 275.

(9) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3.

(10) A contrary opinion is voiced by a recent judgment of the Italian administrative tribunal. *See* T.A.R. Marche, Ancona, sez. I, 30 May 2018, No. 398 (recital 5 and ff.).

for project design incoherencies etc.),(11) the BIM award procedure and the subsequent execution.

Among their main purposes, the 2014 EU Directives on public contracts envisage simplification, to be achieved also by means of IT, though with a certain discretionary power of contracting entities.(12) In particular, the EU Directive on public procurement (classical sector) has the goal of simplifying procedures, thus reducing fragmentation among contracting authorities and ameliorating the assessment of quality price *ratio* of a tender. Nonetheless it is worth remembering that the EU Directives define procurement principles and procedures that apply to 28 different countries – which means 28 different implementations in 28 different legal systems rooted in diverse cultural and social traditions.(13)

The EU is therefore dealing with a vertical challenge. The Public Procurement Directives can be regarded as defining only a minimum common denominator for the 28 Member States, that then have to implement the provisions therein set forth in accordance with their own legal systems, thus using different languages and different approaches to procurement. As a result, although detailed provisions of EU Directives are directly applicable to any above-threshold EU procurement, to some extent their implementation is subject to variation anyway. However, as stated by the EU Court of Justice,(14) most of the rules set forth in the Public Procurement Directives are mandatory, and hence directly applicable if not implemented within the deadline or not correctly implemented.

Because of the considerable amount of below-threshold procurement, the applicability of the EU Procurement Directives is further limited, and so is their impact as a consequence. Also, cross-border procurement in the EU is still rare.(15)

(11) G.M. Di Giuda *et al.*, "Lean construction applied to a BIM process: how to control point attribution in MEAT tender process", *Tema*, 2018; S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3.

(12) Dir. 2014/23/EU of the European Parliament and of the Council of 26 February 2014 on the award of concession contracts; Dir. 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Dir. 2004/18/EC; Dir. 2014/25/EU of the European Parliament and of the Council of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Dir. 2004/17/EC.

(13) *Cf.* G.M. Racca and R. Cavallo Perin, *Plurality and diversity of Integration models: the Italian unification of 1865 and the European Union ongoing Integration process*, forthcoming.

(14) The direct effect of European law was first enshrined by the Court of Justice in the judgement of *Van Gend en Loos* of 5 February 1963. That is, individuals can invoke a European provision in a challenge to a Member State only if the State has not transposed before the deadline provided (ECJ, 5 April 1979, *Ratti*, C-148/78). ECJ, 10 November 2011, *Norma-A SIA – Dekom SIA v Latgales plānošanas reģions*, C-348/10, concerning the Remedies Directive (EU Dir. No. 2007/66).

(15) EU Comm., "Measurement of impact of cross-border penetration in public procurement", Final report, February 2017.

European efforts to develop a more uniform procurement system could facilitate the creation of national procurement markets in contexts where 'internal barriers' still exist, for example between Northern and Southern Italy.(16) Another example are the German *Länder*.(17) A study published in 2011 revealed that only 1.6% of the public procurement contracts in the EU were won by economic operators from outside the country of the contracting authority.(18) More recently, the EU Commission has reported an increase of said occurrence to 3.5%.(19) The reason why that figure is still low could be that, despite the change pursued through the Directives mentioned earlier, the national procurement legal system of each EU Member State is different and separate from others. Hence, legal and language barriers produce a fragmentation of the public procurement market, with which economic operators are quite used. For this reason, Member States should be able to provide for a competitive dialogue, especially in cases where contracting authorities are unable to define the means of satisfying their needs, foremost when innovative projects are concerned. In this regard, the BIM strategy represents a design effort that might hasten and promote this dialogue in order to boost the synergy among the parties.(20)

The BIM may become a strategic methodology to overcome the aforementioned differences and barriers. This applies in particular to the award phase of public procurement, which, on account of the pooling of modelled information, could be turned into smart procurement through a coordinated group of smart collaborative contracts. The sharing of data and information describing the physical and functional characteristics of a facility through technology with all the parties involved in that process allows a deep-dyed assessment during the selection phase (for choosing the best suppliers), thus overcoming 'information asymmetries' – one of the main reasons for disputes and failures.

(16) G.M. Racca, "Public Contracts – Italy", *Ius Publicum Network Rev.*, 2012, p. 4; A. Massera, "Italie/Italy", in *Comparative Law on Public Contracts* (R. Noguellou and U. Stelkens eds) Brussels, Bruylant, 2010, pp. 719-720.

(17) M. Burgi, "Public Procurement Law in the Federal Republic of Germany", *Ius Publicum Network Rev.*, 2012, p. 6; U. Stelkens and H. Schroeder, "Allemagne/Germany", in *Comparative Law on Public Contracts*, *op. cit.*, p. 320; A. Rubach-Larsen, "Selection and Award Criteria from a German Public Procurement Law Perspective", *PPLR*, 2009, p. 112.

(18) Rambøll Management, "Cross-border procurement above EU thresholds", Rambøll study for the EU Commission, May 2011, p. 38. The study found that direct cross-border procurement accounts for 1.6% of awards or roughly 3.5% of the total value of contract awards published in OJ/TED during 2006-2009 and that 50% of contracts above EU thresholds are awarded within the distance of 100 km. The EU Commission refer to this data in the "Green Paper on the modernisation of EU public procurement policy Towards a more efficient European Procurement Market", COM(2011) 15 final, 27 January 2011, p. 4.

(19) EU Comm., "Making Public Procurement work in and for Europe", 3 October 2017, COM(2017) 572 final, p. 4. For further details on the matter, *see* also *Measurement of impact of cross-border penetration in public procurement*, Final Report, February 2017.

(20) *See* recital 42 and 43 of Dir. 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Dir. 2004/18/EC.

As procurement is a matter of shared competence between the EU and its Member States, contract management mostly pertains to each EU Member State's sphere of competence. The EU Directive, therefore, does not govern contract execution, which is overseen differently by each Member State. As a consequence, executing a contract may turn out to be significantly different from what is outlined in the relevant procurement award.(21) Such an issue might undermine the meaningfulness of competitive selection and also the fair competition principle, which is at the heart of the EU model.(22)

Arguably, the reason for the separation established between procurement award and contract execution, as set forth in the EU Directives, stem from the Member States' will to maintain their own sovereignty on contract management. The result, however, is a degree amount of uncertainty among economic operators, which eventually jeopardizes the EU pursuit of a well-performing procurement system meeting the needs of all EU citizens. In that respect, the BIM is worthy of interest as it helps ensure that contract notices and all contract documents subsequently issued will be coherent and predictable. On the one hand, this enhances transparency and integrity among all the procurement phases, on the other hand, the BIM helps to overcome legal barriers that hinder contract amendments or make them unavailable during the execution and management phases.

The 2014 EU Procurement Directives introduced limits to 'material amendments' because, *de facto,* they constitute new awards given without contract notice.(23) Such limits show that contract execution monitoring is necessary, and any methodology that could help achieve that goal should be valued. For this reason, the new BIM tools embody a great potential and constitute an important resource in this sense. This has been acknowledged by the EU Directives on public procurement, which provide that for "public works contracts and design contests, Member States may require the use of specific electronic tools, such as building information electronic modelling tools or similar".(24)

(21) G.M. Racca, R. Cavallo Perin and G.L. Albano, "Competition in the execution phase of public procurement", *Public Contract L.J.*, 2011, Vol. 41, No. 1, pp. 89-108.

(22) EU Comm., "Report from the Commission to the Council and the European Parliament", EU Anti-Corruption Report, COM(2014) 38 final, 3 February 2014, pp. 26-27; EU Comm., "Green Paper on the modernisation of EU public procurement policy. Towards a more efficient European Procurement Market", 27 January 2011, COM(2011) 15 final, p. 25; conference "*La transizione digitale in Europa per il settore delle costruzioni. Gli effetti delle strategie e dei mandati governativi sul settore delle costruzioni*", Camera dei Deputati, Rome, 18 February 2016.

(23) EU Dir. 2014/24, Art. 72-73; EU Dir. 2014/25, Art. 89-90; EU Dir. 2014/23, Art. 43-44; G.M. Racca and R. Cavallo Perin, "Material Amendments of Public Contracts during their Terms: From Violations of Competitions to Symptoms of Corruption", *EPPPL*, 2013, pp. 287-290.

(24) EU Dir. 2014/24/EU, Art. 22, § 4. This provision was implemented in the Italian Public Contracts Code (Legisl. Decr. No. 50 of 2016) on the rules related to the design of public works (Art. 23, 31, 113). For UK, *see* UK Infrastructure and Projects Authority, "Government Construction Strategy 2016-20", March 2016.

A great advantage of using BIM since the very beginning of the definition of public demand is that it could ensure the same project data for different users (contracting entities, suppliers, monitoring agencies, citizens) allowing them to fully understand each other and cooperate in the project implementation.

The fostering of cooperation and the implementation of the BIM can be carried out initially for the enhancement of the existing public works, even before the creation of new ones. The U.S. experience highlighted how a first use of BIM with this purpose has made its introduction into the public works sector simpler and more efficient. This allowed public employees to become more aware of the potential of BIM through its use on already known projects.

In some EU Member States, the introduction of BIM clashes with the low rate of digitalization in the construction sector and with the difficulty in demonstrating the benefits of the BIM.(25)

In the United Kingdom, the BIM statement in the governmental strategy has been in place (i.e., thanks to a recession of the market), while currently, in an expanding cycle, operators appear more reluctant to continue on this path, in part because its benefits are not always demonstrable. A recent study published by the Centre of Construction Law and Dispute Resolution of King's College (London) showed that BIM has increased the scope and speed of data exchange, while at the same time enabling more integration and collaboration for a better asset performance over the full project life-cycle. Nonetheless, some uncertainties remain in relation to the reliability of BIM computer software programs and defensive contractual approach to legal liability encouraged by BIM models.(26)

In Germany, despite a great 'buzz' both at the federal and State levels, the same positive trend of the market induces, beyond a formal adhesion, many subjects to postpone the implementation of digital procedures: analyses carried out by PwC point out that less than 10% of economic operators (in the construction field) are already working in this direction.

In France a special platform called KROQI was developed by the *Centre scientifique et technique du bâtiment* as part of the *Plan transition numérique dans le bâtiment*(27) with the aim to create a reference context in which actors can find themselves in everyday life.

In Italy, the recession, although it advanced selective processes among the organizations and even generated a transformation of the relevant market, did not push actors to seriously introduce, in an autonomous manner,

(25) Conference "*La transizione digitale in Europa*", *op. cit.*, No. 15.

(26) "Enabling BIM through procurement and contracts – A Research Report by the Centre of Construction Law and Dispute Resolution", King's College London.

(27) A.L.C. Ciribini, "L'Italia del BIM", www.ingenio-web.it.

significant innovations in terms of digitalization.(28) All the same, the recent reform and the enactment of the new Public Contracts Code have entrusted a paramount role to the use of digital tools and methods, with the aim of rationalizing design and project activities – as well as improving the control on the timeframes and costs of execution – for public works.(29) The new Public Contracts Code makes explicit reference to the progressive implementation of digital methods such as BIM so to achieve an integrated design phase enabling the creation of a comprehensive database and the 3D modelling of the designed products.(30) Nonetheless, a certain level of uncertainty in the use of BIM has already shown in the Italian legal system, as proved by a recent case before the Italian Administrative Judge, called upon to rule on the compliance of the projects presented in the offer with the requirements provided by the contracting authority.(31) Such case law has clarified that there is not a single BIM model, as BIM is essentially a working method: "the BIM is not a thing or a type of software but a human activity involving extensive modifications in the building sector [...] in order to introduce a more efficient process of planning, projectation, construction, management and maintenance through a standardized model for digital information referring to each single building".(32) The lack of adequate capacity in the use of digital tools has thus become apparent.

That acknowledged, the 2016 Italian Public Contracts code(33) favours collaboration and qualification of public demand(34) with the purpose of efficiency and integrity. The Italian provisions on Public Contracts provide for the rationalization of design activities (for works) and the related monitoring activities through the progressive use of specific electronic instruments such as modelling for buildings and infrastructures.(35) Guidelines provided by the Italian Anticorruption Authority refer, for the first time in the national legal

(28) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3.

(29) *Ibid.*

(30) *Ibid.*

(31) T.A.R. Lombardia, Milan, 3 May 2017, No. 1210. The case concerns the award procedure launched by the Municipality of Milan for an integrated contract (demolition, remediation and reconstruction of a school building) that had to be awarded with the criterion of the most economically advantageous tender. The appeal focused on the illegitimate admission to the tender of a party, which should have been excluded for having submitted a project not compliant with the *lex specialis* of the tender. After the technical verification, the Judge affirmed the compatibility of the project presented with the BIM model.

(32) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3.

(33) Legisl. Decr. No. 50 of 2016, enacted in 19 April 2016.

(34) *Ibid.*, Art. 37-43.

(35) *Ibid.*, Art. 23(h). *See* ANAC, Resol. No. 138 of 21 February 2018, Guidelines No. 1, "*Indirizzi generali sull'affidamento dei servizi attinenti all'architettura e all'ingegneria*", updated to the Legisl. Decr. No. 56 of 19 April 2017.

order, to the person 'responsible for the procedure' as a 'project manager'.(36) Planning and management skills are emphasized, as well as the coordination of the work activities, the achievement of the objectives in time and at the expected costs. These skills may derive from the specific training of public officials and from the coordination of all available resources, which in turn allows the administration to establish a support unit for the procurement official appointed as 'responsible of the procurement procedure'.(37)

In this regard, the Italian Ministry of Infrastructures and Transport recently adopted a regulation(38) implementing the Code(39) aimed to define the methods and timeframes for the progressive introduction of electronic methods and tools by Italian contracting authorities and economic operators, such as those for building modelling and infrastructures, in all phases of the design, construction and management of works and in the related monitoring activities.

From 2019, use of BIM will be mandatory for all works above 100 million euros of value and, by 2025, also for contracts of smaller amounts, until this method will be introduced throughout the whole public works sector. Even though this regulation details the timing for the national implementation, a great effort on capacity development is nonetheless required. The progressive extension of the mandatory use of BIM in the public sector will take longer compared to other Member States: unfortunately, this is in line with the information provided by the European Commission showing that Italy is a country in which, generally speaking, the application of digital tools in the relationship between the citizen and the public administration is still very limited.

In a procurement market that is really fragmented, the fear of restricting access to the most equipped operators is halting a real and effective competition.(40)

2. Collaborative and integrated processes in public works contracts

The effective implementation of BIM, also in the private sector, requires collaboration among stakeholders involved in the different phases of a work life cycle. BIM implies at the same time three types of projects: the architectural project, the structural project and the plant design. The introduction of a BIM

(36) Italian Anticorruption Authority, Resol. No. 1007 of 11 October 2017, Guidelines No. 3, "*Nomina, ruolo e compiti del responsabile unico del procedimento per l'affidamento di appalti e concessioni*".

(37) Legisl. Decr. No. 50 of 2016, Art. 31.

(38) Min. Decr. No. 560 of 1 December 2017.

(39) Legisl. Decr. No. 50 of 2016, Art. 23 (13).

(40) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3.

methodology in the public procurement sector under the EU directive requires a further analysis, as such introduction would as a minimum imply the design of specific clauses or protocols, while at the same time representing an opportunity to define specific contractual models.

Collaborative processes are strategic, also in the private sector, because the fragmentation may lead the Architecture Engineering and Construction (AEC) sector towards a paralysis in terms of productivity.

During the past years, many studies on this topic have been carried out in the U.S. and in European countries, especially on the explanation of the contract structure and regarding how Architecture Engineering and Construction operators might adopt collaborative processes.

Analyzing the Architecture Engineering and Construction macroeconomics,(41) one of the main points which stands out is that the productivity of the sector(42) did not change in the period between 1964 and 2000. In fact, by comparing the productivity index of construction and non-farm labour in the U.S. market, it can be noticed that the latter has doubled its productivity, but on the contrary, the former remains approximately unvaried.

Analyzing ISTAT's (Italian National Institute of Statistic) reports of the last two decades, the 2008 crisis had a stronger effect on the Architecture Engineering and Construction sector (-30% productivity) than on the manufacturing sector, in which the decrease was a little more limited (-20% productivity and tool work, which is the actual time spent working). Still at present, the gap between these two branches remains wide (around 200 points).

Some U.S. studies stated that almost "half of all construction activities are non-productive and disclose the ineffectiveness of many projects".(43) It is possible to declare that poor performance related to the design and construction industry are not just a U.S. phenomenon, rather it is spread across all developed countries.

The data from the UK, the U.S. and Scandinavia showed, as a result, that 30% of construction is reworked, the efficiency of labour is just around 50%, accidents absorb 3-6% of construction costs and at least 10% of all the materials are wasted.(44) This fact means that the construction sector has surely

(41) C.M. Eastman and R. Sacks, "Relative Productivity in the AEC Industries in the United States for On-Site and Off-Site Activities", *J. Constr. Eng. Manag.*, 2008, 134, pp. 517-526.

(42) H.C. Howard, R.E. Levitt, B.C. Paulson, J.G. Pohl and C.B. Tatum, "Computer Integration: Reducing Fragmentation in AEC Industry", *J. Comput. Civ. Eng.*, 1989.

(43) A. Schwartz and R.E. Scott, "Contract theory and the limits of contract law", *Yale L.J.*, 2003, 113, pp. 541-619.

(44) H.-S. Park, S.R. Thomas and R.L. Tucker, "Benchmarking of Construction Productivity", *J. Constr. Eng. Manag.*, 2005, 131, pp. 772-778.

received a certain amount of innovation, but not as much as other industry sectors. Therefore, the concern is how to make the construction companies more competitive.

In the public procurement sector, it is well known that the high number of SMEs is related to the fragmentation of public demand.(45) The collaborative contracts might surely help in this regard.

The main goal of collaborative contracts is to solve the construction industry's low rate of productivity, high rate of inefficiency and excessive costs caused by the organizational process (*i.e.* reworking of information lost during the process).(46) As already noted, one of the main reasons for this inefficiency is the fragmentation in the Architecture Engineering and Construction sector.(47)

Collaborative contracts reduce fragmentation and provide an integrated approach to innovate in the sector. Specifically, according to the abovementioned study,(48) there are three different mechanisms that are typical of the Architecture Engineering and Construction sector and only through an integrated hierarchical organization is it possible to achieve a complete exchange of information between different stakeholders without losing anything.(49) Collaborative agreements (the so-called *alliancing*), in fact, may be a valid alternative to the disputes characterizing the execution phase, which often slow down, halt or make it impossible to attain the goals underlying the procurement procedure. Those kinds of contracts do not replace the typical contractual schemes linking contracting authorities and economic operators for the governance and execution of the contract. Rather, collaborative agreements play a complementary role, as they regulate mutual interactions in a way that is beneficial for all parties involved.(50)

(45) A.N.AC., *Annual Report 2016*, 6 July 3027, p. 155; R. Cavallo Perin and G.M. Racca, "La concorrenza nell'esecuzione dei contratti pubblici", *Diritto Amministrativo*, 2/2010, pp. 325-354; G.M. Racca, R. Cavallo Perin and G.L. Albano, "Competition in the execution phase of public procurement", *Public Contract L.J.*, 2011, Vol. 41, No. 1, pp. 89-108; G.M. Racca and R. Cavallo Perin, "Material Amendments of Public Contracts during their Terms: From Violations of Competitions to Symptoms of Corruption", *EPPPPLR*, 4/2013, pp. 279-293; G.M. Racca and R. Cavallo Perin, "Material changes in contract management as symptoms of corruption: a comparison between EU and U.S. procurement systems", in *Integrity and Efficiency in Sustainable Public Contracts. Balancing Corruption Concerns in Public Procurement Internationally*, *op. cit.*

(46) C. Thomsen, "Managing Integrated Project Delivery – Concepts and Contract Strategies", *Cmaa*, 2007, 35, p. 52.

(47) I. El-Adaway, "Relational contracting and high-performance project outcomes", *Proceedings*, Annual Conference, Canadian Society for Civil Engineering, 2011.

(48) A. Schwartz and R.E. Scott, "Contract theory and the limits of contract law", *op. cit.*

(49) R. Levitt, M. Fischer and A. Smith, "Assessing the Impact of IPD on Adoption of Innovations Related to Energy Efficiency", San Francisco, 2012.

(50) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3. The author references an interesting example of *alliancing*, promoted by the British Ministry of Justice for the construction of a new wing of the *Cookham Wood* penitentiary for minor inmates. In

Collaborative agreements were first used in Asia as 'gentlemanly principles' and were informally and legally non-binding agreements between two or more parties, but they were based on people's honour.(51) Later on, after this first attempt at introducing a collaborative process, there have been many trials in America. At present, the two most important experiences with regard to collaborative agreements are the Integrated Project Delivery (in the United States) and the so-called *alliancing* (an umbrella-term for many different models of cooperation among stakeholders, typical of the British procurement scenario, whose spearheads are the PPC2000 and the FAC-1). Before embarking on a detailed explanation of the two approaches (*see infra*, par. 5), it seems useful to understand how collaborative contracts and BIM can be complementary in enhancing efficiency in public procurement.

This idea is the core concept on which BIM is based: indeed, Integrated Project Delivery is the perfect environment to obtain strong development of advanced management methods.(52) Thus, it will provide substantial benefits in efficiency and safety, as well as integration: statistics on Integrated Project Delivery projects under construction confirmed the results of the abovementioned studies.(53)

A second main point that should be emphasized, as previously noted, is the fragmentation in the diffusion of information among stakeholders involved in the construction chain. Individualism causes information asymmetry, because some people inevitably have more information than others and they do not want (or do not have the interest) to share it. This occurs because every participant wants to pursue his own interest instead of the interest of the project.

The change of perspective from an individual's goal to a team's goal, trying to achieve a better result, is possible only if everyone makes the best both for himself and for the team at the same time;(54) cooperation is able to fill the gap between design, construction and maintenance phases. The missing piece, as

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that case, BIM was combined to the PPC2000 – *Project Partnering Contract*, *i.e.* an embryonic model of collaborative agreement which involved in the first phases of the project all the parties having a role in the realization of the construction. This experiment led to 20% savings and to a reduction of timeframes from 50 to 44 weeks.

(51) One of the first attempts to compare contractual forms was made by Lahdenpera, who analyzed some early endeavors of multi-party agreements, project partnering, project alliancing and integrated project delivery, in P. LAHDENPERA, "Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery", *CMEJ*, No. 30, 2012, pp. 57-79.

(52) D.C. KENT, BECERIK-GERBER, „Understanding Construction Industry Experience and Attitudes toward Integrated Project Delivery", *J. Constr. Eng. Manag.*, 136, pp. 815-825; P. LAHDENPERÄ, "Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery", in *Constr. Manag. Econ.*, No. 30, 2012, pp. 57-79.

(53) H.W. ASHCRAFT, "The IPD Framework", *Hanson Bridg. white Pap.*, 2012, pp. 1-28.

(54) R.B. MYERSON, "Nash Equilibrium and the History of Economic Theory", *J. Econ. Lit.*, No. 37, 1999, pp. 1067-1082.

many studies have demonstrated, is the contractual form allowing the sector to be more competitive. Only with these changes in the sector's mindset, as a consequence of the introduction of cooperative contracts, the construction sector might prove able "to see quality projects that deliver excellent whole life value, that excellence in design and that encompass excellence in design and functionality that are safely built and are on time, on budget and defect free".(55)

From a legal perspective, in the public procurement sector this might simplify cooperation among different suppliers in the execution phase and favour monitoring activities for a correct execution. Furthermore, the inefficiency and integrity issues related to the acceptance of a performance lower than promised might be overcome.

Indeed, whenever delivered quality is shattered by opportunistic behaviour at the execution stage, the principles of transparency and non-discrimination are betrayed, since an incorrect execution undermines the competition principle put in place among competing bidders during the selection phase.(56) Collaborative contracts might overcome such an adversarial perspective and favour positive results for the procurement and a correct execution of the public contracts.

In public contracts, unlike in private contracts, any amendment to the contractual conditions due to the contractor's underperformance also affects third parties, including – but not limited to – unsuccessful tenderers.(57) By having a substantial interest in the conformance of the contractor's performance to what was promised at the award stage, losing tenderers should be able to report infringements to challenge the contractor's lower-than-promised performance as set in the contract awardee. As a consequence, losing tenderers would exercise their right to fair competition and, if properly ranked, the subsequent bidder in the ranking could have the right to replace the winner.

BIM substantially reduces the risks of modifications during the execution of the contract(58) increasing the level of coherence of the project and solving possible clashes among disciplines. In any event, any required modification should be correctly evaluated and agreed in full transparency among all concerned stakeholders. As already mentioned, BIM has been introduced

(55) B. Wilson, UK Construction Minister.

(56) G.M. Racca and R. Cavallo Perin, "Material changes in contract management as symptoms of corruption: a comparison between EU and U.S. procurement systems", in *Integrity and Efficiency in Sustainable Public Contracts. Balancing Corruption Concerns in Public Procurement Internationally*, *op. cit.*, p. 247.

(57) H. Schröder and U. Stelkens, "EU Public Contract Litigation", in *EU Public Contract Law, Public Procurement and Beyond*, *op. cit.*, p. 443.

(58) Dir. 2014/23/EU; Dir. 2014/24/EU; Dir. 2014/25/EU.

in the Italian Public Contracts Code(59) by the Italian legislator with the expression "methods and electronic instrument, through open format, not proprietary". This is very close to the original EU provision which states: "specific electronic tools, such as building information electronic modelling tools".(60)

BIM is not just software but, actually, it is a thinking process, a methodology. This process is characterized by a strong partnership between the employer, on the one hand, and all the tenderers and bidders (*i.e.* suppliers, designers, constructors, facility manager and everyone who is involved in the process), on the other. Through this methodology, it is possible to achieve an analytical and objective observation of the project.

From a public procurement perspective this method allows the qualification of contracting authorities(61) and increase of the coherence among the requirements of the different phases of the design and the subsequent award and execution of a work.

BIM allows also the *ex-ante* definition of the life cycle cost of the work according to the tendered design, so that it can reduce the risks of modification of the contract during its term.

While it is commonly accepted that competition must be ensured among economic operators beyond their mere access to the market,(62) the idea that the respect of the competition principle ought to be ensured also during the performance of a public contract of works, goods and services has not yet been appropriately considered.(63) To avoid having value for money to remain as an abstract concept, the contractor's actual performance should coincide with what was promised at the competitive stage.

A substantial modification can occur in case of "changes in the economic balance of the contract or framework agreement in favour of the contractor in

(59) *See* Art. 23 (13), Legisl. Decr. No. 50/2016, aforesaid, contracting authorities equipped with trained staff can request the use of specific electronic methods and tools for recovery, redevelopment or alteration interventions, primarily for complex works; in fact, these tools use interoperable platforms with non-proprietary open formats, in order to avoid the limitation of competition between the technology suppliers and involvement of specific projects among the designers; in the Min. Decr. 560/2017, aforesaid, published on the MIT Web site on 12 January 2018, procedures and times for the gradual introduction of the compulsory nature of the aforementioned methods are defined for the contracting stations, the granting administrations and the economic operators. They are assessed in relation to the type of assigned works, the digitalization strategy of public administrations and the construction sector. Using these methods is considered as yardstick of the rewarding requisites, ex Art. 38, Legisl. Decr. No. 50/2016.

(60) Dir. 2014/24/EU, Art. 22, par. 4.

(61) On Italian provision on qualification and professionalization of contracting authorities, *see* Legisl. Decr. No. 50 of 2016, Art. 37-43.

(62) G. Napolitano and M. Abrescia, *Analisi economica del diritto pubblico*, Bologna, Il Mulino, 2009, p. 95.

(63) R. Cavallo Perin, G.M. Racca and G.L. Albano, "The safeguard of competition in the execution phase of public procurement", *Quaderni Consip*, VI, 2010.

a manner which was not provided for in the initial contract".(64) This change would undermine fair competition, as the award is decided through the evaluation of the tenders and, in the EU, through a precise ranking subsequent to an objective evaluation. Significantly changing the economic balance means that the winner is favoured and the previous competitive selection is thwarted.(65)

Even when the award procedure has been carried out in strict respect of the principles of fairness and transparency, the contractor's infringements or non-compliance with contractual clauses might modify the economic balance and, by distorting bids ranking *a posteriori*, thwart the competitive selection process.(66)

The ability to collect *and* interpret information (easily, where all the data are defined in a BIM model) during the execution phase can make losing tenderers, together with the procuring authority, the most effective 'supervisors' of the contractor's compliance with contractual terms and conditions. Since they are competitors in the same market, losing tenderers are in a potentially ideal situation for establishing which dimensions of performance are most vulnerable to opportunism. A precise evaluation of the limits for admitted "material amendments" during the execution phase is required in order to avoid thwarting competition. The idea of having losing tenderers that 'cooperate' with the procuring authority might, in principle, be extended to other crucial phases of the procurement process such as the evaluation of seemingly abnormally low tenders, especially in the case of somewhat complex public contracts where both quality and price matter. Allowing for such proactive initiatives by losing tenderers ought to be carefully defined by the procuring authority in order to fully exploit the potential benefits while at the same time limiting the risk of making the overall public procurement system even more adversarial or pro-collusive.

The monitoring of the performance of the contract by unsuccessful tenderers and/or by third parties such as other economic operators, final users, NGOs and civil society, is a way of ensuring respect for EU principles or, in general, the competition principles that rule the award procedures.(67) However,

(64) EU Dir. 2014/24, Art. 72, par. 4(b).

(65) ECJ, *EU Commission v. Federal Republic of Germany*, Case C-160/08, aforesaid, paras. 98-101. The amounts of the extension of the contract was quantified in €673,719.92. This case concerned the award of contracts for public ambulance services where it has been considered substantial due to the extension of the subject matter of the contract to a 'district association' non-indicated in the contract; G.M. Racca, R. Cavallo Perin and G.L. Albano, "Competition in the execution phase of public procurement", *Public Contract L.J.*, 2011, Vol. 41, No. 1, pp. 89-108.

(66) Concerning the principle of Transparency, *see* C.H. Bovis, *EU Public Procurement Law*, Cheltenham, Edward Elgar, 2007, p. 67. *See* also *id.*, "Regulatory Trends in Public Procurement at the EU Level", *EPPPPL*, 2012, pp. 225-226.

(67) G.M. Racca, "The role of third parties in the execution of public contracts", in *Controle et contentieux des contrats publics – Oversight and remedies in public contracts* (L. Folliot-Lalliot and S. Torricelli eds), Brussels, Bruylant, 2017, p. 415.

monitoring the correct implementation of the contract may be a useful tool to prevent potential illegal or collusive behaviour among economic operators and to better ensure competition throughout the entire public procurement cycle and in the procurement sector. Any misconduct during the performance phase constitutes a distortion of competition and within the EU this can entail the ineffectiveness of the contract. In any procurement system, only a deep and effective monitoring of the performance phase can stave off the risks of corruption and waste of taxpayers' money.

The information provided through the BIM approach and its implementation seem to become fundamental to ensure the key goals of efficiency and integrity.(68) The perspective of cooperation contracts implies a different set of relationships among the different private suppliers and the contracting entities, that should find a correct form of incentivization to reach the goal of a prompt and effective implementation of the agreed goal of the procurement.

An external monitoring might be useful and might be provided in the cooperation contract. Nonetheless, the effective incentives for correct behaviour should be internal to the cooperation contract.

3. Construction procurements and contracts models in different legal systems

It seems interesting to make a comparison between U.S. and European approaches and their experiences in collaborative contracts mainly, but not only, in the private sector, as well as to analyze the different types while highlighting the main problems dealing with the specification of the main characteristics which transversally affect each collaborative contract.

A 'project' may be defined as "what a person has the intention to make happen". Based on this concept, a project delivery system should reliably deliver projects capable of satisfying the owner's needs in an efficient, effective and sustainable way. In the public procurement sector 'the owner' is the public administration that acts as contracting entity and requires the procurement of work. At the international level, it is possible to refer to several contractual models for establishing the contractual relationships between awardees and public entities in the work sector. Each contractual model produces different

(68) National BIM Guide for Owners, contracting authorities must to apply their existing data security standards to BIM protocols. "The Owner should consider the security risks in terms of the protection of data. The Owner may wish to consider including data restrictions procedures, such as check-out and check-in, as well as stipulating the degree of access control for project participants. The Owner should require the Project BIM Team to complete a Data Security Protocol that complies with defined data security requirements at an international level".

effects on the content of the contractual documents that will be the basis of the award procedures and in the management of the subsequent contract (division of costs, accountability and risks).

In the U.S. system, the Project Management Institute(69) divides contract types in three main categories, based on the sharing of the risk between sellers and buyers.

The first category is Cost-reimbursable contracts, in which seller receives payment for actual costs to complete the work, plus a fee representing its profit, having Cost Plus Fixed Fee (CPFF), Cost Plus Incentive Fee (CPIF), and Cost-Plus Award Fee (CPAF).

The second one is Time and Materials (T and M) contracts: their characteristics are similar both to cost-reimbursable and fixed-price contracts.

The third category is Fixed-price contracts, which involve setting a fixed total price for a defined product, service, or result to be provided. The categories are: Fixed Price Contracts (FP), Fixed Price Incentive Fee Contracts (FPIF) and Fixed Price with Economic Price Adjustment Contracts (FPEPA).

One of the most used forms of procurement is Design Bid Build (within the CPFF category): it is so popular all around the world because it divides the process into three steps and, in particular, many public administrations (PA) impose a mandatory division. This form allows fragmentation in the Architecture Engineering and Construction sector, in fact designers base their work on the quality of the project in terms of comfort, performances and beauty of spaces, but they are not evaluated on costs and schedules, which are a burden of the contractor.

In this way, many projects can be evaluated and rebates can be obtained. This result could appear as an ideal achievement for the contracting entity but, looking at the statistics, is noticeable that more than 40 per cent of the traditional processes finish over budget and delayed.

Under the EU procurement Directive, the award criteria may be the Most Economically Advantageous Tender (MEAT),(70) which provides for evaluation of the quality of the offers with a view to ensuring the final quality of the project. Nonetheless, it is important to emphasize that subjective and not measurable quality criteria may be included inside the Most Economically Advantageous Tender criteria, which can, in a worst case, turn the process

(69) Project Management Institute, 2008, *PMBOK*, 5th ed., Project Management Institute, Newton Square, Pennsylvania.

(70) G.M. Di Giuda, V. Villa and L. Loreti, "Il BIM per la gestione di una gara con il criterio dell'offerta economicamente più vantaggiosa – BIM to manage public procurement with award criterion Most Economically Advantageous Tender", *ISTeA*, 2015, pp. 1-4.

into arbitrary evaluations.(71) This issue could be faced in an innovative way through the modelling of all the data concerning the project.

Construction Management at Risk (CMAR)(72) is a contract based on an owner (contracting entity) protecting its assets and building construction time. Specifically, Construction Management at Risk is able to accomplish the construction of a project, previously designed, as scheduled and at the defined price. This conceptualization gives the owner assurance of the execution in terms of costs, reducing uncertainty and minimizing opportunism, because the owner, on the one hand, knows how much the project is going to cost as there is typically a guaranteed maximum price. On the other hand, Construction Management at Risk does allow the contractor to be involved in the design phase, but it does not provide a fruitful collaboration with the design team, because each improvement will benefit only the constructor. This contractual form does not improve the conceptualization of the project and each saving in the construction phase will benefit only the Construction Management at Risk. The final product will fit the owner's requests imposed by the project, but there may not be any optimization of the design choices.

A third type of delivery method is Design Build (DB),(73) which could be considered as a sort of collaboration contract set in a traditional environment. This is because the Design Build method is able to ensure a strong communication between designers and constructors, which most of the time is unbalanced since the latter used to hire the former. For this reason, just one participant collects all the advantages of the project optimization and the others are not driven to improve their work. A fixed price imposition is something that protects the owner, but statistical data shows a large volume of litigation created by this methodology of contract, mainly caused by delay and impact claims in fixed-price and guaranteed-maximum-price projects, which suggests that these project methods do not bring price or schedule certainty.(74) Most of the largest projects around the world are executed on fixed price contracts, and statistics also show a high index of litigation related to the number of delays and over-budgets.(75)

(71) G.M. Racca, R. Cavallo Perin and G.L. Albano, "Competition in the execution phase of public procurement", cit., pp. 89-108; D.I. Gordon and G.M. Racca, "Integrity Challenges in the EU and U.S. Procurement systems", in *Integrity and Efficiency in Sustainable Public Contracts. Balancing Corruption Concerns in Public Procurement Internationally*, *op. cit.*, p. 117.

(72) G.M. Di Giuda and V. Villa, "Collaborative Design and Collaborative Contracting a Defiant Challenge", in *Digitizing the Analogical Thoughts in Architecture: A Menace or a Promise?* (B. Angi, M. Battisti and S. Mastrolembo eds), San Marino, IMREADY – Ingenio, 2016, p. 10.

(73) *Design-Build Institute of America*, *2015*. *Design-Build Institute of America*, *2013*, State Statute Report.

(74) M. Konchar and V. Sanvido, "Comparison of U.S. Project Delivery Systems", *J. Constr. Eng. Manag.*, 1998, 124, pp. 435-444.

(75) E.M. Merrow, *Industrial Megaprojects: Concepts, Strategies, and Practices for Success*, Hoboken, John Wiley & Sons, 2011

Through this analysis, attention will focus on the third level of collaboration defined by the National Association of State Facilities Administrators (NASFA).(76) Three different collaboration stages can be recognized: (i) traditional, (ii) enhanced and (iii) multi-party contract. The first level means that collaboration is not contractually required. The second one means that there are some requirements of contractual collaboration in the contract, and the last requires collaboration in a multi-party contract.

The inability of the industry to move from sequential to integrated design seems to reside in the adversarial business context created by transactional contracting methods.(77)

4. Collaborative Contracts: Relational Project Delivery Arrangements (RPDAs)

Relational Project Delivery Arrangements (RPDAs) are contracts based upon a relationship built on trust and transparency principles. This kind of delivery system promotes collaboration among all parties involved. The historical antecedents to this approach are hereby presented to analyse the evolution of the different Relational Project Delivery Arrangements types.

As described before, over the recent decades, some traditional project delivery systems have emerged claiming to fill the gap between the design and construction projects, but they have been shown to be not efficient enough. In this context, collaborative contracts (e.g. AIA C191, PPC2000, FAC-1, NEC4, JTC) were developed in many countries and present basically the same principal characteristics.(78)

Due to their structure and composition, traditional contracts unavoidably create a conflict of interest, which cannot be solved and impose a rigid division of the stakeholders' works. The new working organizational models outlined though collaborative contracts upgrade the optimization of the project through an integrated approach executed under Lean principles.(79) The main

(76) M. Kenig, M. Allison, B. Black, L. Burdi, C. Colella, H. Davis and M. Williams, "Integrated project delivery for public and private owners", National Association of State Facilities Administrators (NASFA), Construction Owners Association of America (COAA), The Association of Higher Education Facilities Officers (APPA), Associated General Contractors of America (AGC) and American Institute of A, 2010.

(77) G. Ballard and L. Koskela, "On the agenda of design management research", IGLC.net, 1997.

(78) G. Di Giuda and G.L. Albano, "Framework Agreement and Collaborative Procurement in Italian Legislation Enhancing a BIM Approach", *New Frontiers of Construction Management Workshop*, forthcoming.

(79) G. Ballard and G.A. Howell, "Competing Construction Management Paradigms", *Contruction Res. Congr. Wind. Chang. Integr. Innov. Constr. Proc. Congr.* 1, 2003, pp. 321-328: these complementary approaches are melded in a report, which concluded that an integrated approach has to respect the five key Lean principles of value, value stream, flow, pull, and perfection.

points which diversify collaborative contracts from other ones are listed in the following paragraphs.

The analysis of data concerning the last decades in the U.S. and in Europe(80) shows that the expected trend for the next years is going to be a severe mutation from the perspective of traditional tenders, such as Design Bid Build, to a collaborative view.

It has been noted how the early involvement of key participants has increased productivity both in design and construction phase.(81) Extending these considerations, the combination of competences from different participants may provide many benefits to Architecture Engineering and Construction sector, which is moving in this direction.

In the next paragraphs, the main characteristics of the Relational Project Delivery Arrangements are presented, starting from the more generic assumptions and proceeding to the more specific ones.

4.1. Multi-party and Poly-party contracts

The integrated agreement creates a system of shared risks, with the aim of decreasing the total risk of the entire project.(82) That could happen if most of the consultant and sub-contractors join the agreement; the general rule is to have at least half of the construction cost discussed at the decision table. The contract could be set in two different ways.

These two kinds of agreements are based on the procedure of setting the first contract through three main figures (Owner, Designer and Constructor).

One of the possible configurations of the collaborative agreement involves just the three main key participants, which sit at the decision table. The other participants are involved in the decisions through an elected member; in this way, there is just one representative for the owner, one for the designer, one for the constructor and the others are in any case part of the risk-reward structure. The abovementioned sub-agreements do not just give duties to the subjects involved, they also provide them with the same rights (with the exception of a limitation in the vote) in terms of sharing profits. On the contrary, in the other case, the core group is composed of all the people in the risk-reward structure: this kind of solution is achievable in relatively small projects due to the limited number of people involved. A new member – which becomes part of the collaborative contract – has the choice to enter either in a risk-reward position, or as a traditional consultant/

(80) M.S. Singleton, *Implementing Integrated Project Delivery on Department of the Navy Construction Projects*, www.researchgate.net, 2010.

(81) D.D. Mcwhirt, *A comparison of design-bid-build and design-build project delivery methods on military construction projects*, Iowa State University, 2007.

(82) W.A. Lichtig, "The Integrated Agreement for Lean Project Delivery", *Improv. Healthc. through Built Environ. Infrastruct*, 2010, pp. 85-101.

subcontractor, which only requires the accomplishment of his duties without a strong collaboration.

One of the main reasons why it is important for collaboration to ensure the sharing of both profit and losses is to account for the risks of the entire collaboration. In the corporate economy, the company's overall risk can be broken down into economic risk, financial risk and asset risk. This means that if a component of a team participates as an active member of the collaboration, it has to guarantee benefits for all the participants involved and face all the consequences. These two kinds of collaborative models are possible both within the Integrated Project Delivery and within a framework alliance as will be described further on.

4.2. Early Involvement of Key Participants

This collaborative form of contract lets team members express their full potential, but, considering the increasing complexity of projects,(83) it increasingly requires an Early Involvement of Key Participants (EIKP) in the projects.

This fact also imposes a change in the investment structure:(84) there is an anticipation of the choices and therefore an early discovery of potential problems, which, in a traditional process, could be found later. The Early Involvement of Key Participants has many benefits.

One of them is that the project team can work together at the same time on the assignment by sharing information and resolving the traditional lack of communication.(85) This way of working, combined with the use of a BIM, removes ambiguity in the documents and optimizes the project quality.(86) The concept of 'Big Room',(87) as a place where all the stakeholders, including the client, can share their knowledge is key to create a joint team that will pursue the same goals, defined together in terms of costs, time and quality. The anticipation of the stakeholders' involvement helps not only in the success of the final project, but also assures mutual sharing of experiences while dealing with the problems so that they can be seen from different perspectives and be solved in the best way possible. This way of collaborating does not reduce the

(83) S. Gokhale, "Integrated Project Delivery Method for Trenchless Projects", *ICPTT Sustain. Solut. Water, Sewer, Gas, Oil Pipelines*, 2011, pp. 604-614.

(84) According to P. MacLeamy's curve, *BuildingSMART International*, HOK presentation, session "BIM promise and challenge", 8 March 2018.

(85) F.D. Lancaster and J. Tobin, "Integrated project delivery: Next-generation BIM for structural engineering", *Structures Congress*, 2010.

(86) M. Mihic, J. Sertic and I. Zavrski, "Integrated Project Delivery as Integration between Solution Development and Solution Implementation", *Procedia – Soc. Behav. Sci.*, 2014, 119, pp. 557-565.

(87) B. Lostuvali and B. Alves, "Learning from the Cathedral Hill Hospital Project during the Design and Preconstruction Phases", *Int. J. Constr. Educ. Res*, 2014, 3-10, pp. 160-180.

number of stakeholders and people involved but optimizes their work. In just a few phases of the project, some people try to command, because they used to behave in this way in a traditional process. This habit has to stop, because it is unproductive.

In a new way of conceptualization of jobs, there are so many aspects and consequences involved in a decision that it is not possible to have a single person who is able to understand the impacts on each branch of knowledge.

Through EIKP, it becomes possible to understand all these aspects: it is a common interface which relates to all the collaborative contracts in general. It is also particularly useful in complex projects that require many project participants to be integrated into a virtual organization. The Key Participants are contractually engaged at the earliest moment. This conclusion is consistent with the research indicating that higher performance is achieved when teams are assembled before, at least, 20% of design has occurred.(88)

4.3. Goals validation and global optimization

One of the best ways to achieve this type of contractual relationship is the alignment of the project goals. It means that everyone in the project has the same aim, so that in order to improve the project, there are no excuses not to propose ideas for development.

One of the main changes brought by Relational Projects Delivery Arrangements focuses on the team: in a traditional vision, a team is seen as sum of people who have to work together but everyone has a different task.

In a collaborative perspective there is a different conception of team, but the main goal is the same: an optimized project. This is the reason why it is fundamental to change from a traditional approach, in which each party follows its own goal to obtain the best for itself even where the project does not enhance. In a collaborative approach – at the beginning – there is a starting phase in which the main objectives are set, so all team members know the final scope. In a collaborative approach the design team, the construction team and the facility management team collaborate in the design and construction phases.

An efficient project uses the minimal amount of labour and material necessary to achieve project goals.(89) The sequencing of objectives and their consequent validation by the team makes the case for a solid and joint teamwork, where everyone acts as a part of a single firm.

The sum of perfect projects is not the best one. This sentence could be explained by a simple verification: an architectural choice of having an

(88) M. Konchar and V. Sanvido, "Comparison of U.S. Project Delivery Systems", *J. Constr. Eng. Manag.*, 1998, 124, pp. 435-444.

(89) H.W. Ashcraft, "The Transformation of Project Delivery", *Constr. Lawyer*, 2014, 34, pp. 1-8.

over-insulated building is the best choice in a winter season, but it is the worst in summer. In fact, this choice will bring to the Mechanical Electrical Plumbing (MEP) system a lot of unnecessary costs. This situation could be solved simply by using a collaborative approach.

A second advantage could be identified in the use of the BIM to make further considerations on the suggested operational proposals. Complexity is an essential theme in the Architecture Engineering and Construction industry. This aspect, which should be taken in consideration, makes design choice difficult, because it is not based on the best solution, but on what better fits a specific project. Strategies, defined each time, also have to take into consideration the European Procurement Directives of 2014.

BIM has already played an important role in the United Kingdom for several years with the aims to capitalise on the success of UK programme based on the BIS BIM Strategy and to take on a global leadership role in BIM exploitation, enhancing the global image of UK designers, contractors and product manufacturers which in turn will translate into winning new work, growth opportunities and increased employment.(90) Such strategies are aimed at increasing the authorities' freedom of choice, but in the meantime, they are affording them more empowering skills. In this way, the owner (helped by his consultants) defines criteria upon which to evaluate the design choices, based on specific and promptly defined needs. In this way, a solution is selected by making a decision based not on a single aspect but on a multi-criteria analysis.

This technique is able to provide the best solution – in terms of building techniques and costs – through a BIM approach automatically tailored to the owner's needs.

One of the main aspects related to BIM is the correlation between graphical and non-graphical information, in this way the project could be validated through an index created on particular requests of the owner. This fact could lead to obtain a specific but objective evaluation of the project (such as cost, time, energy efficiency and so on). These evaluations can provide a continuous overview of the evolution of project, not based on the remaining time until the completion, but rather on the owner's satisfaction.

4.4. Shared risk and rewarding

The sharing of the profits, at least in the U.S. and British experience, seems to provide a monetary reason to collaborate.(91) In other countries, such as

(90) HM Government, "Industrial strategy: government and industry in partnership – Building Information Modelling", 2012.

(91) Association of Consultant Architects, 2010, 10 Years of Partnering Contracts: PPC2000/TPC2005.

in Italy, the sharing of savings and profits would be contrary to the general principles of administrative action (such as cost-effectiveness), but the award of a so-called *premio di accelerazione* (a sum of money to be awarded in case of early completion of a work on the basis of the agreement concluded between the contracting authority and the constructor) would be considered as a good incentive to collaboration.(92) Even though the monetary remuneration is not the primary driving principle, without this factor collaboration is still possible.(93) One of the main points of Relational Project Delivery Arrangements is the sharing of pain and gain. This is possible thanks to an initial agreement that all the people involved in the contract have to sign. This imposes an 'open book' policy: in other words, it means that all the involved subjects have to share with the owner their 'books' so he need only reimburse the actual costs. This condition creates transparency in the teamwork. It also allows work to proceed safely and peacefully, because it is unfair to work below costs and the open book rule puts at risk only the profits which are under contract.

Risks are also present if the project goes in the wrong direction. In this case, all the stakeholders are responsible for the failure or incomplete success of the project. The concept, at bottom, is to accept these shared risks, in order to choose a good project team based on integrity, character competency and trust.(94)

The process starts from a business case, in which, at the beginning, the project costs are set at the validation stage. With the evolution of the planning phase, some improvements can be made and, this way, some savings can be produced. This is an iterative process, conducted by the Key Participants, aiming to maximize the global performance of the project. According to the validated goals, in order to maximize profits, the introduction of a change affects the whole project. The new benchmark is set to the lowest price, which becomes the final target cost for the construction phase.

When the contractor starts building the project, there could also be an incentive to the execution related to the site, which can produce a profit gain or loss. The division of the additional profit is based on a supplementary effort provided by the Key Participants and by the owner.

According to the conceptual models of Relational Contracts and Reputational games,(95) an actor should do his best if he will receive the same

(92) The so-called (speed prize) *premio di accelerazione* is provided for in Art. 145 of the new Italian Code of Public Contracts, Legislative Decree 50/2016.

(93) T. Amabile, "A Model of Creativity and Innovation in Organizations", *Res. Organ. Behav.*, 1988, pp. 123-167.

(94) O. Matthews, G.A. Howell and P. Mitropoulos, "Aligning the lean organization: a contractual approach", *Lean Conference*, 2003, pp. 1-12.

(95) D.G. De Maio, "Relational Contracts and Reputational Games The Role of Informal Agreements", *Supporting Business Relation*, 2013.

amount, just because he performed work that is compliant with laws and not at the best of his ability. However, it should be also noted that on the basis of the administrative principles of effectiveness and fairness, each party should cooperate in good faith and to the best of its knowledge.(96) The owner finds himself in a situation in which he pays a person just because he achieves his scope using the minimum of his capacity, therefore the concept of meritocracy should also be introduced in the remuneration aspect of contracts. Reputational contracts are able to introduce this aspect and inspire people to truly believe in their work.(97)

If the importance of reputation inside the group of participants under the cooperative contract is evident in the U.S. and British experience, it nevertheless recalls some key issues on the ability to evaluate reputation and past good performance in the EU procurement system.

From the EU public procurement standpoint, the EU Directives limit the ability to evaluate vendors' reputation in relation to procurement award criteria, as assessing past performance could turn into a procuring entities' discrimination. Such rules carry a risk of compromising the quality of the performance.

Indeed, a significant difference between the EU and the U.S. approaches to the evaluation of tenders/candidates concerns the relevance of past performances and the objectivity or subjectivity of the choice of the winning tender. From the EU standpoint, pre-qualification along with evaluation of the tenderers' capabilities (quality requirements of the economic operators(98)) constitutes the first phase of the award procedure, completely separate from the evaluation of the tenders/candidates.

In the EU, the choice has been to fix some grounds of exclusion (some of which may be optionally implemented by Member States)(99) and minimum standards of economic and financial standing and technical and/or professional ability, related and proportionate to the subject matter of the contract ('selection criteria')(100) in order for the tenderer to be allowed to participate in the contract competition. Any economic operators that meet or exceed the minimum requirement threshold must be admitted,(101) the reason for such a rule was the existing concern about the risk of discrimination in favour of

(96) In this sense, *see* Art. 30 of the new Italian Code of Public Contracts, Legisl. Decr. No. 50/2016.

(97) J. Levin, "Relational Incentive Contracts", *Am. Econ. Rev.*, Vol. 93, No. 3, 2003, pp. 835-857.

(98) EC Dir. 2004/18, Art. 45-52, for the criteria for qualitative selection of the tenderer. In the 2014/24 EU Dir., *see* Art. 58.

(99) EU Dir. 2014/24, Art. 57.

(100) EU Dir. 2014/24, Art. 58.

(101) In the restricted procedure the possible raising of the requirements permits the selection of only a limited number of tenderers. Nonetheless, once the new raised minimum is met, the quality of the tenderers will not be taken into account in the award criteria. *See* EU Dir. 2014/24, Art. 28.

national undertakings, and led to the exclusion in the EU Directive of the possibility to rate past performances and, in particular, the possibility of evaluating past performances with scores, rather than the pass/fail approach implicit in the EU approach to the assessment of potential contractors' eligibility.

The result, though, is that the EU neglects an important characteristic of contractors, their performance records on prior contracts. As a consequence, companies with poor records of performance will generally be allowed to compete for future contracts.

While in theory the level of technical requirements could be raised in a way to exclude firms that have not performed well in the past, that risk has been considered unjustified, as not proportional and potentially discriminatory.(102) This lack of evaluation and the consequent inability to choose on the basis of a better record of performance on prior contracts means that the apparent impartiality in the EU system translates into greater risks in the quality of spending, and in integrity.(103)

In the U.S., the order of evaluation is often reversed: first the tender is evaluated and only at a later stage the tenderer is assessed for 'responsibility' (qualification), which, like the EU system, is a pass/fail assessment (essentially asking whether the firm is one that the U.S. government is willing to do business with and one that the government believes is capable of performing the contract).(104) That responsibility determination, however, is undertaken only with respect to one firm, the apparent winner of the competition.

The difference mainly concerns the EU's preference for objective, mechanically applied award criteria and the U.S. tolerance of subjectivity, both in the evaluation factors and in the trade-off between price and non-price factors.

In the EU legal framework, the objective evaluation of tenderers and tenders, especially in case of lower price award criteria, boosts the risk of poor

(102) UK Government, "Buying and managing government goods and services more efficiently and effectively", published 20 February 2013. EC Dir. 2004/18, Wh. No. 39, "Verification of the suitability of tenderers, in open procedures, and of candidates, in restricted and negotiated procedures with publication of a contract notice and in the competitive dialogue, and the selection thereof, should be carried out in transparent conditions. For this purpose, non-discriminatory criteria should be indicated which the contracting authorities may use when selecting competitors and the means which economic operators may use to prove they have satisfied those criteria". *See* ECJ, 29 March 2012, *SAG ELV Slovensko and Others*, case C-599/10; ECJ, 12 November 2009, *Commission v Greece*, case C-199/07; ECJ, 24 January 2008, *Lianakis v Dimos Alexandroupolis*, case C-532/06; ECJ, 3 March 2005, *Fabricom S.A. v Belgian State*, jnd cases C-21/03 and C-34/03.

(103) EU Comm., "Green Paper on the modernisation of EU public procurement policy towards a more efficient European Procurement Market", *op. cit.*, p. 18.

(104) S. Treumer, "Exclusion, Qualification and Selection of Candidates and Tenderers in EU Procurement", in *Qualification, Selection and exclusion in EU Procurement* (M. Burgi, M. Trybus and S. Treumer eds), Copenhagen, Djøf Publ., 2016, pp. 13 and ff.

performance linked to the need to reduce costs during execution. Moreover, as already highlighted, the EU objectivity is often only mere appearance.(105)

In the U.S., during the evaluation of tenders, however, the tenderers' past performances will be assessed, typically on a qualitative (not pass/fail) scale, so that a firm's past performance might be rated 'outstanding', 'very good', or 'acceptable'. In the evaluation of tenders in negotiated procurements valued above $150,000, past performance is a mandatory evaluation criterion. From a U.S. perspective, the EU pre-qualification of tenderers seems both anti-competitive and inefficient, since it requires the contracting authority to judge all firms on a pass/fail basis, thus allowing the contracting authority to eliminate firms from the competition before they have had the opportunity to submit a tender.(106) Assessing past performance might ensure performance quality and a fair competition based on the effective quality of public spending, thus reducing the opportunities for corruption.

In the EU approach, mechanical award criteria are applied.(107) According to EU public contracts rules, the award of a contract should be objective(108) in order to ensure non-discrimination among economic operators of different Member States.(109) Such a choice can be implemented with the simplest and most objective award criterion, that is the criterion of lowest price. The problem that the EU faces is to ensure objectivity in the evaluation of any other criteria, particularly when their use normally requires a subjective assessment.

Selection based on 'the most economically advantageous tender' is permitted as long as the evaluation of quantifiable and non-quantifiable quality elements is done through an objective evaluation, including publicly disclosed 'relative weightings' of any element.

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(105) D.I. Gordon and G.M. Racca, "Integrity Challenges in the EU and U.S. Procurement systems", in *Integrity and Efficiency in Sustainable Public Contracts. Balancing Corruption Concerns in Public Procurement Internationally op. cit.*, p. 117.

(106) *Ibid.*; S. Rose-Ackerman, *Corruption and government: Causes, consequences and reform*, Cambridge, CUP, 2010, p. 62. On the issue related to past performance "the use of past performance as a factor in awarding new contracts has proved difficult to implement because there is no generally accepted technique for evaluating performance".

(107) EC Dir. 2004/18, recital No. 46, provides: "Contracts should be awarded on the basis of objective criteria which ensure compliance with the principles of transparency, non-discrimination and equal treatment and which guarantee that tenders are assessed in conditions of effective competition". In the new EU Dir. on public procurement, *see* the recital No. 90.

(108) Dir. 2004/18/EC, recital No. 46, "Contracts should be awarded on the basis of objective criteria which ensure compliance with the principles of transparency, non-discrimination and equal treatment and which guarantee that tenders are assessed in conditions of effective competition. […] In order to guarantee equal treatment, the criteria for the award of the contract should enable tenders to be compared and assessed objectively". *See* Dir. No. 2014/24/EU, recital No. 90, "Contracts should be awarded on the basis of objective criteria that ensure compliance with the principles of transparency, non-discrimination and equal treatment, with a view to ensuring an objective comparison of the relative value of the tenders in order to determine, in conditions of effective competition, which tender is the most economically advantageous tender".

(109) C.H. Bovis, *EU Public Procurement Law*, Cheltnham, Edward Elgar, 2007, pp. 63-80.

This commitment to objectivity remains challenging. For example, apart from the case of quantifiable elements (e.g. delivery to be measured in days, distance between the supplier's warehouse and place of delivery to be measured in kilometres, saving energy to be gauged in kW/h), the EU system also permits the use of non-quantifiable elements, such as technical merit and aesthetic characteristics. In the evaluation of these qualitative elements, the contracting entities have discretionary power, and their evaluation retains a large subjective component, even when expressed in objective numerical scores.(110) The fact is that subjectively assigned scores, however precisely presented and whatever complex formula is used, do not lead to an objective evaluation. Moreover, even when the assessment of non-price factors is objective (such as in the case of assigning points based on the number of days needed for delivery), the trade-off between those factors and price is inherently subjective: if one tender would have the goods delivered in fifteen days and the other would take 20 days, how many additional euros should the contracting authority be willing to pay for the earlier delivery? Of course, in such cases, the 'monetization' of non-price factors can be disclosed in the tender documents (for example, each day shorter than 30 days will be translated into an evaluated price credit of 100 euros), so that an objective formula and transparency are preserved.

The goal of objectivity and the reduction of the discretion available to evaluation committees (juries) and contracting authorities have induced some Member States(111) to provide for the use of mathematical formulas in the award of public contracts.(112) That is, the contracting authority has to determine a mathematical formula for both the assessment of the different criteria and the relative weightings used to determine the most economically advantageous tender.(113) While the mathematical formula translates the scores given by the evaluation committee (jury) into a ranking, the problem often remains that the scores themselves are subjective, and they can tilt the award in favour of one tenderer or another. The jury's assessment thus continues to have a discretionary (or arbitrary) content, and the mathemat-

(110) J. Schultz and T. Søreide, "Corruption in Emergency Procurement", in *U4 Anti-Corruption Resource Centre – Issue Paper*, 2006. Corruption "can take place through violations of ordinary procurement rules or through misuse of legal authorisation for discretionary decisions"; G.M. Racca, "The Risks of Emergencies in Public Procurement", *J. Publ. Finance & Publ. Cho*ice, 2013, p. 105; G.L. Albano, "On the Problem of Quality Enforcement in centralized Public Procurement", *J. Publ. Finance & Publ. Choice*, 2013, p. 145.

(111) Art. 83, § 5, Law No. 163 of 2006, Italian Public Procurement Code, where in the specification of the rules concerning the most economically advantageous tender, the use of a method that permits identifying the most advantageous offer with a single numeric parameter is provided for. *See* also the Government regulation enforcing the IPPC (Presid. Decr., 5 October 2010, No. 207), Annex P.

(112) F. Dini, R. Pacini and T. Valletti, "Scoring rules", in *Handbook of public procurement*, *op. cit.*, p. 304.

(113) P.S. Stilger, *Formulas for Choosing the Most Economically Advantageous Tender – a Comparative Study*, thesis, Utrecht University, 2011.

ical formulas mainly serve to give a semblance of objectivity to a subjective evaluation.(114)

Both the jury's discretionary power of technical assessment and that of the contracting authorities in the evaluation of tenders' qualitative elements must ensure reasonableness, consistency and logic in order to avoid discrimination. Yet, for the reasons explained above, objectivity is only apparent. Moreover, the cost paid for the goal of objectivity can be significant: it may force the contracting authority to make a selection based on a score difference that is minimal – essentially irrelevant, especially when the way the score is developed is taken into account – a higher score of 0.1, with no meaningful evaluation of promised quality, may compel a contracting authority to pick one tender over the other.

The limited evaluation of past performance and the complex scoring schemes in the European system can lead to an award that seems random/irrational and can raise serious integrity and performance risks. Such risks can arise also when the award is decided at the lowest price if the subject matter and contract conditions are not precisely defined in the contract notice, as often happens in work procurements.(115)

BIM could foster the EU public procurement system to ensure a more objective evaluation of tenders. Collaborative contracts should provide new requirements for groups of economic operators (temporary associations, joint ventures)(116) and a new set of award criteria for the evaluation of their offers. This choice might turn into a better monitoring of all the procurement cycle and in particular the final goal of the procurement selection that is a correct execution.

(114) Italian *Cons. Stato*, VI, 2 March 2004, No. 926, concerning an awarding procedure carried out by Consip S.p.A. for substitute services for canteen meal vouchers. Regarding this case, *see* also the investigation activity provided by the Italian Competition Authority; *See*; Italian Authority for the Supervision of Public Contracts for works, services and supplies, Determinazione, 24 November 2011, No. 7; F. Dini, R. Pacini and T. Valletti, "Scoring rules", *op. cit.*, pp. 309-310.

(115) G.M. Racca, "Collaborative procurement and contract performance in the Italian healthcare sector: illustration of a common problem in European procurement", *PPLR*, 2010, pp. 119-133; G.M. Racca, R. Cavallo Perin and G.L. Albano, "Competition in the execution phase of public procurement", cit., pp. 89-108.

(116) In the UK, consortium bidding constitutes a particular form of collaborative contracts, in which two or more economic operators come together to submit a bid for a contract in a public procurement process either through an already established consortium or through a looser, dedicated group of bidders coming together for a specific contract and becoming formalized structures (such as special purpose vehicles) after the award of a contract. For more guidance on consortium bidding, *see* also Crown Commercial Service, "Procurement Policy Note – Reforms to make public procurement more accessible to SMEs", February 2015, No. 03, and PPN 2016, No. 08, which replaced PPN 2205 No. 03, to provide guidance on the Standard Selection Questionnaire, including how this should be completed and evaluated to ensure consortiums are not disadvantage.

4.5. Decision making in Relational Projects Delivery Arrangements

From the private sector perspective, as recalled by the American Institute of Architects (AIA), "Integrated Project Delivery allows all team members to better realize their highest potentials while expanding the value of the provider throughout the project lifecycle". It is therefore possible to deduce that integration is the key element.(117) All decisions should be based on (i) the best quality, (ii) the lowest cost in general and (iii) the least impact on the project. After signing the contract, everyone in the team has the same power to make decisions, even the owner. The same logic is used to fill in all the available positions, using the most suitable person from any of the Primary Team Members (PTM). Joint Project Control (JPC) requires collaboration between stakeholders. When problems arise, they must be thoroughly explained to the parties, in order that they understand how to solve the issues. In this way, the resolution is handled through a discussion and agreement between Primary Team Members.

A Collaborative Contract has the ability, due to its form, to align the participant goals and reduce project variability in terms of cost and performances.(118) AIA also underlines how important it is to change the way of looking at the construction industry, because now the project has a scope of quality and the project management team has the scope to lead the parties toward the achievement of the agreed objectives. The 'policy of age', in which the eldest rules, undermines the relationship between team members and forces the group apart. The owner is involved in the project, because, much like the other parties, he has an interest and he should collaborate to obtain the best result possible. The owner still has the power, but all decisions have to be discussed 'democratically'. This change in the mind-set, especially for the owner, is very difficult, due to a tradition in which the owner has a great power and its words and opinions correspond to the rules, even if its decisions are not for the best interest of the operation. The involvement of the owner in the Integrated Project Delivery gives major advantages to this collaborative contract.

(117) N. Azhar, Y. Kang and I. Ahmad, "Critical Look into the Relationship between Information and Communication Technology and Integrated Project Delivery in Public Sector Construction", *J. Manag. Eng.*, 2014, p. 31; N. Azhar, Y. Kang and I. Ahmad, "Factors Influencing Integrated Project Delivery in Publicly Owned Construction Projects: An Information Modelling Perspective", *Procedia Eng.*, 2014, No. 77, pp. 213-221.

(118) G. Ballard, R. Azari, Y.-W.Kim and S. Cho, "Starting from Scratch: A New Project Delivery Paradigm", in *Construction Research Congress* (D. Castro-Lacouture, J. Irizarry and B. Ashuri eds), Atlanta, ASCE, 2014, pp. 2276-2285.

4.6. Liability among Contract Parties

While there is no need for contractual exclusions or limitations of liability by reason of adopting BIM,(119) there are factors linked to BIM that, in practical terms, reduce liability: increased communication, greater creativity and reduced contingencies.(120)

In this way, some studies have underlined how liability adds hidden costs to the project as a consequence of the self-defence mechanism of every participant and induces people to use common and tested theories or materials which are – in most cases – more expensive. Increased communication through BIM forces participants to take responsibility for the project, instead of blaming others for any errors or failures in the project. In this way, all parties can either benefit or suffer from the results of the project and eliminate the anxiety in and around communication. The reduced liability is a condition that forces participants to take responsibility for the project, rather than attempting to blame others trying to avoid the impact of the problem caused.

One of the main causes of errors is disinformation triggered by incorrect communication, provided by one party to another. It is important that the flow of data is correct. In Relational Projects Delivery Arrangements, all the Key Participants have the duty to communicate and transmit all their knowledge for their own benefit.

Project participants (particularly the design professionals) have become keenly aware of the importance of providing early and complete information to contractors, as the builders cannot effectively plan without an understanding of where the designers are headed.(121) It is possible to assume that designers try to deliver data as complete as possible in order not to receive a claim by the constructor, but without allowing a continuous exchange of information. Key participants should be continuously informed of the project evolution in order to update and inform the others of potential unforeseen consequences. BIM might provide the solution to achieve a coordinated collaboration in real time through an oriented software, which would also allow a continuous evaluation of the project.

A direct consequence of the sharing of information among the participants to a specific project is the problem of the intellectual property rights in each set of data included in the model shared between different companies. Sharing

(119) *See Enabling BIM Through Procurement and Contracts – A Research Report by the Centre of Construction Law and Dispute Resolution*, London, King's College, 2016, p. 7.

(120) Association of Consultant Architects, 2010, 10 Years of Partnering Contracts: PPC2000/TPC2005.

(121) D. Mosey, *Early Contractor Involvement in Building Procurement. Contracts, Partnering and Project Management*, Hoboken, Wiley Blackwell, 2009.

policies could have huge consequences for the owner, which could not receive the product in a digital way. However, since most of the work delivered to a customer is tailored to its needs, the digital delivery of a project does not imply selling the knowledge of a firm. In this sense, BIM is better described as a container of information allowing the owner to better manage its building than as a way for the owner to enrich its own knowledge.

From an EU public procurement perspective, contracting authorities have to ensure the compliance of data and information sharing with EU principles of transparency, equal treatment and non-discrimination in terms of prior involvement of economic operators and for the benefit of the award procedure. In fact, even if early involvement in the construction sector mainly involves the post-award phase, in which the designer/constructor may decide to open a competition among different providers – another profile which would deserve a thorough analysis in terms of compliance with EU public procurement law – it is nevertheless true that contracting authorities should be clear from the outset with regard to the intention to use electronic tools in the award of the contract when engaging with economic operators.

This requires that a possible phase of preliminary market consultation(122) should not distort competition and that the same information is accessible to all economic operators and its outcomes are disseminated. The lack of transparency in the contracting authority's activity from the very beginning can make it challenging for economic operators (especially innovative SMEs) to identify the demand for innovation and the ability to propose the best solutions.

Contracting entities should define the requirements of participants and the kind of early cooperation they aim to settle with all the subjects involved in the design execution and management of the subject matter of the procurement. The BIM methodology should require further efforts in this perspective, especially because BIM could affect duties of care agreed under contract or imposed by law. It is therefore necessary to frame appropriate and enforceable legal commitments accordingly.(123)

During the award procedure, all communication and information exchange should be performed using electronic means of communication in accordance with the requirements of EU Directives on public contracts, and in the construction sector this could evolve into the use of BIM methodologies. Such tools might provide the necessary environment to start the sharing of information for the purpose of the selection of teams for the collaboration contracts. Such instruments should be non-discriminatory, generally available

(122) EU Dir. 2014/24, Art. 40.

(123) *See Enabling BIM Through Procurement and Contracts – A Research Report by the Centre of Construction Law and Dispute Resolution*, *op. cit.*, p. 7.

and interoperable with the ICT products in general use and should not restrict economic operators' access to the procurement procedure.(124) The rapid evolution of technologies would overcome such barriers, and also provide a technical environment that could leave legal obstacles among EU Member States and favour collaboration also in cross-border procurement.

4.7. Teamwork and New Project Delivery Phases

The concept of teamwork should be revisited and adapted to the perspective of collaboration contracts, also in the private sector, and then tailored to public procurement needs. This consideration suggests a cautious choice of the members of the group. The aim is efficiency,(125) but most of the time a disagreement can compromise the entire collaboration. It is really important to carefully select the participants of the group, because the impact on the development of the project in a collaborative teamwork environment is very different compared to a traditional process due to the continuous changes caused by the other components of the team. The differences that persist between teamwork working in the manufacturing and in the AEC sectors is that in the former the components work together for an extended period of time, while in the latter, the components change from one project to another.(126) This fact entails a high risk of lack of cooperation between people who do not truly believe in the collaboration itself.(127)

Increased collaboration is transforming the nature of project delivery. This is the reason why Integrated Project Delivery is a collaborative and trust-based process. It is innovative both in the structure and in the delivery phases, as it also requires a contribution of knowledge and experiences from different stakeholders. This change is caused by working simultaneously, having the same data available through BIM.

The first phase is called 'Conceptualization', where key participants identify the main objectives related to costs, performances, time and preliminary analysis. During the following step, 'Criteria Design', the project takes shape in terms of design, while all the activities that have been commenced continue. In the 'Detailed Design' all the decisions are finalized including finishes, fixtures and equipment and the subcontractors are integrated in the process. The 'Implementation Documents' phase is an implementation of the previous one in terms of information related to the project.

(124) EU Dir. 2014/24, Art. 22 (1).

(125) H.W. Ashcraft, *Location, Location, Co-location*, San Francisco, [publisher?], 2016.

(126) F. Daniel, K. Lauri, D. Forgues and L. Koskela, "The influence of a collaborative procurement approach using integrated design in construction on project team performance", *Int'l. J. Manag. Proj. Bus.*, 2009, 2, pp. 370-385.

(127) M. Oh, J. Lee, S.W. Hong and Y. Jeong, "Integrated system for BIM-based collaborative design", *Autom. Constr.*, 2015, 58, pp. 196-206.

BIM could be developed in parallel during the process, providing the digital representation of the physical and functional features of a building essential to develop a collaborative process exchanging information among parties and to resolve conflicts.

A traditional way of design is not compatible with this innovative collaborative process due to its own foundation, because it includes key figures that do not allow for working together, sharing information and optimizing the project.

The next two simultaneous phases are 'Agency Review' and 'Buyout': the former allows reviewing and validating the design process according to the laws in force and the latter is the payment of the key figures. At the end, the building is built in the 'Construction' phase, where all the benefits of the integrated model are delivered to the owner.(128)

Recently, Integrated Project Delivery has become a milestone for some companies, which were established a few years ago, even if it is still an 'infant', as defined by AIA. Therefore, with the help of these companies, it is possible to discover more data to better understand the real performances and limits of Integrated Project Delivery, inferring as much as possible information from completed projects that are still underway.

4.8. Building Information Modeling challenges

The BIM methodology is the easiest way to perform an effective collaboration between all the stakeholders, allowing a permanent coherence through all the project parties. According to the International Council for Research and Innovation in Building and Construction,(129) it is one of the key elements to perform an Integrated Process. To this end, the very first step is to identify the stakeholders' roles and the project goals and to define an implementation strategy accordingly. The more BIM is aligned with the project goals, the more it can maximize the value of a project within the constraints of available time and resources over its lifecycle.(130)

BIM is an actual collaboration of people involved in the construction process. With the evolution of technologies, all team members have the ability to interact with each other in a Common Data Environment (CDE), which is the virtual space where the work group shares information and data related to the

(128) R. Cheng, K. Dale, A. Aspenson and K. Salmela, *IPD Case Studies, American Institute of Architects*, San Francisco, American Institute of Architects, 2012.

(129) IDDS, *Research Roadmap Report, International Council for Research and Innovation in Building and Construction*, 2013. The dissertation represents the legal framework in which Building Information Modeling can be applied.

(130) D. Shepherd, *BIM Management Handbook*, Newcastle Upon Tyne, RIBA Publ., 2010, p. 9.

evolution of the project(131) following predefined procedures. This space allows all team members to be updated with project information, which is uploaded by each member and permits not only the sharing of information, but also the monitoring of the process, with a structured workflow.

To emphasize the spirit of collaboration of BIM and according to the mandatory requirement of the MIDP,(132) the project manager should appoint the people responsible for the various activities, who would be expected to be informed about what is going on and responsible for validations and signatures.

In 2011, the UK Government Construction Clients group published a report, in which it required small changes in the copyright law and contract form to facilitate the introduction of Level 2 of BIM maturity. It stated that collaboration should be mandatory in a BIM environment, but this methodology did not affect the procurement scenario. This CIC/BIM protocol defined a series of supplementary contractual documents, which constitute the basis of a legal framework, such as: (i) Employer's Information Requirements (EIR), (ii) BEP (BIM Execution Plan) pre and post contract and (iii) Project Procedures. The Employer's Information Requirements (EIR) has the double scope of (i) specifying the ultimate aim of the asset, with the consequent development of the Project information Model (PIM), and (ii) informing the Asset Information Requirement (AIR). The Organizational Information Requirements (OIR) – the compensation of the Plain Language Questions in the Asset Information Model (AIM) – generates the AIR, and all is then merged in the Asset Information Plan. The initial contract can be located in the documents' sphere drawn up by the client, upon which it relies for the professional management of work through BIM.

In 2013, the Construction Industry Council (CIC) developed Publicly Available Specifications (PAS) aimed at meeting an immediate market need following guidelines set out by British Standards Institution: the PAS 1192:2 and the PAS 1192:3. The first specifies the requirements for achieving 3D environment-based BIM during the capital/delivery phase of projects throughout the stages of the information delivery cycle, culminating in an as-constructed asset information model (AIM), thus identifying the downstream uses of information at the outset to ensure its re-use during the whole building life cycle. The latter lays down "Specification for information

(131) British Standard Institution (BSI), PAS 1192-2:2013, "Specification for information management for the capital/delivery phase of construction projects using Building Information Modelling", *Br. Stand. Inst.*, 2013.

(132) Construction Industry Council, *Building Information Modelling CIC | BIM Protocol*, 2013, Cic 1–15.

management for the operational phase of construction projects using building information modelling".

For managing the delivery of the project, the PAS 1192 foresees a BIM Execution Plan (BEP), which is divided in pre-contract BEP and post-contract BEP. The first one is developed by each potential contractor and defines the potential added value that it can provide to answer the Employer's Information Requirement. The last one is drawn up after the conclusion of the contract, confirming the ability of the supply chain and providing a Master Information Delivery Plan (MIDP).(133) Further, Project Procedures explain all the correct workflow and methodology to follow during the project development stages. For instance, the Project Information Model (PIM) developed on the basis of the Exchange Information Requirements (EIR) during the design and construction phase – consisting of a federated building information model, non-graphical data and associated documentation – contributes to the creation of the Asset Information Model (AIM), which compiles the information necessary to support asset management providing all the data related to, or required for the operation of an asset.(134)

In this process, the BIM Information Manager plays a key role, since it ensures the quality of the provided data, and realizes value through its management. His work is based on the Project Information Plan and Asset Information plan, enabling the integration of information in the Project Team. The transformation of pre-BIM contractual forms needs to be defined to accommodate the methodology in several regards: (i) liability and insurance – insofar these are not dealt with when working in a BIM environment; (ii) the ownership of BIM model and data; (iii) integrity of model and data; and (iv) secure storage of data. These points should be resolved, otherwise the contract itself would leave the parties subject to liability. The use of traditional contracts such as JCT or other forms not specifically designed to work with BIM may lead to the possibility of its incorrect use, with all the consequent issues.

From a public procurement perspective, the advantages in terms of efficiency and integrity seem evident and might be outlined as long as the contracting authority actually has precise control of all the phases, especially the definition of needs and of public demand, but also in the selection of participants (tenderers/candidates) and of the group that will cooperate in the contract execution.

(133) *I.e.* a primary plan, which sets out when project information is to be prepared, by whom, using what protocols and procedures.

(134) According to the PAS 1192-3 the operation of built assets shall ensure continuity and consistency in the management of information for both planned and unplanned events that may occur during the operation, maintenance and management of an asset, and it covers the data transfer process required for the creation of the AIM.

The different EU and U.S. perspectives on the modalities of cooperation are flanked by a parallel variety in public procurement objective/subjective selection of contractors. From this perspective, the use of BIM methodologies may have a huge impact in terms of transparency and effectiveness of the selection.

The U.S. federal government now routinely allows 'trade-off' contracting decisions (called 'best value' decisions), in which contracting officers are allowed to make subjective selections among competing tenders, rather than selecting only on the basis of price.(135) U.S. government agencies are permitted to use price as the sole criterion in selecting among acceptable tenders, and they sometimes do so. Nevertheless, non-price selection criteria are also permitted. What is even more noteworthy is that the U.S. system grants agencies broad discretion in selecting and assessing non-price criteria.(136)

First, there is an element of subjectivity in the assessment of non-price factors that would not be permitted in many other procurement systems. Thus, tenderers' past performance is a widely used – and often required – evaluation criterion, and the past performance rating that a bidder receives can be assigned by a contracting official on a judgmental basis,(137) without objective criteria. Generally, only in the case of sealed bidding, where price is the sole award criterion, is there no evaluation of past performance. In the 1990s, the assessment of past performances was often based solely on prior work identified by the bidders in their tenders. In their submissions, they were required to disclose their 'relevant' prior contracts, so that their performance under those contracts could be checked. A past performance database was set up some years ago and despite some difficulties, it is intended to allow government officials to identify prior contracts without reliance on the tenderer, thus reducing the risks posed by the vendors' sometimes biased disclosure of contracts where past performance was good.(138)

(135) D.I. Gordon and G.M. Racca, "Integrity Challenges in the EU and U.S. Procurement systems", *op. cit.*

(136) D.I. Gordon, "Protecting the integrity of the U.S. federal procurement system: Conflict of interest rules and aspects of the system that help reduce corruption", in *Corruption and Conflicts of Interest. A Comparative Law Approach* (J.-B. Auby, E. Breen and T. Perroud eds), Cheltenham, Edward Elgar, 2014, pp. 42-43.

(137) In a 2012 protest decision, GAO stated, as the standard legal framework for its review of a challenge to an agency's evaluation of a firm's past performance: "An agency's evaluation of past performance, including its consideration of the relevance, scope, and significance of a tenderer's performance history, is a matter of discretion which we will not disturb unless the assessments are unreasonable or inconsistent with the solicitation criteria". *Phoenix Management, Inc.*, B-405980.7 *et al.*, 1 May 2012.

(138) The evaluation and any contractor response comprise the past performance information that is stored in government databases (e.g., Past Performance Information Retrieval System – PPIRS –, Federal Awardee Performance and Integrity Information System – FAPIIS) and may be used in future

Second, the U.S. system allows trade-offs between price and non-price factors to be subjective. The acceptability of subjective trade-offs has been recognized at least as far back as the 1970s, when GAO declared that contracting officers had discretion in making trade-offs among competing bids, as long as their decisions were consistent with the publicly announced evaluation criteria and met the test of rationality.(139) That means, for example, that, where a solicitation advised that the government would have weighted price and past performance equally, two contracting officials could reach different – but both permissible – trade-off decisions between competing bids. Thus, one contracting officer could decide that bidder A, with an "outstanding" past performance record but offering a price of $10 million, should receive the contract, rather than bidder B's $9 million offer, because bidder B had only 'good' past performance. Another contracting officer, faced with the identical facts, could decide that it was not worth the government's money to spend that extra $1 million to obtain the benefit of working with a firm with a track record of outstanding performance. That degree of subjectivity can open the system to problems, including problems potentially related to corruption, since it decreases transparency (in the sense that it is not so clear why the government has chosen the winner). Nonetheless, the award is subjected to multiple accountability mechanisms, in the form of bid protests as well as audits. The system thus provides, or at least attempts to provide, a balance between allowing contracting officials to exercise their discretion and judgment in spending public funds, on the one hand, and ensuring the integrity of public procurement through effective accountability, on the other.(140)

source selection decisions. *See* K.M. MANUEL, Congressional Research Service Report for Congress, *Evaluating the "Past Performance" of Federal Contractors: Legal Requirements and Issues*, 4 February 2013, www.fas.org/sgp/crs/misc/R41562.pdf.

(139) The seminal GAO decision establishing this principle was *Grey Advertising, Inc.*, 55 Comp. Gen. 1111 (1976), 76-1 CPD 325.

(140) D. DELLA PORTA and A. VANNUCCI, "Corrupt exchanges: Empirical themes in the politics and political economy of corruption", paper prepared for conference, Bielefeld, 2001, classify the need for discretion as follows: "(i) When public demand and preferences are precisely defined with respect to both qualities and price structure. The award is automatic, and the public agent exercises no discretionary power. (ii) While public demand is precisely defined, general criteria for prices describe the public preferences. Discretionary intervention is necessary. (iii) Public demand is not defined with precision. Public preferences are described by general criteria for both price and quality. The public official has the power to assign weight to the various offers, according to general criteria. (iv) The demand and the public preferences are precisely defined during a bilateral bargaining process, delegated to the public agent. S/he is choosing the private part, while price and other contract conditions are the result of the negotiation process". This classification is reported by T. SØREIDE, *Corruption in Public Procurement Causes, Consequences and Cures*, Bergen, Chr. Michelsen Institute, 2002, p. 13. The author observe that "This way of classifying public procurement into various degrees of discretionary authority, or objectivity, is important to understand the inclination to corruption in different situations". S. ROSE-ACKERMAN, *Corruption and government. causes, consequences and reform*, *op. cit.*, p. 18. "Whenever regulatory officials have discretion, an incentive for bribery exists".

The BIM methodology could allow further monitoring systems related to the collaborative contracts that might permit a check on all the phases and possible criticalities, and to settle them with greater transparency and efficiency. In the end, successful use of BIM is very much related to the ability to align its use with the procurement model and contract terms.

5. *Integrated Project Delivery and Culture of Collaboration*

Collaborative contracts in the US started a long time ago, as a method distinct from the traditional Design-Bid-Built. Even public administrations started using a different form of tendering. This new form is called Integrated Project Delivery. Integrated Project Delivery still does not have a final and unique definition. There are a few definitions, just as a reminder, by the American Institute of Architects (AIA) and the National Association of State Facilities Administrators, but they all include the same principles: (i) multi-party contract; (ii) early involvement of all the parties; (iii) shared risk and reward; (iv) collaboration; (vi) reciprocal trust; (vii) joint development.

The American Institute of Architects defined Integrated Project Delivery as a "method distinguished by contractual agreement between a minimum of owner, design professional and builder where risk and reward are shared and a stakeholder success is dependent on project success". The transformation from a traditional contract to an Integrated Project Delivery agreement imposes an additional shift in order to fulfil the contract.(141)

Due to their structure and composition, traditional contracts unavoidably create a conflict of interest and they impose a rigid division of the stakeholders' works.

The two main standard contracts developed in the US, which can help establish a real collaboration through a multi-party integrated project delivery agreement, are AIA C191 and Consensus Docs 300 series. The integrated agreement creates a system of shared risks, with the aim of decreasing total risks of the entire project.(142) In Integrated Project Delivery most of the consultant and sub-contractors have to join the agreement. A general rule is to have at least half of the construction costs discussed at the decision table. There are two ways to add new subjects to the team: the first is through sub-agreements, as part of the Integrated Project Delivery contract but with the

(141) N. Azhar, Y. Kang and I.U. Ahmad, "Factors Influencing Integrated Project Delivery in Publicly Owned Construction Projects: An Information Modelling Perspective", *Procedia Eng.*, 2014, No. 77, pp. 213-221.

(142) W.A. Lichtig, "The Integrated Agreement for Lean Project Delivery", *Improving Healthcare through Built Environment Infrastructure*, pp. 85-101.

same rights, duties and just a limitation in the voting rights. The second is through joining the agreement, with a consequent amendment to the original version.

The American experience has demonstrated how public administrations prefer a joint entity before a contract is stipulated in which the party is entrusted to design and/or build a project. This is one of the main reasons why framework alliancing was created.

5.1. A Focus on the European Experience on Collaboration

The analysis of the European experience on collaboration should follow three key elements:(143) (i) integrated processes, (ii) inter-operable technologies, and (iii) collaborating people. Integrated Design and Delivery Solutions need collaborative work processes and enhanced skills, with integrated data, information, and knowledge management to minimize structural and process inefficiencies and to enhance the value delivered during design, build, and operation, and across projects.

Collaborative contracts could reflect different schemes, depending on the specific legal order and on the types of relationships that suppliers would intend to enter into, given the competition rules that govern the market and the procurement terms. Generally, consortium bidding might imply a mandate, a temporary association, a consortium or a joint venture, whether corporate or contractual.

That acknowledged, the implementation of BIM might require a significant societal, technological and legal change, especially in the procurement sector, and a step further in collaboration in order to include all the relationships between suppliers under a common framework alliance.

An alliance is a collaborative and integrated team brought together from across the supply chain. The team shares a set of common goals aligned with customer and client outcomes and work under common incentives.(144) During the past years in the United Kingdom many proposals were made to ensure a well-structured collaboration through the supply chain. English contract law constitutes the historical basis of the American contract law. In the same way, it is possible to affirm that both cultures created a series of standard contracts to support collaboration. (FAC-1, NEC4, JTC)

In Europe, the collaborative approach is quite new in the Architecture, Engineering and Construction sector. Actually, it would be more accurate to say

(143) According to Integrated Design and Delivery Solutions, 2013, on the International Council for research and Innovation in Building and Construction, 2009.

(144) Infrastructure Client Group Alliancing Code of Practice.

that there is no such thing as a European approach, as many European countries are trying to import in their procurement systems the British approach to collaborative contracts. A new standard of contract, PPC2000(145)was created at the beginning of this century: used in the last few years, it had a great usage in the private sector and it was also validated by many companies and by the UK government. This document is close to IPD conceptualization, as it is a contract which includes (i) the aggregation of the team, (ii) the entrusting of the project, and (iii) the construction phase. Sometimes, a last point is added: maintenance.

Shared objectives, success measures, targets and incentives are the core of the framework alliance, especially in the FAC-1, which can take a multi-party or poly-party configuration according to a case-by-case evaluation. This collective agreement model was introduced in 2016 in the United Kingdom and has been used for many public and private projects, such as in the case of the construction of popular homes in the *Epping Forest* district for a total value of GBP 25 million.(146) The alliance has a joint aim, the realization of a project guarded by the governance structure of a core group. FAC-1 has been the first contractual model in Europe able to accommodate all the characteristics of this methodology and combine the Architecture Engineering and Construction sector in a single entity. It was adopted in its first year in over 12 B£ of procurements. At present, some States such as Brazil, Bulgaria, Germany and Italy are adopting this contractual form. Actually, among these States Italy is the only country that has imported FAC-1 in its legal system, thanks to the collaboration among different universities.(147) However, still at present in Italy there are some obstacles that are deeply rooted in the stakeholders' mindset regarding the underlying logic and actual implementation of collaborative agreements: on the one hand, the standardization of contracts is undervalued; on the other, economic operators do not often see the contract as a tool capable of facilitating economic and commercial relations.(148) This is even truer if the collaborative agreement is based on the English and American model of hyper-detailed contracts with many annexes and definitions. Since economic operators are not yet used to collaborative agreements and a unified approach is still lacking in the construction sector, the scenario is fragmented in as many contracts as the professions involved in the project; static, as it is focused in the

(145) Association of Consultant Architects, 2010, 10 Years of Partnering Contracts: PPC2000/TPC2005.

(146) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3.

(147) *Ibid*. For more information, *see* also the Web site of the Center of Construction Law and Management and the Italian reference point for FAC-1.

(148) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3.

individual contractual relationship, losing touch with the surrounding context; occasional and not qualified, as the content of the contract and its clauses are uniquely determined by the contracting authority for its own advantage.(149) By encouraging the process of *alliancing* – which would include all the parties in a unique contractual framework containing goals, aims and timeframes, without substituting the individual service contracts signed by each professional involved – the legislator can seek to safeguard the legality of the contractual relations, the control over public expenditure, the reduction of variants and errors, and the emergence of extra costs in the execution phase.(150) The framework alliance is able to accommodate any potential change in the collaboration from the addition of a new member to the sharing of benefits, through a standard format. The benefit which derives from a pre-defined standard is to have all the possible situations already assessed by the drafters.

6. Comparison among different Contract Procedures in the Private Sector and challenges for their application in Public Procurement

The aim of a collaborative contract is to enable and develop collaboration between the owner, the designer and the builders.

In this private sector perspective, the evolution of new technologies and of collaborative processes used in the US and the UK has generated an increase in productivity and a decrease in time wasted in the design, construction and operational phases. That is the reason why BIM and collaborative contracts are conceived to work on the same project, reducing the Architecture Engineering and Construction industry fragmentation. The basic concept underlying these three forms of collaboration is essentially the same, the difference consists in the timing.

Project partnering is an alliance among different parties, typically designers, participating in the tender processes. After that, a second contract is signed to make the construction or the design, but it does not impose a strict collaboration and a complete change of mind-set in the conception of the model. It could be applied to a Design Build process and the collaboration made transversally to the supply chain. It does not require any of the previously described characteristics. This contractual form could be the closest form of traditional approach to a Relational Projects Delivery Arrangement. The advantages of

(149) *Ibid.*
(150) *Ibid.*

this contractual form are that the counterpart is known in advance. Conversely, in the partnering there are no advantages in improving the project to better tailor to meet the owner's needs, as there is no alignment of goals nor other collaborative practice.

The second type of collaborative procurement is Integrated Project Delivery, a method that was developed in the late 1980s in the United States, and it was the first complete collaborative contract, which fits all the parties involved within a single scope, which is the construction of an asset. Integrated Project Delivery is a contract that can work alone without any other agreement. It is designed as a collaboration form defined in any part. This method was also imported into the UK in the form of PPC2000 as a concept, but it was very difficult to import it in public tenders. The reason is that with a single contract there is a group of key participants, who know each other in advance, and combine themselves in a single group, making the implementation of a classical tender process harder. A further evolution of this contractual form is framework alliancing, which is an agreement able to link more contracts together even if they were initially designed as traditional bilateral contracts. It basically is an alliance, which crosses the individual agreements. Therefore, this approach is more adaptive and can be applied in many cases and to most of the current standard forms. Collaboration can be added as a value to contracts that are not originally thought of as collaborative. At the beginning, traditional contracts have a process flowchart, which starts from the owner, through the design team and, only at the end, builders engage with the project. It is a linear and unidirectional process and team members do not have other ways to communicate. In contrast, the collaborative approach requires that participants work together when issues arise. Everyone should pursue the same scope. The framework alliancing introduction, in our system, is the way to engage the constructor role from the beginning of the project, hence all the team members can work to obtain a better building in a cheaper way. In the coming years, every country will have to deal with the problem of introducing this contract typology in order to solve the construction paralysis. Relational Project Delivery Arrangements establish a new approach to the management of construction procurement.

The two approaches analysed so far represent two completely different methods. In particular, the former, represented by Integrated Project Delivery, is an all-embracing contract between all the parties and it can subsist by itself. On the contrary, the second one, represented by FAC-1, is a meta-contract that encompasses the pre-existing ones; hence it cannot subsist by itself. The former needs to be created in a bureaucratic system that would allow it (e.g. the State of Massachusetts does not). On the contrary, the second one could be applied to

create a legal status that includes previous contracts and allows all the parties involved to communicate and have interactions.

In the public procurement perspective, a pressing need is therefore to reorganize the tender process to accommodate a BIM approach in the relevant legal order.(151) This restructuring should take into account a computational view of the contracts based on collaborative processes instead of a traditional opportunistic scheme (*i.e.* DBB). This change leads to a transformation of behaviour and improves the performances of the sector.

BIM methodology thus requires a drastic modification of traditional approaches to the construction sector in all the process stages, especially in the contract framework. To accomplish this digital transition, the Architecture Engineering and Construction sector has to accommodate different contract procedures, either in the private and public sector, in order to reduce the risks of litigation and projects' variants.

There is a cultural gap that slows down the collaboration, which needs to be filled and requires clarification to be addressed.

Although the experiences in the private sector seem to be much more advanced in comparison with those in the public sector, the perspectives opened by BIM methodology and collaborative contracts appear to fit to the issues that arise in the public procurement sector and thus might favour a quick adoption of such new contractual models that overcome the opportunistic divergences between the public and private parties.

In the EU legal system, as initiated in the UK, the public procurement sector should adapt procurement policies and strategies to such a perspective and favour cooperation with the purpose of obtaining the correct execution of the contract and not only a formally compliant award procedure.(152) To this end, the UK Government, pursuant to its 2011 Government Construction Strategy as subsequently updated in 2016, initially recommended the following procurement models: (i) *Cost-Led Procurement*, implying the use of a framework mini-competition to obtain proposals for savings and improved value, within stated cost ceilings, prior to team selection and appointments; (ii) *Two Stage Open Book*, implying the use of pre-construction phase conditional

(151) As per UK legal order, *see* UK Government Trial Projects, as reported in *Enabling BIM Through Procurement and Contracts – A Research Report by the Centre of Construction Law and Dispute Resolution*, *op. cit.*, Chap. 10, "Evidence of links between BIM, procurement and contracts".

(152) The recent publication of the regulation UNI EN ISO 19650-1 and -2, which in addition to EIR – Exchange Information Requirements has introduced AIR – Asset Information Requirements and OIR – Organization Information Requirements, shows that the direction is more and more to consider any single procurement as part of long-standing investment plans pursuing public purposes within budget constraints. This way the logic behind the drafting of a provisional budget should be adjusted to comply with Digitally Enabled Portfolio & Programme Management too. The contracting authorities are then expected to meet such changes and prepare to accommodate BIM methodologies into their procedures.

appointments of the team to obtain proposals for cost savings and improved value, within a stated budget, after selection but prior to construction phase appointments; (iii) *Integrated project insurance,* implying the use of project insurance without recourse, including cover for design problems and cost overruns, to create a no blame culture and obtain additional proposals for savings and improved value.(153)

The so-called FAC-1 model was developed to let the private and public sector introduce framework alliancing – which can work with different contract forms – in standard procedures. Its aim is to directly connect different parties, allowing transparency, which fits in BIM and in joint work, being essential in a collaborative system.(154) BIM cannot be applied to every form of contract though. FAC-1 provides a way to link in a single multi-party agreement the content of each bilateral contract. This means that any kind of two-party agreement, stipulated in a traditional form, can bring collaboration to a project. This framework alliance can be defined as an adaptable form. If project stakeholders are not ready to establish a full multi-party framework alliance, they might enter into a linked FAC-1 with each appointed consultant, contractor, supplier or provider. Generally, such a model should be compatible with any project procurement model that would use its direct award procedure and competitive award procedure.(155)

The framework alliance model has benefited from errors that occurred in other frameworks and alliances. In particular, it builds the improvement of PPC-2000, with the aim of including collaboration through different projects, supporting the improvement of working practice.(156) According to a report published by the Centre on Construction Law and Dispute Resolution, the new standard introduced two main differences compared to the previous one. The first is the introduction of BIM in the public procurement procedure with its technological advantages. The second is the possibility of introducing a transversal supply chain. Such a model might be developed in a more sophisticated system of integrated framework agreements, to evaluate and incentivize the participant suppliers (foremost SMEs). Specifically, this strategy could be realized through a structured division in lots of the contracts that might be included in a framework agreement, or defining, within the agreement, the

(153) *See Enabling BIM Through Procurement and Contracts – A Research Report by the Centre of Construction Law and Dispute Resolution*, *op. cit.*, pp. 29-30.

(154) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3, that refers of a recent tender by the *Unione dei Comuni Adda Martesana*, in Italy, for the construction of a new school in the Municipality of Liscate.

(155) D. Mosey, "FAC-1 Framework Alliance Contract Briefing Paper", London, King's College, Centre of Construction Law, 2016, p. 6.

(156) Architects, T.A.I. of, 2007, Integrated Project Delivery: A Guide, Canada Mortgage and Housing Corporation.

inter-relationship between the private operators and the sub-suppliers in order to manage the supply-chain at tendering stage. This alliance, like other collaborative contracts, might allow the parties to achieve a target shared between team members.

The best practice is the line guiding the evolution of the project. The idea behind such alliance models seems to be the improved value and improved working practices as a result of the use of systems of supply chain collaboration that include in the framework agreement different, yet coordinated contracts, so that the strong negotiating position of the private economic operator upon the subcontractors can be coordinated at the very first phase, and better conditions and incentives for the timely and correct execution of the contract can be ensured. The development of adapted models of alliances could in fact establish mutual commitments related to each lot of the framework agreement.(157) Different models might be developed according to National legal systems, providing different sets of relationship among the suppliers included directly in the framework agreements. Such model might favour SMEs in entering directly the multiple framework agreement obtaining directly their role in the contract execution and reducing the subcontracting issues.

In such models a key role might be played by the Alliance Manager, with the task to coordinate all the participants in the framework agreement. The Alliance Manager should be an impartial subject characterised by a strong commitment with the public administration to solve the problems of the core-group and pursuits to efficiently carry on the execution of the contract. The success of the project is connected to the selected actors, while the maintenance of the working relationships can increase the group productivity and their index of productivity, being understood that the termination of any of such working relationships would provide a further incentive for the execution of additional lots of the framework.

Obviously, such contractual models should be consistent with the public procurement principles of transparency and non-discrimination and be able to face the challenges of innovation and smart contracting that imply technologies and capacity as recently outlined by the EU Directives. Such a perspective might also favour horizontal administrative cooperation among procurement agencies that could define a new strategy of cross-border procurement and overcome legal barriers for the benefit of EU citizens.

(157) D. Mosey, "FAC-1 Framework Alliance Contract Briefing Paper", *op. cit.*, p. 2; S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3.

7. Conclusions

Technologies are shifting the way public procurement is implemented, making it simpler to develop aggregations both on the demand and the supply sides, with an important increase of the level of transparency, efficiency and predictability – thanks to the possibility of sharing data and information that could eventually limit the risks of information asymmetries. In this trend, BIM methodology plays a crucial role insofar as it pushes the adoption of collaborative contracts. In the EU, technologies are considered tools potentially capable of improving the internal market of public procurement, in so far as they could ensure greater participation, objectivity of the evaluation and efficiency in the execution phase.(158) The advanced use of digital tools, such as BIM, might lead to an effective revolutionary change in the procurement sector as it might make available a significant volume of data as never before. Because of that, the definition of public demand could be more precise, and the selection of participants more transparent and substantially objective. The significant volume of data acquired through the BIM and the coherence of the consequent information flow could even allow the structuring of smart contracts to coordinate the different relationships that would characterize the project implementation. This emphasises that the most strategic form of procurement for the effective use of BIM are those schemes, which give rise to greater coordination among all the procurement phases, from the design to the execution and maintenance. Furthermore, such an approach allows purchasing agencies to apply the MEAT paradigm also during the execution stage, where a team-dialogue among the parties, functional to the achievement of the best result, is fostered. To this extent, information becomes a pivotal element, where data interaction and integration serve as tools for describing the organizational structure of the operators and define the share-out responsibility of the parties involved. BIM methodology will thus allow the creation of digital infrastructures that are able to communicate and bring out the effectivity of such information flow, so that they will constitute the basis of any relevant decision-making process of the public administration. This highlights that BIM-based e-procurement may reduce the time and effort variables related with information management activities that have heavy contractual and administrative procedures and documentation.(159)

(158) G.M. Racca, "The Electronic Award and Execution of Public Procurement", *Ius Publicum Network Rev.*, 2012, pp. 13-22; S. Arrowsmith (eds), *EU Public Procurement Law: an Introduction*, Nottingham, U. Not., 2011, p. 248.

(159) A. Aguiar Costa and A. Grilo, "BIM-Based E-Procurement: An Innovative Approach to Construction E-Procurement", *Scientific World J.*, Hindawi Publ. Corp., 2015, p. 10.

Accordingly, BIMmodel becomes a unique repository for all technical, managerial, administrative, and contractual information about the project both to the owner, contractors, designers, or subcontractors. Hence, the BIM-based project significantly improves information management and synergies among these parties aimed at the optimal meeting of the citizens' need also in a circular perspective.

In the new contractual models of cooperation and alliances the public entity should select the best team, as a coherent and efficient group of suppliers ready to work together and with the same goals as the public administration and the citizen, which require the prompt and efficient execution of the procurement. This way, apart from the public-private partnership, the competitive dialogue procedure could be the most appropriate to conduct the selection phase in an open book context.

All in all, these models would allow a real cooperation among contracting authorities and the suppliers, therefore a greater mutual trust, that would be encouraged and improved through the recourse to digital tools and methodologies capable of sharing information and evaluation methods at a reduced cost and with optimized processes. Such an evolution would require training and capacity building both for public procurers and private undertakings to fully grasp the potential of BIM and of collaborative contracts and to find the best way to involve contracting authorities into authentically integrated framework alliances. The adoption of new BIM methodologies and of collaborative contracts would eventually change the traditional aggregation schemes between suppliers and, in accordance to that, require new drafts of the procurement documents, the definition of the professional requirements of the tenderers, the establishment of mutual relationships inside the group and the identification of their common interest in improving their reputation of capacity and efficiency. In this perspective, it would be useful to provide *ad hoc* training to officials involved in the public procurement process and the definition of specific contractual models in conformity with the BIM methodology.(160)

Where correctly addressed, BIM,(161) in the perspective of Legal Information Modelling (LIM), might improve participation and an open comparison of offers by groups of suppliers aggregated in teams, alliances

(160) S. Valaguzza, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, *op. cit.*, No. 3.

(161) Dir. No. 2004/18/EC, Art. 33. The new EU Directive on public procurement includes dynamic purchasing systems among the *techniques and instruments for electronic and aggregated procurement* in the Art. 34. *See* EU Comm., "Report from the Commission to the Council and the European Parliament", EU Anti-Corruption Report, COM(2014) 38 final, *op. cit.*, pp. 31-32; EU Comm., "Evaluation Report Impact and Effectiveness of EU Public Procurement Legislation", *op. cit.*, p. 24; G.M. Racca, "The role of IT solutions in the award and execution of public procurement below threshold and list B

or consortia that could ensure the coordination of their intervention and the continuous monitoring of the work progress under a common framework. Collaborative contracts could indeed align the different goals of the project participants and hence strengthen the relationships along the project lifecycle. Hopefully opportunistic behaviours would decrease and public interest would once again be central. On this understanding, as BIM methodologies develop the dynamic character of the construction project, they would become strategic in order to better enforce efficiency, non-discrimination and transparency principles and favour cross-border participation, especially with regards to major projects aimed at addressing transversal issues. This potential shall thus be borne out by suitable procurement strategies such the "early involvement of key participants", where the main actors collaborate together at preliminary project study phase. The different models of framework agreements represent a strategic tool for the effective use of BIM innovative way of contracting.

To conclude, BIM methodologies might allow the planning, award, execution and management of the complete cycle of life of the public works at reduced costs and enhanced integrity and efficiency. This seems to change the perspective on the work of procurement though, turning it into a wide 'service contract', that provides a flow of cooperation in the execution phase and cooperation for the management and maintenance contracts during the years of the evolving 'life' of the infrastructure over time. BIM methodologies cannot be considered any longer as confined to the design phase, they should instead be thought of as a new way of thinking about procurement implemented through collaborative contracts throughout the project cycle.

services: overcoming e-barriers", in *Outside the Procurement Directives – inside the Treaty?* (D. Dragos and R. Caranta eds), Copenhagen, Djøf Publ., 2012, pp. 385-389.