THE LEGAL IMPLICATIONS OF BUILDING INFORMATION MODELING (BIM) IN PUBLIC PROCUREMENT LAW.

An Italian perspective.

Le implicazioni legali del Building Information Modeling (BIM) nel diritto degli appalti pubblici. Una prospettiva italiana

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Abstract (En): Unlike other European countries, Italy has only recently approached the advent of BIM in the public procurement sector, with a regulatory transposition that still seems far from grasping all the actual potential of the definitive passage from the document to the data for the digital modeling of public works. The purpose of this paper is to identify the essential elements of BIM technology, in order to present to the jurist the benefits that the adoption of information technologies can entail for the entire sector of public contracts. The examination of the experiences of other legal systems will demonstrate the need for the continuation of the path already outlined by the Italian Legislator in the progressive adoption of BIM in public contracts, but also the need for an overall rethink of some institutions of traditional public procurement law. This reconsideration should jointly accompany the transition to digital modeling, filling the regulatory gaps that still exist and ultimately enhancing the potential for the integrity and efficiency of public contracts.

Abstract (It): A differenza di altri paesi europei, l'Italia si è affacciata solo di recente all'avvento dei BIM nel settore degli appalti pubblici, con un recepimento normativo che sembra ancora distante dal cogliere tutte le effettive potenzialità del passaggio definitivo dal documento al dato per la modellazione digitale delle opere pubbliche. Lo scopo del presente contributo è individuare gli elementi essenziali della tecnologia BIM, al fine di presentare al giurista i vantaggi che l'adozione delle tecnologie informative possono comportare per l'intero settore dei contratti pubblici. Attraverso la disamina delle esperienze di altri ordinamenti si dimostrerà la necessità non solo della prosecuzione del percorso già delineato dal Legislatore italiano nella progressiva adozione dei BIM nei contratti pubblici, ma anche di un complessivo ripensamento di alcuni istituti del diritto degli appalti pubblici, il quale dovrebbe accompagnare di pari passo il passaggio alla modellazione digitale, colmando i vuoti normativi ancora attuali ed esaltandone, in definitiva le potenzialità per l'integrità e l'efficienza dei contratti pubblici.

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1 – Introduction. Why a legal study on BIM?

The construction sector and, in particular, the public works sector, is about to undergo – and in part is already undergoing – a revolution of epochal proportions due to the new potential that Information Technology offers in the design and execution of works. Among the protagonists of this revolution there is the BIM, an acronym of Building Information Modeling, which represents much more than a simple productivity monitoring software, being in fact a completely new, dynamic and big data based approach to the planning, realization, verification, testing and maintenance of a construction, able to process information regarding the whole work, from the foundations to the technological systems, as well as to foresee and prevent most of the possible criticalities. The complete digitalization of the production process is undoubtedly one of the first objectives of the technological and industrial revolution in progress, from which no sector seems to be able to reasonably escape. In this context, even the Architecture, Engineering & Construction (AEC) sector has found in BIM its opportunity for full digitization.
However, interest in BIM did not manifest itself simultaneously in Western countries and saw some European countries, including the Scandinavian ones, excel in digital modeling before others, thanks to the traditional open-

mindedness and cultural predisposition to the challenges of modernity. Similarly, as will be said in the course of the discussion, the UK has experienced and analyzed in detail, both from a technical-architectural point of view and from the point of view of legal implications, the general effects of BIM on public contracts, recording astonishing and encouraging results in terms of increased efficiency and reduction of costs or anomalies. Excellent results have also been recorded in the US, where, as a result of a regulatory obligation for public clients to adopt BIM, the *modus operandi* of public bodies and private companies has now changed to the point of stimulating the adoption of digital modelling far beyond the confines of public contracts. The results in these countries have been so encouraging that it seems difficult today to find a Western country that has not yet tackled this issue and has not concluded on the adoption of BIM. But not all legal systems have understood in the same way the advantages that the transition to the creation of an information ecosystem, open to the simultaneous collaboration of all parties, can offer.

In this context, it is certainly not edifying to note the delay with which the Italian construction sector and, even more so, the legal system has dealt with this matter. The lack of knowledge of BIM and the use of obsolete workflow tools by the Public Contracting Stations is a symptom, on closer inspection, of a growing lack of interest, widespread among politicians and many operators, in the new information technologies. The above-mentioned revolution has not been ignored by the Italian Public Contracts Code (Legislative Decree no. 50 of 2016[2]), with which the Legislator has given an overall reorganization to public procurement. With art. 23, paragraph 1, letter h) of the Code, the «progressive use of specific electronic methods and tools such as modelling for construction and infrastructure» was identified as the target for the design of public works, with a view both to making the execution more efficient and to reducing costs, anomalies and opportunities for litigation. With such provisions, however, only a part, certainly important but not complete, of the benefits of the shift to a collaborative approach in the implementation of public works seems to have been taken into account. But more than normative, the delay in the adoption and enhancement of collaborative smart contracts and digital modeling seems to be cultural. As in many other parts of the legal system, also the Italian administrative law sector suffers a traditional delay in fulfilling its essential function of regulating new technologies[3]. The

2 Legislative Decree No 50/2016, *"Implementation of Directives 2014/23/EU, 2014/24/EU and 2014/25/EU on the award of concession contracts, public procurement and the procurement procedures of entities operating in the water, energy, transport and postal services sectors, as well as for the reorganization of the existing rules on public contracts for works, services and supplies*".

3 On the use of big data and algorithms in administrative justice, please refer to G. AVANZATINI, *Predeterminazione, analisi predittiva e nuove forme di intelligibilità,* Editoriale Scientifica, Naples, 2018.

digitization of law is, in fact, an inevitable process that knows no boundaries and cannot be stopped. The spread of BIM represents the opportunity for the digitization of public procurement law, which many virtuous legal systems have been able to take advantage of. In the field of information modeling, the traditional alacrity of the Italian Legislator in intervening frequently on public procurement law has not been sufficiently revealed. Neither the introduction, with Ministerial Decree no. 560/2017 of the Ministry of Transport, of rules and precise deadlines for the mandatory and progressive adoption of BIM in public tenders as of 1 January 2019 on the basis of decreasing thresholds for the amount of the work, seems to have generated adequate and widespread interest among legal professionals on the subject, which is often still perceived as a purely technical and niche issue. On the basis of this laconic observation, the present review intends to highlight, also through the experience of other legal systems, both the opportunities in terms of efficiency, integrity and reduction of litigation that the use of such instruments offers, as well as the inevitable criticalities that their sudden inclusion in the delicate regulatory framework of public or private procurement causes. The legal implications of the adoption of BIM are, in fact, so numerous and so significant that they impose an unavoidable debate among legal professionals at least equal to the one generated among engineers and architects. The risk is to arrive unprepared for the progressive lowering of the thresholds set out in Ministerial Decree no. 560/2017 and the arising of new kinds of disputes based on the use of digital modelling tools, with respect to which it is urgent to update not only the technological but also the legal aspects of public contracting stations.

The task of the jurist is to catch the benefits and to be aware of the critical issues, analyzing in depth the fruitful experiences of other countries of the European Economic Area, in order to be able to adequately assist the construction industry in this delicate phase of transition to BIM, preventing possible legal disputes. A support also legal to the adoption of the BIM seems to be essential precisely because of the objectives that digital modelling sets itself in the field of public contracts: to make the building of infrastructures more efficient, to deflate judicial litigation and, finally, to radically change the paradigm of public procuring in a new collaborative perspective. Collaborative contracts, also known as '*smart contracts*', can, together with the deployment of BIM, transform the face of the construction industry. For the Italian jurist, who has only recently entered these new frontiers of law, the virtuous experiences of systems such as the English or Scandinavian one offer an unreplaceable asset to count on for the transposition of an instrument – the

Similar delays also occur in the area of criminal procedural law, where the diffusion of big data has not yet found adequate regulation in the Italian legal system, despite the European Directive no. 680/2016. See C. COSTANZI, *Big data e garantismo digitale. Le nuove frontiere della giustizia penale nel XXI secolo*, in *La legislazione penale*, 2019.

BIM – which is destined to penetrate definitively the normative framework of public procurement law.

2 – The essential features of digital modeling in BIM. The characterizing information of an infrastructure.

The importance of the construction industry is known to anyone. In the European context, it accounts for about 9% of the Region's GDP[4] and about 18 million jobs, 95% of which are provided by small and medium-sized enterprises (SMEs). Nevertheless, unlike other sectors, the construction industry is still today one of the least digitized sectors, with the lowest performance indices (around 1% per year over the last twenty years[5]). This is due, on closer inspection, not only to difficulties in updating production techniques, but also to the limited use of information technology in the design and, more generally, in the execution of works. From these ungenerous data emerges the clear need to shrink the weight of bureaucracy and the reaction time of the public administration to executive problems, including the proper planning of execution and maintenance, the elimination of diseconomies, the prevention of litigation and costly design variants for the outbreak of unforeseen critical issues. Digital engineering and digital construction seem to offer irreplaceable tools to increase efficiency margins, to an estimated 10 to 20% of capital project expenditure across buildings and infrastructure projects[6]. An increase that both industry and public procurers must duly take into account.

To use the exciting words contained in the *Handbook for the introduction of Building Information Modelling by the European Public Sector*, presented by the EUBIM Taskgroup, the «*digitalisation of the construction sector represents a once in a generation opportunity to tackle these structural challenges by taking advantage of the general availability of best practices from other industrial sectors and of engineering methods and tools, digital workflows and technology skills to shift to a higher level of performance – and to become a digital construction sector*»[7].

4 FIEC, Annual Report, 2017 and European Commission. In Italy, however, without considering the related industries, the impact of the construction sector on the GDP has decreased from about 15% of the years of the economic boom (1960s), to less than 10% in 2019 (Data from the Italian National Institute of Statistics, section of the annual survey "*National accounts; Annual national economic accounts and aggregates; Production and added value by branch of activity*").

5 McKinsey Global Institute, "*Reinventing Construction: A Route to Higher Productivity*", February 2017.

6 BCG, "*Digital in Engineering and Construction: The Transformative Power of Building Information Modeling*", 2017.

7 EUBIM Taskgroup, *Handbook for the introductionof Building Information Modelling by the European Public Sector*, 8, in www.eubim.eu, from which the references and economic data

Building Information Modelling is the solution to the need for digitization of the entire production chain, providing each phase of the contract with more innovative tools, capable of preventing critical issues through the prior collection and sharing in real time of the information of a given work. Although there is no standard definition of BIM[8], it consists of a computer-generated model for the high-definition representation of a building, along all phases of its construction, including a very large amount of information (big data) necessary for the retrieval of materials, construction, testing, maintenance during the entire life cycle, the effective prediction of possible critical issues and interference and each phase of the public procurement. This model, however, is not a closed and static system, being, on the contrary, a collaborative working environment, therefore open to the contribution of all stakeholders, both for the initial exchange of all the information necessary for the correct and extremely detailed design, and to easily make changes to the original information during the work. The potential of BIM could hardly be understood by limiting its conception to a simply more sophisticated three-dimensional digital representation model than the tools now still in use in many systems (including CAD, Computer-Aided Design, etc.[9]). More precisely, BIM represents a «*process focused on the development, use and transfer of a digital information model of a building project to improve the design, construction and operations of a project or portfolio of facilities*»[10]. The BIM has, therefore, transformed the design and execution, with the abandonment of a static project, even if more and more articulated and three-dimensional, and the adoption of a real dynamic and collaborative process, endowed with extraordinary adaptive capacity and discreet predictive ability with regard to problems and costs of maintenance. All the parties involved in the realization of a work are required to exchange information and, each with their own purposes and according to their own skills, to make design changes, including those related to structural aspects and the choice of materials, resulting in a

shown above are taken.

8 D. Doan – A. Ghaffarianhoseini – N. Naismith, - T. Zhang, - U. Rehman – J. Tookey, *What is BIM? A Need for A Unique BIM Definition. MATEC Web of Conferences*, 2019, 266.

9 For the transition from two-dimensional CAD, to three-dimensional CAD, to the development of BIM, see C. Eastman – P. Teicholz – R. Sacks – K. Liston, *BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors*, John Wiley & Sons, 2011

10 PSU Computer Integrated Construction Program 2010. Similarly, and in more detail, *ibidem*, 16, BIM is defined as «*set of processes to produce, communicate and analyze building models […] characterized by: Building components that are represented with digital representations (objects) that carry computable graphic and data attributes that identify them to software applications, as well as parametric rules that allow them to be manipulated in on intelligent fashion; components that include data that describe how they behave, as needed for analyses and work processes, for example, takeoff, specification, and energy analysis; consistent and nonredundant data such that changes to component data are represented in all views of the component and he assemblies of which it is a part; coordinated data such that all views of a model are represented in a coordinated way*».

real paradigm shift in contractual relations. Therefore, it is necessary to create a digital environment characterized by the interoperability of an incredibly high number of information characterizing an infrastructure, with the creation of a common data set and a convention on the nomenclature of the same[11] that allows the easy exchange between different professionals called to work in synergy in the drafting of the works and in their concrete implementation. From the use of a coherent format for all the data processed by the BIM also derives the possibility to carry out, after the design and during the whole execution phase, a model checking, which allows to verify the correct management and elimination of interferences between the different disciplines involved in the design and implementation of the work. In this way, a BIM project can be approved only after all the critical points foreseen by the model have been effectively overcome, which, with a traditional project, would probably have gone unnoticed[12].

Finally, the traditional relations between public clients, designers, contractors, subcontractors and testers have also profoundly changed, overcoming a formalistic and hostile approach to everyone's roles throughout the production chain and injecting flexibility and collaborative afflatus between the parties, in the common interest of efficient building construction. Such interoperability and information sharing, however, does not affect the clarity of the boundaries of responsibility of each actor in the production chain. On the contrary, the sphere of responsibility of each professional is defined, with particular regard to the role of coordination of the different production areas. Considering these advantages, it is not surprising that BIM has easily established itself as a versatile tool, increasingly indispensable in the realization of complex works. This explains why many States have chosen to impose the progressive use of digital modelling in public procurement as a regulatory requirement, with the clear intention of exploiting the benefits to public demand that such an approach offers.

11 To this purpose, we highlight the importance of the shared file format known as Industry Foundation Classes (IFC), founded by the International Alliance for Interoperability (IAI), established with the aim of facilitating the sharing of data in the same format in the construction, engineering and architecture sectors, normally at the basis of BIM software operation. The format makes possible the digital description of all the objects that can be part of a model, such as components and materials, allowing also to bring together in a single model all the projects from different disciplines, such as structure, systems, architecture and even those related to furniture and greenery.

12 With regard to model checking, at least three different levels of analysis can be identified: *Clash detection* (control on geometric interference between the different degrees of the federated model between the different disciplines), *BIM Validation* (activities aimed at analyzing the level of quality of the model, in order to avoid overlapping objects) and *Code checking* (compliance with the information requirements necessary to ensure a consistent and verifiable model).

3 – The requalification of public demand through the implementation of BIM. Efficacy, affordability, efficiency.

The complete «*digital representation of the physical and functional characteristics of a building*» and the prior virtual realization of the work, in addition to providing an important contribution to increasing the efficiency of the sector, make BIM an "open" tool for spreading knowledge and constant interaction between the public client, economic operators and various stakeholders, both in carrying out the procedures for choosing the contractor and in the downstream execution[13]. As mentioned above, public procurement law, starting with the regulation of the procedure for choosing the contractor, cannot remain inert in the face of the complete change in the forms of comparison between operators that is taking place in the major works sector.
The Public Contracting Authority, as first subject interested in making the entire design and construction process more efficient, reducing the risk of errors or variants and ensuring the respect of the estimated expenditure limit[14], is required to ask for the use of the BIM model by all competitors during the tender procedure, drawing up an informational specification attached to the notice as *lex specialis*. The complexity of the drafting of the Employer Information Requirement (EIR), as well as the verification of its compliance for the entire duration of the work and testing, may require the identification by the main contractor of a BIM manager, with the function of coordinator of the entire information flow of the various parties involved. Reducing «*significantly the changes during the contract execution phase, increasing the level of project consistency*»[15], BIM also becomes an instrument for the requalification of public demand. The accuracy and precision of the project drawn up in BIM, especially if verified through the three phases of model checking, determines first of all a reduction of design errors. This, both in the hypothesis of a traditional contract, where the contractor is required to simply carry out an executive project, and in the hypothesis of an integrated contract, where the contractor is required to develop an executive project before execution. Moreover, digital modelling reduces the frequency of cases in which, due to design errors, it is necessary to make variants which, in addition to having a significant impact on construction times, could generate

13 See G. M. Di Giuda - G. M. Racca, *From Works Contracts to Collaborative Contracts: The Challenges of Building Informatin Modelling (BIM) in Public Procurements*, in G. M. Racca – C. R. Yuknis (eds), *Joint Public Procurement and Innovation: Lessons Across Borders*, Bruylant, 2019 (our translation).
14 For support in determining the benefits of using BIM, see K. Barlish – K. Sullivan, *How to measure the benefits of BIM: A case study approach*, in *Automation in Construction*, 24, 2012, pp. 149–159.
15 G. M. Racca, *La modellazione digitale per l'integrità, l'efficienza e l'innovazione nei contratti pubblici*, in *Istituzioni del federalismo,* 2019, 754. See also G. M. Di Giuda - G. M. Racca, *From Works Contracts to Collaborative Contracts*, cit. (our translation).

diseconomies for contractors and costs for the employer, sometimes exceeding not only the sums that can be predicted, but even those actually available, with a traumatic stoppage of construction. Likewise, the advantage of having a common IT environment for the adjustment of the various technical components relating to a building, makes possible to shorten the process of adopting variants, even for those of mere regulatory alignment, identifying with extreme precision the actual higher costs to be paid to the contractor. It is indeed undeniable that it is precisely in terms of design variants that the contracting authorities can derive one of the most significant advantages from the use of BIM. The variant with updated quantities and amounts can once again become a truly exceptional hypothesis as it should be, which also benefits the *par condicio* of the offerors, since the distortive effect on competition of revisions of contractual obligations is clear. To this must be added the risk that, in the hope of obtaining a variant, the undertaking performing the contract may attempt to recover excessive rebates by giving the regulatory institution of the variant a function of economic rebalancing which it should not have. As noted by the Italian National Anti-Corruption Authority (ANAC)[16], with considerations that can easily be extended to all national legal systems, the amount of the variants often coincide with the amount of the discount offered during the selection procedure by the winning contractor, with a distortion often made possible by projects full of computational errors and omissions that oblige public clients to comply with the need to modify the amounts and implementation solutions. The use of digital modelling also offers clear benefits in terms of the amounts of a possible variant. The integrity of the relationship is, in fact, guaranteed by the automated determination of the amount of variant, thanks to the exact predetermination of the required quantities, without leaving any room for discretion. Thus, the use of BIM, reducing to a minimum the risk that a project may present deficiencies or computational errors due to incoherent analysis of certain parts of the building, allows to give back to the design variant the exceptional nature that suits it.

Furthermore, during the execution phase, the BIM offers the client an irreplaceable support in monitoring the constructive progress and in verifying the respect of the chronoprograms to which the company is obliged. In the same way, the use of the BIM and the existence of professionals responsible for the continuous comparison between what has been carried out and what has been declared in the bid, allows public clients to ensure constant compliance with their contractual obligations and the tester to deny the acceptance of works carried out in deformity, without leaving room for

16 ANAC, *Prime valutazioni in corso d'opera trasmesse dalle Stazioni Appaltanti*, Announcement of the President, 24 November 2018, no. 4, referred to in G. M. RACCA, *La modellazione digitale per l'integrità, l'efficienza e l'innovazione nei contratti pubblici*, cit.

discretionary evaluations. Even from this point of view, digital modelling has a deflating effect on the litigation that traditionally afflicts the execution of public works, making the final judgement on performance more effective and objective. At the end, the BIM makes it possible to restore the safeguards for the protection of competition, an essential and primary value on which the entire European discipline of public procurement is based[17].

Finally, the use of BIM makes it possible to indicate, as essential and decisive information in the identification of the various design solutions, the cost of the entire life cycle of the work, on the basis of which the contracting station could rely to identify the contractor.

The adoption of a digital model, open to the contribution of such a large number of qualified subjects, in addition to the traditional 'client-contractor' relationship, determines a radical change in the archetype of the public procurement contract and in the professional requirements of all the bidders. Qualification is of course required first and foremost from the public procurement authority itself, which must have the necessary professionalism to be able to manage public contracts effectively with open digital tools, and to ensure the best use of the potential that BIM can offer from time to time. In fact, the public authority is assigned a role of *dominus* not only of the contractor selection and execution procedure, but also of the maintenance throughout the entire life cycle of the work, constantly assured thanks to a digital model capable of predetermining the necessary maintenance interventions and managing anomalies and critical issues that have occurred, with efficiency and reduction of time and costs. As a result, it is necessary to completely revise the internal structure of public administrations in charge of contracting and monitoring the execution and maintenance of a building, through a redefinition of roles and workflows oriented towards the collaborative attitude that the use of BIM intrinsically imposes. The reorganization presupposes the placement of new highly specialized figures, such as BIM coordinators and BIM managers, in the direction of the works, but also in the bidding committee, in order to ensure that the digital process runs efficiently. In the short and medium term, a public client could equip itself with these figures also through new services contracts, but it is necessary to highlight the need for the interpenetration of these professionals in the organizational structure and the full assimilation of BIM-based reasoning. Without a public administration strongly oriented to digital modelling and information exchange, technically prepared to operate in complex digital ecosystems, the targets of efficiency, affordability and

17 In these terms, it has been suggested that economic operators who were unsuccessful in the tendering procedure throughout the execution and testing phase should participate as guarantors of fair competition from the successful contractor, either at the highest bid or at the most economically advantageous bid, by undertaking to execute the contract as signed. This issue is addressed below, in §4.7.

effectiveness of the administrative action that BIM intends to pursue cannot be fully achieved.
From the above, it is clear why many national Legislators have, with very different timeframes, started to make the adoption of BIM mandatory in public procurement contracts. What will change will be the scenario of the entire production chain involved in the construction of buildings and infrastructures, with natural survival on the market of the only operators able to rethink all their work in BIM. The interoperability between BIM software will undoubtedly guarantee the widest and easiest diffusion of the use of tools among the operators of the construction chain, but they, including subcontractors and suppliers, will be required to radically restructure the industrial process and the company organization, in order to offer adequate support to a project management more and more oriented to the meticulous predetermination of materials and construction choices and less and less characterized by improvisation and attempts to recover delays and diseconomies during the work. In brief, a good functioning of the BIM requires the prior realization of the work in the digital environment, where it is not a construction site worker but a highly trained technician who operates[18].

4 – Legal implications of BIM.

The use of the new technologies of digital modelling and information sharing seems to lead to a redefinition of the legal instruments for the regulation of public procurement. Hence, in addition to the traditional technical figures of the BIM coordinator and BIM manager, it is now inevitable that both public administrations and construction companies will be equipped with in-house lawyers who are experts in the countless legal implications of the use of BIM in the procurement sector and with solicitors specialized in litigation that such use can generate. On the normative level, this revolution does not seem to be adequately managed through the inclusion of ad hoc rules concerning single aspects of the contractual relationship. On the contrary, it should lead, as anticipated, to a general and definitive implementation of the legislative discipline of public procurement for the execution and management of public works, with new forms of “open” collaboration between client, designer, contractor, subcontractors, suppliers and testers. Given this, the jurist is concerned with some immediately perceptible legal criticalities produced by BIM. These criticalities must be taken into account also at the legislative level, since it is the Legislator's task, especially in Civil Law countries, to prepare

18 See below, §8.

suitable rules for the regulation of legal relations, able to grasp the full potential of digital modelling. Below are some non-exhaustive examples.

4.1 – The need for a new contract structure. Notes on "collaborative contracts".

At a glance, it seems necessary to assess whether the current contract schemes are able to fully regulate the obligations related to the efficient use of BIM and the open cooperation between the many stakeholders. This is the origin of the first legal issue, connected to the fact that, traditionally, the contract is signed between two parties, one client, the other contractor, without the direct intervention of all the other parties some-how involved in the execution. So, as a platform open to the collaboration of a multitude of professionals, at least equal to the number of technical substrates involved (architectural, plant engineering, structural, bodies and companies involved, suppliers, subcontractors), the adoption of the BIM makes it at least necessary for each party, as far as it is concerned, to guarantee the fulfilment of third parties' information sharing obligations. Thus, the public client will have to guarantee the constant support to the contractor of the designer in the adaptation of the various executive solutions in BIM. Likewise, the contractor will have to bind himself also on behalf of the supplier and its subcontractors, with specific reference to their competence to use the BIM correctly and their obligation to collaborate with all the stakeholders involved in the platform. In order to do so, the Contractor must share with them the same obligations he assumes towards the Client. The principal contract must also provide for a detailed regulation, also by referring to the special specifications on the use of BIM, in terms of the model used, desirable interoperability, standardization and consistency, but also, inevitably, identification of those responsible for coordination. In order to respond to these needs, it seems inevitable the progressive abandonment of the current contract schemes in use by Public Administrations, with the creation of frameworks as standardized as possible, able to contain the full regulation of the main legal implications connected to the use of BIM for the construction and maintenance of public works[19]. It is not, therefore, by chance that the British Government, in dictating in 2011 its

19 This, also in order to overcome the complexity of managing contracts with different forms and rules. The adoption of a unitary model of digital programming thanks to the use of BIM should lead public clients, at least within the same productive sector and, *a fortiori*, within the same public entity, to standardize the contractual schemes. The Italian experience, characterized by "standard models" of calls for tenders and specifications, suggested by the National Anti-Corruption Authority, having general competence in the field of public contracts as provided for in the Code of Contracts, does not seem to have, in fact, produced the desirable degree of simplification that the Legislator aimed at providing uniform contract schemes.

strategy for the successful adoption of BIM in the public construction sector (Digital Built Britain) has outlined among the key measures, «*the establishment of a new contractual framework for projects which have been procured with BIM to ensure consistency, avoid confusion and encourage, open, collaborative working*».[20]. In fact, the solution of a newly constructed contract for the incorporation of the consequences and peculiarities of digital modelling seems preferable to the possibility of creating a protocol attached to the contract for the management of the BIM, regardless of the latter's ability to prevail over all other contractual provisions through an "order of precedence" clause. If, in the first phase, the adoption of an *ad hoc* protocol seems to be easier, it takes into account the limiting and negative effects of the non-transposition of BIM into the connective tissue of the public-private relationship. The adoption of the BIM does not only cause critical issues that can be overcome with individual provisions and contractual clauses, but requires, first of all, a coherent and complete rethinking of the forms of collaboration between public clients and contractors that should be used to regulate differently the entire time span of the contractual relationship.

This new conformation of the relationship between the parties is achieved through a shift from the adversarial approach to a collaborative approach, which takes due account of all the public and private interests that should be sublimed when the project is implemented, without limiting attention to the offer price on the one hand and the mere expectation of the timely completion of the work on the other. A competitive dialectic between the client and the contractor and between the main contractor and other operators involved in the production chain, in addition to not finding any basis in the reasoning of public bargaining, would not even allow a full enjoyment of the advantages of the information exchange from the offer phase to the maintenance phase in the life cycle of the work. The typically adversarial structure of the contractual relationship tends to exacerbate the critical issues that traditionally plague public contracts. These include design errors, the occurrence of extra costs and unforeseeable unexpected events, undetected defects, inertia, bureaucracy, use of non-conforming materials, delays in the authorization of subcontracting and in making payments. Therefore, where the adverse approach is consolidated and endorsed by the Public Administration, it can only be understood the predictable attitude of the economic operator who, in addition to not sharing his information with other stakeholders, tends to adopt an attitude of mistrust and to pursue only his own interest, instead of the overall interest of the project. BIM technology, thanks to the creation of an open environment for the sharing of data from the early stages of the tender procedure and design, offers operators and the client an opportunity for

20 J. HARTY – T. KOUIDER – G. PATERSON, *Getting to Grips with BIM*, Routledge, 2015, 253. See below, §5.

constant collaborative dialogue, a real "alliance" in the common interest of the efficient consequence of the work required and the best realization of the work. In other words, «*the alliance created by the collaborative agreement can bring added value both for the components of the collaboration and for the client, who will benefit from an efficient and rewarding interaction*»[21].
The new prospect of alliancing has long been successfully tested in the UK, as part of a more general Construction Strategy discussed below. Making such a strategy structural and widespread, through the creation of a single and coherent contractual complex, that includes all the relationships in various ways related to design and execution, appears to be very strict, given the very high level of conflict that the public contract can generate from the earliest stages. In order to make this possible, the structure of public contracts must in any case be rethought[22], recovering the collaborative and equal essence inherent in the very nature of pactum, which practical experience often leads to forget[23]. The abandonment of antagonism in favor of new forms of co-responsibility extended to all stakeholders seems, therefore, to generate a virtuous network that can find in BIM a platform for discussion and an opportunity to rethink legitimate private interests in accordance with those of the client and all the other operators involved, thus adhering to a win-win logic.

4.2 – The difficult risk allocation and attribution of professional responsibility for the incorrect use of BIM.

21 G. M. RACCA, *La modellazione digitale per l'integrità, l'efficienza e l'innovazione nei contratti pubblici*, cit., 754 (our translation). The subject of contracts and collaborative agreements is extremely broad and fascinating. It encompasses both questions of formal qualification of such agreements, as well as more operational issues related to the actual calculability of the productivity advantage they can offer. But, on closer inspection, the perspective through which to look at collaborative contracts is much broader, embracing economic, financial and even social aspects. For a framework of the matter, see also G. DI GIUDA – S. VALAGUZZA, *Gli accordi collaborativi come elemento cruciale per una regolazione strategica nel settore delle costruzioni*, *Working Paper della Collana Scientifica di ANAC*, n. 1/2019, 8; D. WILLIS – T. C. L. ALVES, *Contracting for Collaboration in Construction*, in *Proc. 27th Annual Conference of the International Group for Lean Construction (IGLC)*, Dublin, 3-5 Jul 2019, pp. 809-818; J. MASON, *BIM Fork: Are Smart Contracts in Construction More Likely to Prosper with or without BIM?*, in *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, vol. 11, issue 4, 2019. On a technical level, see B. DANIOTTI – A. PAVAN – S. LUPICA SPAGNOLO – V. CAFFI, *Collaborative Working in a BIM Environment (BIM Platform)*, in B. DANIOTTI – A. PAVAN – S. LUPICA SPAGNOLO – V. CAFFI – D. PASINI – C. MIRARCHI, *BIM-Based Collaborative Building Process Management*, Springer, 2020.
It should not be ignored, however, that the advantages of the collaborative logic can also be well realized in the private building sector, where, moreover, there are no limits and difficulties of coordination with public procurement law in those systems where the latter have a significantly different discipline from private law contracts.
22 See G. M. RACCA, *La modellazione digitale per l'integrità, l'efficienza e l'innovazione nei contratti pubblici*, cit., 751.
23 Effective on the point S. VALAGUZZA, *Gli accordi collaborativi nel settore pubblico: dagli schemi antagonisti ai modelli dialogici*, in *Il diritto dell'economia*, 2019, pp. 255-278.

Another fundamental legal issue related to the use of BIM is risk allocation. The use of new digital modeling technologies requires, as anticipated, a large amount of information regarding, *ex multis*, the characteristics of the materials or goods used, the costs indicated for the same, the type of structures according to the design choices, the nature of the land and all elements interfering with the work, the information entered in the course of work by contractors and subcontractors. Such information must of course always be correct and up to date in order to ensure the proper functioning of BIM. Well, in an open dimension of the model, characterized by the continuous collaboration between the traditional parties (client and contractor) and ancillary parties (designer, suppliers, sub-contractors, bodies owning structures or works interfered with by the works), there is a clear risk that an error in the determination of the data or its inclusion could have devastating effects on the correctness of the model. The importance of the integrity of the datasets shared between the contracting party and economic operators called to operate in any capacity in the production chain, is evident and explains the importance of making all those who can insert or modify the information collected responsible. The traditional regulations on public contracts resolve the risk allocation by charging the contractor for all risks connected with the execution, including calculation errors in construction projects, unless the executive project is provided by a design firm contracted by the Public Administration. The higher cost resulting from an error in calculation or execution is economically burdensome to the contractor, with total disinterest of the Client, especially in contracts where the amount is determined in a fixed and invariable manner with respect to the quantity of raw materials and working hours used. Similarly, in the case of design contracts with professionals different from the contractor, it is the designer who is charged with the higher cost deriving from the need to redesign and, if necessary, rework. Each supplier or sub-contractor is liable to the contractor, who is held accountable for their actions towards the public client. The clarity and simplicity of such a risk allocation gives comfort to insurance companies, called to recognize the necessary insurance coverage to contractors and designers to protect the Public Administration. This configuration of the risk allocation is in no way suitable to assist the realization of a work in BIM through the collaboration open to all the subjects involved in the articulated production chain, who are required not only to read the project in BIM, but also the supply of data already in the initial phase for the first digital realization, then concrete, of the work. The liability for the inclusion of the data involves, in fact, a potentially very high number of subjects in the assumption of risk. Allocating risk and pinpointing fault may not be easy in the absence of a clear regulatory criterion that assigns definitive and preventable responsibilities to all operators involved. For this reason, the essential

obligations of the subcontractor and the supplier must include the assumption of professional responsibility for data entry. It cannot be excluded that, in the freedom of the parties, the financial effects of this liability extended to subcontractors and suppliers will be borne by the contractor in the first instance. Obviously, the assumption of liability, wherever it is ultimately allocated, must be matched by insurance cover against occupational risk.
Also from the point of view of responsibility, special attention must be paid to the responsibility of the software manager, responsible for managing the complexity of data and providing, as output, a project that conforms to the construction rules and is able to predetermine predictable costs and critical issues in a precise manner.
The last aspect to highlight about responsibility is that of the Client's responsibility. Usually excluded from the dialectic between the parties, there are many cases in which the client may be charged with omissive or non-compliant behavior. Restricting our attention to the obligations assumed by the Public Administration in the context of the execution of a BIM contract, it can certainly be noted that this new technology requires the setting up of a public works management structure that is extremely efficient and able to promptly grasp critical issues in the input of information by all parties involved. In any case, the plethora of subjects called to operate in BIM may not belong to the same subject (in this case, the contractor). There could be a number of independent executing companies, each other without any reciprocal obligations, which could be damaged by incorrect or incomplete information provided by the other companies. Consider the case of the designer chosen by the client to draw up the project, which is then carried out downstream by the contractor. Or think of the subdivision of an area for the construction of a public works project into lots with areas of interference between several companies and production chains that are not interdependent. Or, finally, consider the case of insufficient or incorrect information provided by other public bodies owning power lines or works adjacent to or interfering with the construction to be carried out, with which the private executor normally does not assume any relationship, which is managed by the client who requested the work. Well, in all these cases, the point of connection of the responsibility for a wrong use of the BIM platform could be identified in the Public Administration, to which, as anticipated in the previous paragraph, can be addressed claims for damages for fact of third parties. It is certainly not possible to charge the executor or the designer with the greater burden resulting from the inclusion of incorrect information by the public body owning the power line interfering with the public work. In the definition of the complex framework of responsibilities deriving from the adoption of an open platform of collaboration, the role of guarantor must also be taken into account, without prejudice to the right of recourse, assumed by

the Public Administration towards the contractor for the conduct of companies and other public entities involved in the construction of the work. And as the number of people involved grows, so will the complexity of the intertwining of responsibilities. The ability of the BIM to prevent and resolve disputes, albeit net of such complexity, lies in its ability to allocate with absolute certainty the responsibilities of all the economic operators involved in the execution of the work, without excluding anyone. These are the compelling reasons that make clear the need for a complete regulation with contractual value, clearly defining obligations and responsibilities.

4.3 – Intellectual property issues.

Particularly remarkable is also the issue of the intellectual property of the final product of digital modeling, which takes on value for a long time after the realization of the work to allow its proper maintenance. Undoubtedly, the rights over the software used to combine the data should remain with the developer. The model produced by the collaboration between all the parties involved in the project is very different. In order for the model to be complete and useful both to allow its execution with precise predetermination of costs and the maintenance of the infrastructure throughout its entire life cycle, the data processed must be multiple and must cover all the components and processing steps required. The data input also presupposes the codification of the same data, which could be the result of intellectual activity of an IT type carried out directly by the operator solely for the order[24]. It should be added that, as regards components and materials, the manufacturer, through the supplier, must guarantee all the specifications of its products expressed in computer language compatible with that used for the operation of the BIM. The intellectual property of the producer, besides covering the good, must also extend to the codification of its characteristics. Thus, the final product is given by the contribution to different degrees of a large number of operators, including certainly the designer and the main contractor, but also, for example, all suppliers and subcontractors, whose intellectual activity of data input and management must be taken into due consideration in the determination of the intellectual property and in the possible economic exploitation of the final project. The project, in fact, could well assume also economic importance, and could even constitute one of the services paid by the Public Administration to be able to equip itself with a digital model capable of assisting it in entrusting maintenance work on the infrastructure.

24 In fact, used components are not always standard, as it is common in the infrastructure sector to build components designed and built specifically for the project.

The contract is, therefore, called to specify who is entitled to the patrimonial rights for the exploitation of the digital model after the completion of the work, but also the obligation to make it available for the entire life cycle to the client, to allow it to be maintained. The extension of these obligations compared to the traditional extinction of the contract for its full performance constitutes a new element, which public procurement law must take due account of. Abstractly, it seems desirable that ownership of the final model should be transferred to the Public Administration as well as ownership of the work as soon as it is delivered and accepted. For this to be possible, it is necessary that the transfer takes place for a consideration, with recognition of a specific compensation to all economic operators for the activity performed in order to make the model complete and useful in the long term, while, at the same time, assuming responsibility for it for a time at least equal to the declared life of the infrastructure, *i.e.* for the entire period in which maintenance is to be performed. The risk of the information contained in the model being commercialized should be avoided by prohibiting its sale and limiting its usability only for the maintenance of the work, which seems more easily achievable if public ownership of it is maintained.
At the same time, the contract should clearly specify that ownership of the individual information processed by the software does not change, remaining with those who made it available for the implementation of the model as a whole. Think also of the importance of trade secrets and patents, the protection of which must be ensured despite the obligation to include all the information necessary for the proper functioning of the BIM software. Equally important is confidential information, which should not be disclosed to parties other than those employed in the construction of the infrastructure and its maintenance, with the dissemination - or, worse, the marketing - of the model.
Finally, the medium and long term importance of the model and the information contained therein should imply the provision of appropriate tools to constantly counter the risk of hacking and theft of information, as the owner and developer of the software should ensure appropriate tools to constantly protect the integrity of the model and the information contained therein[25].

4.4 – The determination of appropriate remuneration for the use of the BIM and the long-term reduction of costs.

25 See. E. A. Pärn – D. J. Edwards, *Cyber threats confronting the digital built environment: Common data environment vulnerabilities and block chain deterrence*, in *Engineering Construction & Architectural Management*, 2019.

One of the most important aspects for economic operators is certainly the need that all the activities constantly required for digital modelling and its constant updating shall find the right economic recognition by the Public Administration in the determination of the budget of the project. While it is certainly possible to imagine that these costs may be part of the economic dialectic of the bidding price reduction, it can certainly not be imagined that the use of BIM will keep the incidence and determination of overheads on the amount of the work unchanged. The use of staff dedicated on a permanent basis to updating and reading the project in BIM inevitably requires taking into account a greater incidence of the staff course on the contract budget. The number of figures required is extremely variable and depends on the size of the work, the number of information required and, therefore, the number of activities to be carried out by the contractor. In the technical office of the worksite there must certainly be a senior official with the function of BIM manager, but also a variable number of employees assigned to the constant updating of the model. In addition to this, there are the costs of the legal services which, at least in the first phase of the adoption of the BIM, may have to be outsourced to expert lawyers to assist in the negotiation.
The increase in costs, however, is only apparent. All in all, the use of BIM offers a significant reduction in costs thanks to the advantages that have been taken into account in the first part of this paper. Among these, the reduction of the incidence of diseconomies, the possibility to determine the amounts with precision due to a clear predetermination of the quantities, the minimization of the possibility of design errors and consequent variants. While the use of new technologies leads to new skilled labour costs and imposes additional burdensome activities, such as the transposition of all information in code language compatible with the BIM software, it also reduces costs due to diseconomies and unforeseen events, to the benefit of the financial sustainability of the order. It is important that clients understand this aspect properly, as they too are required to make an important initial investment in the digitization of their workforce. Without a deep knowledge of BIM, public client risk to remain passive to the digital revolution, with evident frustration of a good part of the advantages. Likewise, the determination of costs for the use of BIM cannot bow to the need for savings. As much in the internal investments as in the choice of the service provider and in the attribution of the fees to the performers, the logic that should be followed is the one that sees in the investment in BIM technology a more than proportional return in terms of efficiency and cost reduction, ascertainable at the end of the order. These achievements are now widely recognized and found, with varying degrees of impact, in all countries that already make extensive and effective use of these digital tools. Certainly, limiting BIM to a mere design accessory in the execution of public contracts, without really exploiting the countless

benefits that its correct use and absorption in the contractual relationship can offer, only determines costs and does not generate real savings. In essence, taking BIM seriously is what makes the cost of the digital revolution a profitable investment.

4.5 – The upgrading of the entire production chain and the transformation of the market.

The need to operate in BIM can certainly not, as said, be limited to the main contractor. As it is currently structured, the outsourcing of part of the contractor's work and services to subcontractors ensures the involvement of craftsmen and small and medium-sized enterprises (SMEs), whose importance in some national economies, such as Italy, is even greater than that of large companies. It is true, however, that the transition to digital modelling and the recruitment of qualified resources to qualify for public tenders is a cost (*rectius*, an investment) that only a certain segment of the market can bear. Well, this can only be harmful to small and very small companies that usually operate as subcontractors in the execution of public works, which will have to choose between renouncing the execution of sub-contracted works or aspire to continue this business having to incur in the immediate future huge costs for the updating of their staff and the digitization of their production chain. In choosing its sub-contractors or suppliers, the main contractor must not only identify at the beginning of the tender those capable of operating in BIM, but must also transfer to them all the obligations it has undertaken towards the Client and other operators with reference to the operation of BIM.
In addition, the level of specification required for the information to be included in the model must necessarily be transferred to subcontractors, with the assumption by the subcontractors of legally binding obligations towards the main contractor. This means that, in addition to the main contract, the reference to the obligations related to the use of BIM will have to be included in all the subcontracts stipulated, with upheaval of the market and introduction of new legal aspects in the supply chain discipline[26].

4.6 – Procurement and Tendering rules.

Among the possibly most pervasive implications, together with the need for innovative and dynamic contracts open to the collaboration of all parties

26 Similar assessments can be made for supply relationships. It will be inevitable, in BIM regulated works, to exclude all suppliers unable to provide the characteristics of goods and materials in BIM.

involved in the information feeding of the BIM, is the appropriate reconsideration of the way in which the tender is carried out and awarded. From the earliest stages of the awarding procedures, the use of BIM presupposes that the bid is formulated on the basis of a more or less definitive digital model, made available by the client to potential bidders for the insertion of the data required to determine the costs and, consequently, the bid, the auction discount and any improvements. The BIM inevitably transforms the way public tenders are handled, since, thanks to the degree of precision in terms of quality and quantity that it offers, the economic operator will necessarily have to submit a well-determined and calibrated bid on quantities that are no longer hypothetical, but essentially certain. This is to the disadvantage of those companies that rely more on the auction price reduction than on improvements for the award, in the hope of being able to recover part of the reduction with the instruments of traditional procurement law, which, in the cumbersomeness of the discipline, offer many opportunities to correct design errors (such as, for example, on the occasion of variants[27]), which the BIM almost completely eliminates. In the same way, the awarding criteria should also be changed, with preference given to criteria for determining the most economically advantageous bid over the criterion of maximum discount. More generally, it was found that the adoption of BIM in the evaluation of tenders seems to provide a more objective basis for the evaluation of offers and economic operators[28].

The use of a model of precise digital modeling, which allows the preliminary digital realization of the project with an approximation very close to reality, compels to reconsider the determination of the anomalies of the offer and to redetermine the bases of the possible explanation for the defense of the proposed decrease. The result is obviously positive for the Contracting Authority, which should receive only highly considered offers, in order to avoid any reduction aimed only at the awarding of the tender, with the hope, often well-placed, of seeing the inevitable diseconomy deriving from an increase in the contractual amount corrected.

27 On the frequent coincidence of the amount of the variants with the economic impact of the auction price drop, reference is made to the ANAC, *Prime valutazioni in corso d'opera trasmesse dalle Stazioni Appaltanti*, cit.

28 See S. ROSE-ACKERMAN, *Corruption and government. Causes, consequences and reform*, Cambridge University Press, 1999, which mentions, among the factors of failure in the evaluation of the bids, the difficulty of attributing scores on an objective basis to previous experience in public works. In particular, on page 62, we read: «*the use of the past performance as a factor in awarding new contracts has proved difficult to implement because there is no generally accepted technique for evaluating performance*».

4.7 – A new role for non-winning bidders for the defense of the principle of competition and par condicio in the execution phase.

It was rightly noted that «*the information provided through the BIM approach could assume strategic importance also in the pursuit of the objectives of efficiency and integrity*» also through the involvement of non-selected bidders, making them, together with the Public Administration, «*the "supervisors" of the conditions and terms of the contract*»[29]. The availability of a digital model capable of collecting all the information concerning the execution and progress of the work is a formidable transparency tool and could make it possible to entrust non-winning bidders with new tasks. Indeed, these functions are carried out in order to enforce the right to be identified as the new successful tenderer in the event of proven breach of the obligations promised by the contractor during the tendering procedure and which led to the award (for example, the impact of the promised improvements in determining the most economically advantageous tender)[30].
The new role attributed to the excluded operators, through mere access to the information of the BIM model, could constitute a real revolution in the relations between economic operators, whose conflicts are traditionally limited to the disputes arisen over the award of the contract, not extending, due to a lack of control instruments, to the verification of the correct execution and implementation of the improvements promised during the tendering procedure that revealed to be decisive for the award of the contract[31].

29 G. M. Racca, *La modellazione digitale per l'integrità, l'efficienza e l'innovazione nei contratti pubblici*, cit. (our translation). On this subject, see also H. Schroder – U. Stelkens, *EU Public Contract Litigation*, in M. Trybus – R. Caranta – G. Eldstam (eds), *EU Public Contract Law. Public Procurement and Beyond,* Bruxelles, 2010, 443 ss. and G. M. Racca, *The role of third parties in the execution of public contracts*, in L. Folliot-Lalliot – S. Torricelli (eds), *Controle et conteniteux des contracts publics – Oversight and remedies in public contracts*, Bruylant, 2017.
30 See G. M. Di Giuda – G. M. Racca, *From Works Contracts to Collaborative Contracts*, cit.
31 In fact, the protection of competition must inevitably extend also to the executive phase, in which, to take up the well-known Pressetext judgment of the Court of Justice of the European Union (C-454/2006, judgment of 19 June 2008), it was recognized that contractual modifications in progress that are substantial, i.e. capable of altering the balance of the contract, must be considered as a termination of the previous contract and not as a mere variant.
See R. Cavallo Perin - G. M. Racca – G. L. Albano, *The safeguard of competition in the execution phase of public procurement*, in *Quaderni Consip*, VI, 2010.

4.8 – Conflict management, ADR and BIM.

To a large extent, the role of BIM in conflict prevention and resolution has yet to be explored. Disputes are undoubtedly one of the main causes of inefficiency in the implementation of public works and failure to meet deadlines and budgets. Without wanting to investigate here whether it is the propensity of companies to take legal action that constitutes an inefficiency of the public construction sector or whether it is, indeed, the cumbersomeness of the regulatory system and the inefficiency of the public administration that causes the high level of conflict, it can certainly be said that litigation is the enemy of good public procurement. The technological revolution offered by BIM is, indeed, at a first step, also cultural. The collaboration between the parties and the full involvement of the entire supply chain in the updating of the model for the first digital and then real construction of a public work are certainly a reason for reducing the hypotheses of conflict. The elimination of design errors, the predetermination of costs and timeframes, the predictability of some critical execution issues are just some of the benefits that the BIM can offer in terms of conflict prevention.
However, BIM software can play a very important role in resolving the conflict that has already arisen, through data-based dispute management tools offered by digital modeling. Although the positive impact in terms of conflict reduction of BIM has not yet been the subject of a complete investigation, studies are beginning to spread that offer the jurist an opportunity to deal, even in the construction sector, with the issue of decision making algorithms applied to the law[32]. These studies show a clear ability of BIM to offer not only conflict prevention tools, but also conflict management tools, given its ability to predetermine critical issues and to easily allocate responsibilities and increased costs in the production chain.[33]. It is clear that such a use of BIM requires, in addition to a complete regulatory discipline, also a clear acceptance in the contract, where the parties involved in the realization of the work and the Public Administration itself must accept the prior referral of the resolution of the conflict that has arisen for certain aspects to tools capable of being based on or integrated into BIM software.

32 There are many areas in which these new frontiers have opened up unimaginable opportunities until a few years ago. With regard to the resolution of disputes under administrative law, see, *ex multis*, G. AVANZATINI, *Predeterminazione, analisi predittiva e nuove forme di intelligibilità,* cit., and A. SOLA, *La giurisprudenza e la sfida dell'utilizzo di algoritmi nel procedimento amministrativo*, in *GiustAmm*, 2, 2020. With reference to the application of the decision making algorithms to criminal justice, see C. COSTANZI, *La matematica del processo: oltre le colonne d'Ercole della giustizia penale*, in *Questione Giustizia*, No. 4, 2018, pp. 166-188.
33 See C. AREF – C. CHANGSAAR – M. Y. AMINAH – C. HEAP-YIH – C. L. SIAW, *Building information modeling in construction conflict management*, in *International Journal of Engineering Business Management*, 2017, Vol. 9, pp. 1-18.

Among the causes of conflict that the BIM seems able to manage were identified, among others, the failure to determine the exact cost of realization, with a consequent error in the determination of the offer price, the delay of the Public Administration in evaluating the works carried out in order to make periodic payments, design errors and omissions not detected during the verification of the accuracy of the model. The existence of automated or semi-automated conflict resolution tools, admitted and not granted that they may prove to be truly indisputable in merit and method – and it is up to the lawyer to provide an answer to this – can become a deterrent to reckless litigation and a means of preventing the onset of a conflict from leading to a contraction in productivity and the accumulation of delays and increased litigation costs.

4.9 – The essential regulatory role of the National Legislator.

It is quite clear that the amount of risks associated with the use of BIM is far less than the amount of benefits it can offer, but the Legislator is required to provide operators and public administrations with clear guidelines when dealing with the legal implications. Despite the different connotations of the different legal systems and the different weight of public intervention in the economy, it can certainly be considered necessary that it is the legislative power to imprint the principles to which the use of BIM should be inspired. Indeed, the advantages of using BIM are such and many that it explains why many private companies commissioning complex buildings and infrastructure have often required the use of digital modeling, regardless of any legal requirements. In the private sector, it is possible that the legal problems associated with the use of BIM can be more easily traced back to traditional civil law through the use of general institutions. The same cannot be said for the public sector, especially in those systems, such as the Italian one, where public procurement law regulates not only the entire procedure for the selection of the contractor up to the conclusion of the contract, but also certain aspects of its execution. In these systems, the Legislator is required to assume its essential regulatory role, with the definition of rules for the proper management of BIM in public procurement and the provision of all the necessary resources to operate the gradual and complete transition from traditional modeling to dynamic and digital. Institutes such as those of design variants, the registration of claims for compensation by the contractor for the occurrence of facts not attributable to the most onerous and testing must be reviewed by integrating them with the BIM. More broadly, the discipline of the tender procedures, the form of the offer, as well as the selection criteria

cannot remain unchanged once the digital modelling revolution has reached its full completion.
Well, the traditional stability of the institutions of public procurement law must be surpassed in order to pursue objectives of efficiency of administrative action and public bargaining, along lines that only the legislator of civil law countries must dictate in the first instance. Like all the instruments that information technology has offered to the law, the criticalities that are certainly present can and must be regulated. A cultural and technological revolution must proceed within a framework well delimited by political power, which must assist public and private operators in the «*mental passage, rather than operational, from "document" to "data"*»[34] required by the BIM technology, supporting them by dictating the legal principles to overcome the difficulties this passage involves on the traditional institutions of public law or construction law. And in this, not all Legislators have shown the same timing, sensitivity and understanding of the potential of BIM[35].

5 – BIM in the United Kingdom, the Scandinavian countries, and other European systems.

Among the European countries which, before and better than others, have attempted to gain the benefits of adopting BIM modelling as part of a wider strategy to improve the efficiency and performance of public works, a special mention goes to the United Kingdom. Thanks to a clear path of modernization of the construction industry in the public sector, outlined in May 2011 with the Government Construction Strategy and divided into four stages[36], the UK is now at a certainly advanced stage, easily comparable to the US, Singapore and Scandinavia. With the beginning of 2020, the UK entered the fourth stage (level 3), characterized by the widespread and compulsory use of BIM in the design, construction and management of all new public buildings. The interoperability of software is ensured by the BS 1192 regulation adopted at national level, which lays down the essential requirements for the construction and proper functioning of BIM. In addition, the integration of digital modeling on the contractual level is ensured by the "BIM Protocol" realized by the Construction Industry Council and now in its second edition in

34 A. L. C. CIRIBINI, *I limiti del "BIM" e le potenzialità del "dato"*, 17 febbraio 2019, www.ingenio-web.it (our translation).
35 For an accurate overview of all experiences, see. A. SAWHNEY – M. M. SINGH – R. AHUJA, *Worldwide BIM Overview*, in W. PENG – L. HAIJIANG – W. XIANGYU, *Integrated Building Information Modelling*, Bentham Science Publishers, 2017.
36 In particular, with a time spectrum until 2020, a gradual transition between the following levels: Level 0 - 2D CAD drawing; Level 1 - 2D/3D drawing in CAD format; Level 2 - BIM in the design and construction phase, mainly for public works; Level 3 - BIM for the management of the entire life cycle of a public/private building.

2018[37], with which the fear of legal repercussions on the contract of the use of BIM has been fully addressed. The BIM Protocol, to be understood as an appendix to existing or new contracts through the provision of an incorporation clause, is a supplementary legal agreement containing synthetic but extremely effective rules on obligations, liabilities and limitations on the use of BIM. Among the most relevant rules are those relating to the obligations of the Employer and the obligations of the Project Team Member. In addition to this, there are also precise rules on the responsibility for executive differences and the choice of materials, the security of the data entered into the system (described as a primary objective of the protocol) and coordination tools for conflict resolution, the latter already significantly placed at point two of the Protocol. The BIM Protocol is completed by two appendices adaptable to the specifics of the case in point, useful to ensure the functioning of the BIM, one concerning the Model Production and Delivery Table and another one concerning the Employer's Information Requirements. The great ductility of this document lies in the possibility to incorporate it in all the contracts of the supply chain, in particular those signed by the main contractor with subcontractors and suppliers, to ensure the creation of a large data sharing environment in BIM consistent and with precise assignments of responsibility to all operators.

In this virtuous scenario, the collaborative contracts model has spontaneously become an integral part of the digital strategy since the adoption in 2000 of the first Project Partnering Contracts model[38], to which was added in 2016 the famous Framework Alliance Contract (FAC-1), a standard multilateral contract model, suitable to create that shared network of obligations of transparency and mutual collaboration between private operators and Public Administration. The FAC-1 is characterized by shared principles and objectives to be adopted flexibly in different circumstances, from litigation to the conclusion of bilateral contracts with other operators involved in the production chain. Naturally, the model includes the use of the BIM[39], which confirms itself as an instrument of exceptional effectiveness in promoting

37 Accessible to the link *http://cic.org.uk/admin/resources/bim-protocol-2nd-edition-2.pdf.*

38 The first PPC model was launched in September 2000, after being formulated by the Construction Industry Council (CIC) in collaboration with the Association of Consultant Architects (ACA). the CIC also published the 2005 TPC, the first standard form Term Partnering Contract which applies the principles adopted by PPC 2000 to term contracts. The first application of the PPC concerned a range of housing, office and school projects, including refurbishments and new builds in both the public and private sectors. PPC 2000 provides a pathway for the partnering process. It creates a single contractual hub that allows all team members to contract on the same terms, without the need to sign other agreements. It regulates the project management processes, methods and the conduct of the parties in all project stages, from the design phase to the conclusion of the execution.

39 See D. MOSEY *et al*, *Enabling BIM Through Procurement and Contracts*, King's College, 2016.

efficiency in public contracts through the precise predetermination and constant sharing of information relevant to construction[40].
Also in other European systems the use of BIM has reached a level of full assimilation in the economic and cultural substratum of the construction industry, also through the foundation of a new culture of partnering, information exchange and collaboration in the common interest of efficient and timely execution of the works, which soon proved to be able to stimulate the interest also of the financiers of private works[41]. Among the first countries to adopt BIM in the design and construction of complex works are the Scandinavian ones, with the creation of Building Smart Nordic, a non-profit organization owned by Sweden, Finland and Denmark, to which Norway is added as an observer, with the aim of promoting the full exploitation of digital modeling to benefit both the community and private companies, thanks to the recovery of productivity and efficiency. In Finland, the use of BIM has been common since 2001, and since 2007 the Government has required all software manufacturers operating in the state to obtain IFC certification, to ensure total interoperability between systems and information. In Sweden, the Swedish Standard Institute (SSI) has been promoting the adoption of BIM since 1991 and the reception of BIM has been so enthusiastic that it does not require any particular imposition or guideline from the Government, which only provided it in 2015[42]. Similar are the experiences of Denmark, where the use of BIM has been imposed since 2011 on all regional and local institutions[43], and Norway, where, thanks to the collaboration between the Norwegian Homebuilders Association and the Norwegian Directorate of Public Construction and Property (*Statsbygg*), since 2010 almost all public buildings have been constructed in BIM through virtuous forms of Project

40 For an overall examination of BIM in the English contest, see. B. MCADAM, *Building information modelling: the UK legal context*, in *International Journal of Law in the Built Environment*, Vol. 2, no. 3, 2010, pp. 246-259.
41 For a complete summary of the progress of BIM adoption in Europe, please refer to the study conducted in March 2019 by the European Construction Sector Observatory, entitled Building Information Modelling in the EU construction sector, accessible at this link: *https://ec.europa.eu/docsroom/documents/34518/attachments/1/translations/en/renditions/native*.
42 See M. HOOPER, *Bim Standardisation Efforts - The Case Of Sweden*, *in Journal of Information Technology in Construction*, vol. 20, 2015 and E. ENGLUND – M. GRÖNLUND, *Current Legal Problems ans Risks with BIM in the Swedish AEC Industry*, Royal Institute of Technology – Department of Real Estate and Construction Management, 2018.
43To this was added the Regulation 1365, adopted in 2007 (extended in 2011 with the ICT Regulation 1381, and in 2013 with the ICT Regulations 118 and 119) with the aim of promoting the integration of ICT in the construction sector, thus increasing productivity. More generally, see L. F. USSING – J. K. LARSEN, *Implementation of BIM in the Danish Building Sector*, in *Proceedings of the 7th World Conference on Mass Customization, Personalization, and Co-Creation (MCPC 2014)*, Springer, 2014, pp. 265-274.

Partnering Contracts, which have clearly enhanced the benefits of digital modelling[44].
It is also worth mentioning the German experience, in which the Government, with the "*Planen-bauen 4.0*", has provided for the transition to BIM development of all contracted works by the end of 2020, with the contextual definition of rules for the creation of an open data environment and a collaborative approach between all parties[45]. Not dissimilar are the French experience, whose time horizon for the final transition to BIM and the creation of an open and interoperable digital ecosystem in the field of public procurement is 2022[46], and the Spanish one, where the project "*es.BIM*" has already led to a technological transformation of the construction market[47], with an exploit in 2018 that marked the 700% increase of calls for tenders in BIM compared to the previous year[48].
As can be expected, the adoption of BIM has been almost everywhere accompanied by the drafting of Protocols containing the main rules for the attribution of obligations and consequent responsibilities to operators in the supply chain and to the Public Administration itself. Some of the best-known and most appreciated protocols at European level include the Finnish (*Cobim*) and Norwegian (*Statsbygg*) ones. Outside Europe, in addition to the appreciated protocols and guidelines published by the American Institute of Architectures, the Australian protocol (*Naspec*) and the Singapore protocol (Building and Construction Authority), which appear to be strongly influenced by the English and American model, are also worth mentioning.

6 – A preliminary transposition of BIM into Italian law. The Ministerial Decree n. 560/2017.

The Italian situation seems peculiar compared to the rest of the European context. Although the path for the definitive transition to digital modelling appears to have begun, it cannot yet be said that it has been completed or

44 On the Norwegian case, see A. TADAYON – P. WONDIMU – O. KLAKEGG – B. ANDERSEN – O. LÆDRE, *Project Partnering in the Construction Industry: Theory vs. Practice*, in *The engeenerign Project Organisation Journal*, Vol. 8, 2018.
45 See. G. M. Racca*, La modellazione digitale per l'integrità, l'efficienza e l'innovazione nei contratti pubblici*, cit., 745.
46 On this topic, A. TRANCHANT – D. BELADJINE – K. BEDDIAR, *Bim In French Smes: From Innovation To Necessity*, in A. GALIANO-GARRIGOS – L. MAHDJOUBI – C. A. BREBBIA (eds), *Building Information Modelling (BIM) in Design, Construction and Operations*, WIT press, 2017, 135 ss. and "*Plan Bim 2022*" by *Ministère de la Cohésion des territoires et des Relations avec les collectivités territoriales*, in *www.cohesion-territoires.gouv.fr*.
47 M. D. VIVAS – P. DEL SOLAR – A. DE LA PEÑA – S. ANDRÉS, *Implementation of BIM in Spanish construction industry*, in *Building & Management*, vol. 1, 2017.
48 *Report 2018*, accesible here: *https://www.esbim.es/es-bim/*.

even sufficiently digitized in the public contracts sector[49]. Likewise, the planned changeover to BIM modelling has not yet been accompanied by a full-scale debate within the legislative and executive bodies on the possibility of using BIM as a means of updating procedures and institutions subject to very frequent changes, most often in mere adjustments induced by the necessary compliance with European standards and the constant warnings of the Court of Justice of the European Union. The reality is that, in the current ordinary structure of the public contracts sector, the time seems not yet mature for a real and proper transition to the digitization not only of projects, but also of procedures, as well as for the opening up to truly collaborative forms to carry out the comparison between client, contractor and other operators. This is despite the fact that the public contracts sector is studded with an innumerable series of legal criticalities, operational problems and chronic inefficiencies that should suggest an urgent digitization and the transition to collaborative forms of the relationship[50].

The Italian Public Contracts Code (*i.e.* Legislative Decree no. 50 of 2016) has identified digital modelling as a tool for rationalizing and making the execution of complex public works more efficient, referring to a more detailed regulatory source for the regulation of BIM. So, in order to achieve the objective set forth in art. 21, paragraph 1, letter h) of the Italian Public Contracts Code, as well as implementing the provisions of art. 23, paragraph 13 of the Code[51], the Ministry of Infrastructure and Transport issued Ministerial Decree no. 560 of 2017[52], with which it provided for the gradual introduction of BIM in the design, construction and management of public works (art. 1), according to the timeframe based on the amounts of the tender

49 For similar conclusions S. VALAGUZZA, *Governare per contratto. Come creare valore attraverso i contratti pubblici*, Editoriale Scientifica, 2018, as weel as G. M. RACCA, *La modellazione digitale per l'integrità, l'efficienza e l'innovazione nei contratti pubblici*, cit., 747 and G. L. ALBANO, *Il Public Procurement come stimolo alle PMI: il caso del Mercato Elettronico della Pubblica Amministrazione Italiana*, in *Riv. Pol. Econ.*, VII-IX, 2014.

50 See S. VALAGUZZA, *Gli accordi collaborativi nel settore pubblico: dagli schemi antagonisti ai modelli dialogici*, cit., 261.

51 Which it envisages: «*Contracting stations may require the use of the specific electronic methods and tools referred to in paragraph 1(h) for new works as well as for rehabilitation, upgrading or variants, with priority for complex works. Such tools shall use interoperable platforms using non-proprietary open formats in order not to restrict competition between technology providers and the involvement of specific design specifications between designers. The use of electronic methods and tools may only be required by contracting stations with appropriately trained staff. By decree of the Ministry of Infrastructure and Transport to be adopted by 31 July 2016, also with the assistance of a Commission specifically set up within the same Ministry, without additional charges to public finance, the methods and timescales for the progressive introduction of the aforementioned methods at the contracting stations, the granting authorities and economic operators are defined, assessed in relation to the type of works to be entrusted and the digitization strategy of public administrations and the construction sector. The use of such methods shall constitute a parameter for the assessment of the bonus requirements referred to in Article 38*».

52 *http://www.mit.gov.it/sites/default/files/media/normativa/2018-01/Decreto%20Ministro%20MIT%20n.%20560%20del%201.12.2017.pdf*

mentioned at the beginning, and described in art. 6. In particular, since 1 January 2019 the use of BIM has become mandatory for all complex works relating to works with a tender value of EUR 100 million or more, progressively decreased to EUR 50 million from 1 January 2020, EUR 15 million from 1 January 2021. From 1 January 2022, on the other hand, the use of the BIM will be mandatory whenever the tender-based amount exceeds the so-called thresholds of European significance as per art. 35 of Legislative Decree 50/2016. Subsequently, from January 1, 2023, the extension of the mandatory use of BIM will cover all works with a tender amount equal to or greater than one million euros, to be then generalized to all tenders for works of any amount from January 1, 2025. On the basis of this timetable, the switchover to digital modelling for all contracts with a value of less than or equal to EUR 1 million by 1 January 2025 will bring about a global transformation in the market for construction companies engaged in the construction of public infrastructure. Briefly reviewing the Ministerial Decree, amongst the requirements preliminary to the adoption of the BIM, art. 3 inevitably requires contracting stations to prepare a training plan for their staff, but also the preparation of a plan for the purchase of hardware and licenses for the use of software for the digital management of the appropriate decision-making and information processes through the tools provided by public contract law and, finally, the emanation of an internal organizational act that explains the process of control and management, the data managers, as well as the management of any conflicts. The adoption of digital modelling must be adequately regulated in the *lex specialis* of the procedure for selecting the contractor, through specific provisions, in particular, in the special tender specifications, in which the modalities of use and interoperability of these tools are to be regulated (Article 7). In support of the contracting stations, a commission is then set up to examine and resolve the main criticalities reported from time to time in the application of BIM (Article 8). Finally, from the point of view of the entry into force, art. 9 of the Ministerial Decree has made a certainly courageous choice, in providing for the obligation to adopt the BIM according to the amounts to all the procedures for the award of public works, in which the design phase has not yet begun on the date of entry into force of the Decree (27 January 2018).

Since the adoption of the Ministerial Decree, there has been no lack of criticism from both procedural and substantive points of view. Regarding the nature of the legislative act, the Plenary Meeting of the Council of State has already highlighted the erroneous failure to qualify the Ministerial Decree and the consequent evasion of the Council of State's opinion[53]. From the point of

53 See *Final opinion of the Council of State on the update of the Guidelines no. 1 on "General guidelines on the provision of services relating to architecture and engineering", in implementation of Article 213, paragraph 2, of Legislative Decree no. 50 of 18 April 2016, consultative section, measure no. 1349/2019*, which reads as follows: «*In this regard, it*

view of merit, much more relevant here, it was first of all noted the conspicuous absence of binding references to international standards UNI 11337, with the consequent risk of compromising the effective interoperability and equal quality of Italian models compared to international ones. The absence of any sanction whatsoever for the Contracting Stations that do not adopt the BIM in the procedures included among those for which the Ministerial Decree provides for its adoption. To this must be added, as anticipated, the general forecast of a use of the BIM still very much focused on the design phase, without taking sufficient account of the full potential of digital modelling in terms of changing the conduction of the bidding phase and the collaborative comparison phase during execution and subsequent maintenance. In brief, what can be recognized to the Ministry of Infrastructures is that it has implemented the provisions of the Procurement Code, which, however, regulates the traditional institutes without taking into full consideration the efficient potential of the BIM[54].

This leads to believe that in the Italian legal system there is still a preliminary phase of "procuring with BIM", which should be followed as soon as possible by a step-by-step programming, on the Anglo-Saxon model, of the implementation and integration of digital modeling in the structure of public procurement law. Even today, the avant-garde theme of "collaborative contracts" is still traced back to general regulatory sources such as art. 1322 of the Civil Code, since there is no reference to this new paradigm of relations with the public administration in the implementation of public works in the 2016 Code, which should be configured as an ideal place for their complete discipline[55]. Therefore, the acceleration that the Ministerial Decree n.

should be noted that the Decree of the Minister of Infrastructure and Transport of 1 December 2017, no. 560, has not been submitted to the opinion of the Council of State, despite its regulatory nature. With regard to the legal nature of the Decree of the Minister no. 560 cited above, it should be noted that its qualification as a regulatory act is inferred from the contents of the measure, regardless of the fact that the above mentioned primary legislation does not refer to the regulatory nature of the act. In fact, the fact that the source of the legislation providing for it does not qualify the act as a regulation does not mean that the form and procedure prescribed by Article 17 of Law No 400 of 1988 must, in any event, be observed for its adoption if the act actually has the characteristics of the 'regulation': generality, abstractness and innovativeness (Constitutional Court 22 July 2010, no. 278 and 21 October 2011, no. 275; Council of State Plenary Meeting 4 May 2012, no. 9; Council of State, Section VI, 27 May 2005, no. 2731; Council of State, Section VI, 18 February 2015, no. 823)» (our translation).

54 The very fact that the entry into force of the Ministerial Decree is extended to procedures that are already underway, but in which the design phase has not yet begun, confirms that the adoption of the BIM, as understood by the Ministry of Infrastructure and Transport, has no impact on the contractor's selection procedures themselves, starting from the writing of the special specifications, the determination of qualification requirements and the submission of bids, still limiting itself to the mere preparation of the design documentation.

55 Very clear on the point is S. VALAGUZZA, *Gli accordi collaborativi nel settore pubblico: dagli schemi antagonisti ai modelli dialogici*, cit., 269 where it is stated that «*obviously, if we refer specifically to our legal system, we would have to say that these are atypical agreements, since they are not regulated in the Civil Code or in special laws, nor are they regulated in the*

560/2017 wanted to give to the diffusion of digital modelling in the design and execution of public works and infrastructures, represents an appreciable, but not yet sufficient, attempt to fill a cultural and technological gap with other North European systems, in which, as anticipated, the use of BIM has already had a deeper absorption in the legal system and in the industry.
Given this, it can certainly not be said that in terms of design activity, our system has not begun to effectively implement BIM. This is clearly demonstrated by two pronouncements of two Regional Administrative Courts (TAR), which, for different reasons, have been called to pronounce on issues related to the application of BIM to public contracts. In a first ruling, the Lombardy Regional Administrative Court rejected the appeal by one economic operator against the non-exclusion of another operator which, in the context of an integrated contract (*i.e.* including design and construction), had submitted a project in BIM whose method of representation was considered not to comply with the requirements of the *lex specialis*. The Court of Milan, demonstrating a good understanding of the function and characteristics of BIM, rejected the appeal on the grounds that «i*n the BIM methodology, attention must be paid to the concept of information rather than the method of representation of individual objects*»; information all correctly reported in the project, as verified at the request of the Court by the Polytechnic of Turin[56]. In another ruling by the Liguria Regional Administrative Court, the issue of the ability to guarantee interoperability for the purposes of qualification of the economic operator, called upon to provide the design service in BIM, was examined in depth. Well, having clarified that one of the main merits of BIM consists in «*allowing the continuous exchange of data necessary for the construction and subsequent operational life of the work*», the Court went into the merits of the appeal, which challenged the failure to meet a qualification requirement for the design of a hospital consisting in the demonstration of having previously exchanged data with a certain format within a BIM model. In rejecting the claim, the Administrative Court pointed out that the rationale for such a request had to be found in the possession of adequate experience in the use of BIM, a requirement which could be demonstrated even without proof of specific previous experience with the

Collaboration Agreement or similar. Consequently, in our system, collaborative agreements, qualifying as atypical agreements, would find their basis in Article 1322 of the Civil Code, which admits that the parties can freely determine the content of contracts that do not fall within the types, as long as they aim to achieve interests worthy of protection under the legal system. From this last point of view, it seems that no doubt can be raised that the content of the collaborative agreements would exceed the admissibility assessment on the merits, necessary to recognize the lawfulness of the atypical agreements, considering that the discipline of the collaboration, as we have seen, is aimed at bringing benefits both in economic and qualitative terms that end up improving the substantial result that a certain activity prefigures» (our translation).
56 Lombardy Regional Administrative Court, Milan, Section One, sentence no. 1210 of 29 May 2017 (our transaltion).

exchange of data in a given format. In agreeing with the outcome, it should be pointed out how important it would be for a regulatory source, even a secondary one, to indicate the formats to be used for the realization of BIM models in the field of public procurement, as it is not possible to leave this identification to the contracting stations alone. This would entail, in fact, not only the risks of compromising interoperability if a format not widely used and not used by suppliers and other operators in the supply chain were chosen, but also a serious difficulty in assessing the operator's qualification, as happened in the present case[57].

On the overall, it can be said that the adoption of BIM in Italy has reached, on the regulatory level, an initial recognition, with imposition on the Contracting Stations through a sharable progressive mechanism. However, as has been pointed out, the adoption does not seem to have embraced the full benefits that could offer - and in other European systems it is offering - the transition to digital modelling, data interoperability and information sharing among all stakeholders to overcome asymmetries. From the point of view of the impact of BIM on the traditional institutions of public procurement law, there is no serious impact, as well as the diffusion of best practices characterized by the use of collaborative agreements remains isolated and not yet significant[58]. Nevertheless, it can now be considered a revolution in the discipline of public procuring, since it is unthinkable that the BIM revolution is limited to the purely design aspects of it.

7 – Statistical notes on the incidence of BIM in public tenders launched in Italy.

From the statistical analysis of the public procurement sector conducted in Italy by OICE (Confindustria) from 2018 to nowadays[59], some encouraging data emerge. In 2018, there was a number of tenders launched with the forecast of the use of BIM up by 263.9% compared to 2017, with a growth trend that was also confirmed in the first year of mandatory BIM (2019),

57 Liguria Regional Administrative Court, Section I, Genoa, Section One, judgment no. 930 of 26 November 2018 (our transaltion).

58 The Centre of Construction Law and Management in Milan reported two virtuous examples of small Italian municipalities (Liscate and Melzo) that have opted for an experimental use of collaborative agreements. The Study Centre has also effectively translated the English FAC-1 into the Italian reality, with the drafting of an experimental protocol since 2016 accessible at the following link *https://www.unimi.it/it/ricerca/innovazione-ricerca-e-imprese/ricerca-commissionata/modello-di-accordo-collaborativo-fac-1*. This is in spite of the many public-private partnerships provided for in public procurement legislation. See the recent overview made in F. NICOTRA, *Collaborare per migliorare il partenariato pubblico-privato*, in *Il diritto amministrativo*, n. 5, 2020.

59 *https://www.oice.it/638197/rapporto-sulle-gare-bim-2019*.

expecting around 58.3% compared to the previous year. The figure seems to demonstrate that the interest in BIM does not entirely depend on the existence of regulatory constraints and, at least for 2018 where the obligation was not yet in force, is explained by the diffusion in our country of the first studies on the advantages of digital modeling. Analyzing now in more detail these data, it emerges that both in 2018 and 2019, a constant percentage, which is around 7% (6.95% in 2018, 6.9% in 2019), concerns framework agreements, by their nature more difficult to express in BIM due to the fragmentation of interventions and, indeed, precisely because of the latter feature, ideal ground to test the advantages of efficiency and rationalization of BIM. Analyzing only the tenders for engineering and architecture services for design, the use of BIM was requested in 19.7% of the calls issued in 2019, with a surprising result regarding the tenders above the Community threshold (where the request for BIM concerns 56.1% of the calls), but above all below the Community threshold, where, although not required by sector regulations, the Contracting Stations requested the development of the project in BIM in 21.5% of the calls.

Taking the type of infrastructure as a reference, in 85.4% of the cases the use of BIM was required for complex works of the "punctual" type, i.e. spread over a restricted area, with a high number of interferences between different phases and work areas. This type includes executive and office buildings, but also hospitals. Among the calls for tenders in BIM, linear works such as roads, motorways, viaducts, and tunnels occupy only 14.3%, even though the use of BIM in this field has proved to be very useful in other European experiences.

Taking, finally, the subjective nature of public procurers as a reference, the majority of public clients who opted for procuring with BIM belong to the central and peripheral state administration (35.8% of total calls for tenders), followed by municipalities (26.4%) and the concessionary companies on behalf of the State required to apply the Public Contracts Code (12.6%). Among the state administrations that were particularly zealous in the adoption of BIM, also thanks to fruitful collaborations with universities such as the Polytechnic University of Turin, there are ANAS S.p.A., responsible for the management, construction and maintenance of the Italian road and motorway network, and RFI S.p.A., responsible for the management, construction and maintenance of railway lines[60]. In the absence of a uniform protocol, similar to the one offered by the English Construction Industry Council (CIC) mentioned above, these contracting stations are now also engaged in the difficult task of defining information specifications to guarantee the quality and effective

60 A clear example of this is the "white paper" on the use of Building Information Modelling, adopted since 2013 by Italferr S.p.A., a company of the RFI S.p.A. Group, dedicated to design services and accessible at the link: *http://www.italferr.it/content/dam/italferr/expertise/innovazione/Innovare%20per%20progettare%20il%20futuro.pdf*

interoperability of operations and to predetermine, albeit with a minimum degree of delay, the legal implications that the advent of such an instrument generates in a still highly traditionalistic and substantially unchanged regulatory context. The lack of a shared Protocol for the contractual regulation of BIM certainly seems to delay a full assimilation of digital modelling in the field of large works.

8. – Conclusions. The role of the jurist.

The scenario of procurement law has now changed even in those countries, such as Italy, where there is a delay in the adoption of BIM, and there is now a growing awareness that an approach to public works based on information asymmetries and conflict is destined to disappear. What seems to emerge from the analysis of the contracts launched in Italy in the last two years is an important diffusion of digital modelling, despite the fact that the adoption of BIM has not been fully mature and has not fully embraced the potentially beneficial effects offered.
If it is significant the number of Contracting Stations that have started the transition from the static CAD model to the dynamic and open model offered by the BIM, admittedly this corresponds to a real ability to manage the new forms of collaboration still underestimated at the moment, the picture that concerns private companies, not yet cared for by OICE, seems to give different results. The weak part of the chain risks being precisely the small and medium private enterprise, called (*rectius*, almost obliged) to make a costly transition in terms of time, investments, and efforts of its staff without sufficient attention from the Public Administration. It is clear, in fact, that if public demand wants to take advantage of BIM, private supply must rise to the challenge, not only by offering projects in BIM or by demonstrating that it knows how to create a complex work starting from a digital and informative representation of it, but also and above all by demonstrating that it knows how to grasp the underlying digital revolution. The mechanical adoption of BIM as a mere different design representation of the infrastructure or the work, without a backward cultural renewal in the way of doing business in the public procurement sector, would demonstrate a lack of technological understanding and would ultimately determine the non-qualification of the company in public tenders. A low diffusion of BIM among private companies is, however, first of all a damage for the Public Administration itself, which would see the competition of a sector already strongly affected by the most recent economic crises even more restricted. On the other hand, if this risk were to materialize, the objectives of efficiency, integrity and disincentives to litigation that inspired the national Legislator to request, in the Code of Public

Contracts, the passage to this different conception of the public contract, would be disregarded.
Finally, in this revolution, the greatest effort is required of small public procurers and private companies that want to continue to operate in the field of public procurement. However, the transformation required does not only cover the technical side of a public or private organization. The adoption of BIM has such significant and numerous legal implications that the transition to digital modeling without a complete knowledge of the tool by those who are called to regulate the relationship in the contract is a necessity from which no one, neither the public client nor the contractor nor the other operators in the production chain, can escape. The transition to BIM is already changing the essential structure of the contract, but it is also changing its essence, to the extent that, while waiting for clear indications from the Legislator, the general rules of civil law would already allow for “collaborative contracts”. The jurist, especially the one engaged in the management of the contract and in the prevention of litigation, is required a deep knowledge of the new critical issues that BIM may involve, which is only partially taken into account in this paper. If all the public and private players are asked to change their traditional institutions, the jurist is required to make an even greater intellectual effort: to know how to understand and facilitate the cultural re-foundation of the dialectic of the relationship between public client and contractor, looking at the positive experiences of other European countries. If this step can be taken and extended also to private works, this will be to the advantage of efficiency in the broad sense that the construction sector, as mentioned in the introduction, needs for the definitive transition to industry 4.0.