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The use of FAC-1 as a contractual integrator enhancing the use of BIM: a focus on the Liscate school in Italy

El uso del FAC-1 como integrador contractual para favorecer el empleo del BIM: una mirada a la escuela de Liscate en Italia

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Abstract:
This paper reflects on the capacities of enterprise contracts, such as the 'FAC-1 Framework Alliance Contract', to facilitate and enhance the success of BIM processes.

We will consider some of the main legal issues arising in the development of a project using BIM processes and will show how the application of FAC-1 as a collaborative framework helped tackle such legal issues on a school project undertaken in the municipality of Liscate in Italy. We will highlight how, on the Liscate project, the correct combination of a collaborative contract tool, a good procurement strategy and the adoption of BIM increased the efficiency of information exchanges, the effectiveness of process decisions and information management and the reduction of information asymmetries.

Resumen:
El presente artículo reflexiona sobre las capacidades de los contratos empresariales, como el 'Contrato de Alianza Marco FAC-1', para facilitar y mejorar el éxito de los procesos BIM.
Examinaremos algunos de los principales problemas legales que surgen en el desarrollo de un proyecto utilizando procesos BIM y mostraremos cómo la aplicación del FAC-1 como marco de colaboración ayudó a abordar estos problemas legales en un proyecto escolar emprendido en el municipio de Liscate en Italia. Asimismo, destacaremos cómo, en el proyecto Liscate, la combinación correcta de un instrumento de colaboración, una buena estrategia de adquisición y la adopción del BIM aumentó la eficiencia de las decisiones de los procesos, la gestión de la información y la reducción de las asimetrías de la información.

Keywords:
Framework Alliance Contract – BIM – ISO19650 – Enterprise contract Data-driven approach

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Palabras clave:
Contrato de Alianza Marco – BIM – ISO19650 – Contrato de empresa – Enfoque basado en datos

Summary:

1. Introduction

The construction sector's productivity has been trailing behind other sectors for years. The industry's fragmentation is one of the main problems, whilst others include poor project management and execution, insufficient skills, inadequate design processes, and underinvestment in research and innovation[1]. A solution for this fragmentation is a collaborative approach to construction projects, which allows the possibility of a holistic and integrated contractual structure linked to the adoption of digital tools and technologies such as BIM[2]. With the support of collaborative procurement models and collaborative contract forms, BIM is capable of transforming the industry into a more productive environment[3].

Since the 19th century, pressure has been shifting from clients to architects and main contractors in order to establish a mutually acceptable working environment. This shift can be also seen in standard form contracts, where clients seek increased certainty on price and increased assurance to meet their deadlines and expectations[4].

However, standard forms often reflect only "a conservative view of current good practice of contracts" that is representative of a "middle-of-the-road majority view" but "does not represent the best"[5]. Meanwhile, analysis of the built environment over the last century shows a decrease in the quality and durability of assets[6]. Latham identified poor value, inadequate quality and late completion as a constant scourge of the construction sector[7].

As an alternative way forward, a shift from traditional procurement models to supply chain collaboration and closer integration during the pre-construction and construction phases of a project can bring the changes we have long been waiting for. However, this requires a new mindset and a break from blind reliance on the false comfort of fixed-price contracts that are derived from single stage lump sum tenders.

MacNeil noted that tendering a project to contractors "on a take-it-or-leave-it basis" denies the opportunity for mutual planning, and that exacting agreement on a price without joint examination of all relevant issues is "a process heavily laden with conflict"[8]. Similarly, Egan commented on growing dissatisfaction of both public and private sector construction clients derived from the fact that "Projects are widely seen as unpredictable in terms of delivery on time, within budget and to the standards of quality expected", recognising instead that "clients believe that significant value improvement and cost reduction can be gained by the integration of design and construction"[9]. This integration deeds on a rewiring of the contractual relationship and the creation of clear connections among the parties involved in the process.

Taking full advantage of the BIM technology entails construction processes which shift from traditional approaches to integrated data-driven approaches. However, for digital processes to function at peak capacity, they require a reduction of horizontal fragmentation and an increased involvement of the supply

1 Filipe Barbosa, Jonathan Woetzel, Jan Mischke, Maria Ribeirinho, Mukund Sridhar, Matthew Parsons, Nick Bertram and Stephanie Brown, *Reinventing construction: a route to higher productivity* (New York: McKinsey Global Institute, 2017).
2 Construction Leadership Council and Supply Chains Workstream, *Procuring for Value* (London: Construction Leadership Council, 2018).
3 King´s research interviewees recognized the potential for improved data management through BIM and the benefits from this approach. See King´s College London Centre for Construction Law y Dispute Resolution, *Enabling BIM through procurement and contracts* (London: King´s College London Centre for Construction Law and Dispute Resolution, 2016).
4 Pertti Lahdenperä, *Design-Build Procedures. Introduction, illustration and comparison of U.S. modes* (Tampere: Valtion TeknillinenTutkimuskeskus Publications, 2001), 121.
5 John Bennett, *Construction the Third Way* (London: Routledge, 2000), 178.
6 National Research Council, Learning from Our Buildings: A State-of-the-Practice Summary of Post-Occupancy Evaluation (Washington DC: The National Academies Press, 2001), 178.
7 Michael Latham, *Constructing the team* (London: Join Joint Review of Procurement and Contractual Arrangements in the United Kingdom Construction Industry, 1994), 12.
8 Ian MacNeil, *The many futures of contracts* (City of Los Angeles: Southern California Law Review, 1974), 777.
9 John Egan, *Rethinking Construction (London: Department of Environment, Transport and the Region, 1998), 10-11.*

chain. This entails moving from bilateral agreements - the traditional approach - to multilateral collaborative agreements, through which clients and teams can exchange knowledge and gain improved value from early contractor involvement and supply chain collaboration.

The remainder of this paper considers how a collaborative approach improves the regulation and specification of the information exchanges among the parties. This proposition reflects our research into the capacities of enterprise contracts[10], such as the FAC-1 Framework Alliance Contract[11], to manage BIM processes. This contract form has been used successfully in the UK as well as civil law jurisdictions[12]. It has been translated into Spanish for use in Spain, Peru and other Latin American countries and adapted to the Spanish and Peruvian legislation[13]. Data transparency and team integration can be achieved if driven by agreeing objectives through direct relationships under the multi-party structure of the FAC-1 contract.

2. Difficulties in managing digital approaches with two-party contracts

One of the challenges of working in a BIM environment is that the information discrepancies and different skills between the parties can create information asymmetry.

By rewiring the contractual obligations of the supply chain, it is possible to link and align the objectives of the client and consultants with those of the main contractor and the other supply chain members. Such an environment enables the efficiency of direct links between the parties, fulfilling the need of the construction sector to create more structured communication among the team members involved in a project or programme of work. Combined with the use of BIM, collaborative information management is becoming a common feature and its legal value is progressively emerging.

Thanks to compelling evidence of improved value and reduced risks[14], the motivation to collaborate among the parties is increasing. This phenomenon, initially experimental, is accelerating thanks to the pioneering experience of leading clients[15]. Teams are also beginning to utilize digital tools to manage risk and resolve disputes, for example: (i) BIM, (ii) Project Management Information Systems (PMIS) and (iii) Digital Field Data Collection Systems[16.]

However, as the use of BIM and collaboration spreads, so does the complexity of legal issues related to the use of BIM, such as Intellectual Property rights and ownership of the BIM model.

Some fundamental legal challenges arising from the use of BIM include identifying the person responsible for the models, establishing who has intellectual property in the models and who is responsible for the information inserted and updated in the models. As the use of BIM technology becomes more widespread, the creation of a legal framework that manages collaboration and exchange of information between various team members also becomes fundamental. For example, mutual agreement and legal certainty over intellectual property rights are key issues in creating and sustaining a collaborative environment.

The World Trade Organization defines an intellectual property right as a person's exclusive rights over the use of his/her creation for a certain period17. In a complex environment, where there are mutual exchanges of information and contributions required to finalise the project, it is difficult to define what information is provided by each entity if this is not managed through a digital platform.

10 An enterprise contract provides for a succession of choices in order to accommodate and utilize increasing information. See David Mosey, *Collaborative Construction Procurement and Improved Value* (Oxford: Wiley-Blackwell, 2019), 143-163.

11 Professor Mosey underlines the impossibility to structure a digital process based on just two-party agreements. These are not able to create mechanisms that pledge a strong commitment to shared objectives. These traits, required by terms oriented to digital processes, do not assure transparency and efficiency. Ibíd.

12 Since the launch of FAC-1 in January 2018, the standard contract was used on a variety of projects and programmes for over £45b. Among their users, we can recall Crown Commercial Service, Surrey County Council, Central Bedfordshire Council, Football Foundation and Football Association, Housing Group, The Union of Municipalities Adda Martesana (Italy), Southern Housing Group, Mears, Kier, Esh. Please find more users at https://allianceforms.co.uk/news-and-users/.

13 See more information on the transnational use of the FAC-1 standard contract here: https://allianceforms.co.uk/news-and-users/.

14 Association of Consultant Architects, *10 Years of ACA Project Partnering Agreements* (London: Association of Consultant Architects Ltd, 2010), 20-21.

15 Mosey, *Collaborative Construction Procurement and Improved Value*, 59-78.

16 Arcadis NV, *Global Construction Disputes Report 2019* (Amsterdam: ARCADIS, 2019), 11.

17 World Trade Organization, "Trade-Related Aspects of intellectual Property Rigths", https://www.wto.org/english/tratop_e/trips_e/trips_e.htm.

To overcome problems in managing data created by another party, direct mutual licences of intellectual property rights[18] should be provided to all the parties within the collaboration with the authors retaining ownership of their data.

Achieving "clarity of the rules set by the agreement"[19] is the first step to create a trusting environment, and the parties' attitudes are influenced by the contract terms that are used in the project. Contracts can acquire a bad reputation if they are focused on excuses for failures in performance and late project completion/cost overruns/defects[20]. A standard form of contract can also suffer if is subject to many amendments that lead to a change in its primary intent[21].

Other aspects that reduce the adoption of collaborative procurement are, from an organizational perspective, the "perception of losing some degree of control"[22]. Standard forms of contract manage risk differently, and clients as well as contractors can be concerned by changes in the risk allocation. Some contracts make the contractor more confident in a fair approach while others can cause early problems if they appear to allocate excessive risk to the contractor[23]. The choice of the form of contract sends messages to the parties based on the typology of relationship that could occur. This decision signals the approach[24] that each party will adopt during the evolution of the project.

A further difficulty is the "definition of a comfortable environment"[25] provided by a bilateral agreement in terms of defined liability and risks. This problem is linked to the misconception that collaborative agreements all reduce responsibility among the parties involved.

Also, traditional contracts do not normally look at both the client's capital expenditure and revenue expenditure, which is necessary in order to integrate the operation and maintenance with design and construction. This shows a continuing failure to recognise the importance of the "whole life-cycle approach"[26] , despite the experience of PFI/PPP projects in addressing whole life financial aspects that are necessary to understand their feasibility[27].

3. Moving toward a collaborative environment

Collaboration in construction projects is defined differently by scholars and practitioners, but it is generally agreed that standard form construction contracts will not provide a good starting point for collaborative relationships if they are seen as unfair by the parties on whom they are imposed, if they treat different team members inconsistently or if they do not describe collaborative processes. For example, Latham recommended that a modern construction contract should include "a wholly interrelated package of documents which clearly defines the roles and duties of all involved, and which is suitable for all types of project and for any procurement route"[28].

The main collaborative features of modern construction contracts should include the following relevant Latham recommendations:

– A specific duty for all parties to deal fairly with each other, and with their subcontractors, specialists and suppliers, in an atmosphere of mutual cooperation,

18 The Association of Consultant Architects, *FAC-1 Framework Alliance Contracts* (London: The Association of Consultant Architects Ltd, 2016).

19 Sophie Cacciaguidi-Fahy and Anne Wagner, *Obscurity and Clarity in the Law: Prospects and Challengues* (London: Routledge, 2018).

20 David Mosey, *Early Contractor Involvement in Building Procurement*, 2009.

21 "A standard form is supposed to be just that. It loses its value if those using it, or at tender stage those intending to use it, have to look outside it for deviations from the standard". See Royal Brompton Hospital Health Service Trust v Hammond and others, EWC 206 (2002).

22 Niraj Thurairajah, Richard Haigh and Dilanthi Amaratunga, *Leadership in construction partnering projects: research methodological perspective* (Manchester: University of Salford, 2006), 1-4.

23 Jason Challender, Peter Farrel and RRoberts, Nigel N*Building Collaborative Trust in onstruction Procurement Strategies* (Oxford: Wiley-Blackwell, 2019).

24 By using an overarching umbrella (e.g., FAC-1), a different message is sent to the parties. As BIM and data management technology drives new approaches to the design and construction process, the need to replace traditional competitive procurement and tendering processes with more collaborative structures and arrangements becomes ever more acute. See Martin Roberts, Nigel Blundell, Richard Dartnell and Russell Poynter-Brown, *Collaborative Construction: more myth than reality* (London: Pinsent Masons, 2016), 3.

25 Peter Fewings, *Construction Project Management* (London: Routledge, 2013).

26 Paolo Urio, "Conclusion, PP in In-transition Countries: Prospects and Limits for the Improvement of Efficiency, Sustainability Equity and Security" in *Public-private Partnerships. Success and Failure Factors for In-transition Countries* (Lanham: University Press of America, 2010), 315-347.

27 Ibíd.

28 Latham (1994), *Constructing the Team*.

- Clearly defined work stages, including milestones or other forms of activity schedule.
- Integration of the work of designers and specialists.
- A specific and formal partnering agreement that is not limited to a particular project.
- Partnering arrangements that include mutually agreed and measurable targets for productivity improvements[29].

Collaboration requires not only the right contracts, but also the right approach to procurement. Bennett & Co noted that single-stage tendering fails as a procurement system ""because it provided no overall direction, reducing everyone involved to defending their own interests". Furthermore, they acknowledged the attraction to clients of "the simplicity of inviting competitive bids", encouraged by "professionals with a vested interest in old ways of working", but suggested that these clients are "all too often…sadly disappointed as they discover that claims, delays, defects and disputes make this an expensive and ineffective approach"[30]. These assumptions are reflected in the trend expressed by NBS contract surveys[3132] which found that the legal framework through which the project is undertaken depends on the procurement method selected by the client.

However, collaborative forms of contract are still limited by the behaviour of the people and familiarity in approaching contracts. In the UK construction industry, the main form of procurement remains traditional, and the adoption of collaborative approaches is shared by a limited number of projects.

In broad terms, and in the context of construction and engineering projects, an 'alliance' is an agreement providing that the parties to it will act in a certain way to achieve a common goal[33]. An alliance tends to be a multi-party arrangement including the key stakeholders - client, contractor and professional team and potentially also key subcontractors[34]. Another definition suggests that an alliance contract records "long term partnering on a project in which a financial incentive scheme links the rewards of each of the alliance members to specific and agreed overall outcomes"[35].

A multiparty alliance can ensure that all parties are aware of each other´s roles and their respective contract terms are consistent. This can motivate the mutual trust among team members that is necessary for successful joint working[36]. By the creation of an alliance it is also possible to restructure the relationships and to fill a behavioural vacuum across multiple appointments.

In a collaborative environment, the client can influence the designs and can help consultants and contractors to develop the project, according to its needs and to obtain insights from different parties.

In the complex scenario of a construction project, the need to provide for coordination and collaboration is growing. Subcontractors execute over 80 percent of work on construction sites[37]. Non- compliance with a contractor's programme generates many inefficiencies in the construction process. The lack of integrated working systems among supply chain members can be solved through the collaborative agreement of programming and timelines. So as to coordinate the work of the different parties, it is important to distinguish when design information is actually needed[38] as opposed to when a contractor perceives it is needed[39]. By detailed and methodical planning of the activities and the interactions, enterprise contracts can create a structured environment for collaboration[40].

Enterprise planning provides techniques for working along with other parties, aligning their interests. The benefits of collaboration (e.g., PPC2000) are seen overcoming the concept of the single approach creating a joint entity that can correctly define the boundaries of a project (time, cost, quality, risks)[41]. So as to provide successive levels of detail, this level of expertise can be achieved only by a mixture of experience

29 Latham (1994), *Constructing the Team*, Section 4, 5 and 6.
30 John Bennet and Sarah Peace, *Partnering in the Construction Industry: a Code of Practice for Strategic Working* (Oxford: Butterworth-Heinemann, 2006), 7.
31 NBS Enterprises Ltd., *National Construction Contract and Law Survey 2012* (New Castle: NBS, 2012).
32 NBS Enterprises Ltd., National Construction Contract and Law Survey 2018 (New Castle: NBS, 2018).
33 Ibíd.
34 Guide to Contract Alliancing in Construction, ARCADIS & CMS, available here: https://www.arcadis.com/media/D/C/F/%7BDCF5C2D3-C3E0-4CB8-8793-9AC468DA2767%7DCMS_Guide_to_Contract_Alliancing_in_Construction.pdf.
35 Government of the United Kingdom, *Delivery: Alliancing Code of Practice (London: HM Treasury, 2015), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/487294/alliancing_code_of_practice_18122015.pdf.*
36 David Mosey, "The origin and purposes of the FAC-1 Framework Alliance Contract," *International Construction Law Review Journal, (October 2017): 391-405.*
37 Office for National Statistics, *Construction statistics, Great Britain: 2018* (Newport: UK Statistics Authority, 2019).
38 Wembley Stadium steel structure dispute as to whether delay caused by late contractor design or late briefing.
39 H. Fairweather & Company v. London Borough of Wandsworth, BLR 106 (1987).
40 See D. Mosey, *Collaborative Construction Procurement and Improved Value*, John Wiley and Sons Ltd, ch. 3, 2019.
41 ISO 19650 series.

from different areas of the market and by getting involved the contractor and subcontractor gradually in a multiparty environment.

4. The collaborative BIM environment required by ISO19650

In December 2018, the European Committee for Standardisation approved the series of standards ISO 19650 series dealing with "organisation and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling"[42] and, in January 2019, the BSI (British Standards Institution) published the BS EN ISO 19650 series[43]. These standards outline the concepts and principles of information management at a stage of maturity described as "building information modelling according to the ISO 19650 series" and provide recommendations for a framework to manage information throughout the whole life cycle of the built asset.

Most importantly, the ISO 19650 series emphasises the importance of collaborative engagement between members of a team and establish that "the recommendations and requirements for information management in the ISO 19650 series are based on appointing, lead appointed and appointed parties working collaboratively together, and all parties should participate in the implementation of the ISO 19650 series"[44].

Information management through BIM is said to enable dramatic improvements in delivery and performance efficiency by catalysing increasingly innovative ways of working across the built environment[45]. It is generally agreed that BIM offers a clearer view of the mutual dependencies between the activities of team members.

However, BIM can only support these dependencies if the team members agree to share design, cost and time data not only in a digital form, but also in the levels of information required and at the times when this data will be most useful to the project. This became increasingly evident when ISO 19650 was published, and these new standards stress that "Collaboration between the participants involved in construction projects and in asset management is pivotal to the efficient delivery and operation of assets"[46].

It is acknowledged that "the ISO 19650 series calls for transparent, collaborative cross-sector ways of working which require mutual understanding and trust alongside appropriate/proportionate measures and processes to reduce the risk of loss, corruption or disclosure of information"[47]. The need for a contractual medium through which to achieve that level of collaboration in multiple bilateral agreements is both evident and pressing.

FAC-1 provides the collaborative structure and processes for managing a BIM environment. It integrates agreed approaches to design, supply chain engagement, costing, risk management and programming, as required by the ISO 19650 series. Mosey states in his research[48] that the provisions in FAC-1 enable alliance members to seek improved value through BIM and that the contract includes clauses and guidance in respect of:

- Data transparency and team integration through direct relationships under the multi-party structure and agreed objectives[49].
- Agreed software and clarity as to reliance on data in the communication systems and template documents[50].
- Mutual reliance on agreed BIM deadlines, gateways and interfaces in the timetable for agreed alliance

42 Hereinafter, the ISO 19650 series.

43 Is the UK Implementation of the European standards and which supersede the previously applicable BS 1192:2007 + A2:2016 and PAS 1192-2:2013.

44 See ISO 19650:1, 4.2. Information management according to the ISO 19659 series.

45 UKBIM ALLIANCE: ´Information Management according to BS EN ISO 19650. Guidance Part 1: Concepts´, page 9 available here: https://www.cdbb.cam.ac.uk/Resources/ResoucePublications/InformationManagementaccordingtoBSENISO19650GuidancePart1Concepts.pdf

46 ISO 19650:1, p. VI.

47 https://www.cdbb.cam.ac.uk/Resources/ResoucePublications/InformationManagementaccordingtoBSENISO19650GuidancePart1Concepts.pdf, page 16.

48 See D. Mosey, ´Collaborative Construction Procurement and Improved Value´, John Wiley and Sons Ltd, 2019.

49 Through the FAC-1 Framework Alliance Contract (2016), the TAC-1 Term Alliance Contract (2016) multi-party structure, the Schedule 1 Objectives and the clause 13 limits on confidential information.

50 In the FAC-1 Framework Alliance Contract (2016), the TAC-1 Term Alliance Contract (2016) clause 1.9.3 provision for communication systems, the FAC-1 Schedule 5 provision for Template Project Documents and the TAC-1 provision for Template Order Documents.

activities[51].

- Flexibility to agree with any combination of BIM contributions through the multi-party structure[52].
- Flexibility to bring in BIM contributions from specialist sub-contractors, suppliers, manufacturers and operators through Supply Chain Collaboration[53].
- Direct mutual licences of intellectual property rights[54].
- Integration of BIM management with governance and clash resolution through the core group and early warning provisions and through the alliance manager[55].
- Flexibility to obtain BIM contributions from additional alliance members involved in the occupation, operation, repair, alteration and demolition of completed projects and tasks[56].
- Potential for BIM to enable learning and improving from project to project and from task to task[57].

5. FAC-1 collaboration applied to BIM on the Liscate school project

The "Adda Martesana" Municipality applied the FAC-1 (Framework Alliance Contract) on the project to build a school in Liscate (Italy). This is a middle school project for 150 students and 5M € of construction costs, which was developed through a BIM approach and showing an elevated level of complexity.

5.1 The tender process for parties to the FAC-1 alliance

The award criteria in the tender process were the most economically advantageous tender, mandatory as per the EU procurement regulations[58]. The tender notice included selection criteria and award criteria based on transparent formulas to evaluate the propositions of the participants in terms of performance, environmental target, maintenance and safety solutions.

One of the primary aims was to guarantee a high level of coherency of the bids. This was possible using the BIM methodology both in the project design phase and in the drafting of the tender documentation. The BIM methodology meant that the team used an integrated design system, including all graphic and performance information in the database associated with the objects of the BIM models. It was thereby possible to extract every tender document directly from the BIM model and also to obtain the "guidelines for the compilation of the bid" attached to the tender documents.

This integrated approach reflected innovative management of the design phase. The first step consisted of parametric modelling of the building by the contracting authority, with the BIM model that replicated the project constituting its digital twin. This comprised virtual objects equivalent to the technical elements that would constitute the future built asset.

The weighting of evaluation criteria looked at the whole life cycle of the building, focusing on the performance of the building envelope, on the performance of the MEP system, on the hygiene and the management of resources, as well as the maintenance of materials, the technological solutions offered and the programmed maintenance of the architectural and plant design elements.

51 In the FAC-1 Framework Alliance Contract (2016), the TAC-1 Term Alliance Contract (2016) Schedule 2 Timetable and the clause 6 Alliance Activities.
52 Through the Framework Alliance Contract (2016), the TAC-1 Term Alliance Contract (2016) multi-party structure and under the clause 1.11 and the Appendix 2 Joining Agreements.
53 Through FAC-1 Framework Alliance Contract (2016), the TAC-1 Term Alliance Contract (2016) clause 6.3 Supply Chain Collaboration and under the clause 7 Order procedure.
54 FAC-1 Framework Alliance Contract (2016) clause 11.
55 In the FAC-1 Framework Alliance Contract (2016), the TAC-1 Term Alliance Contract (2016) clause 1 Core Group and Early Warning provisions and the clause 5 Alliance Manager role.
56 Under the FAC-1 Framework Alliance Contract (2016), the TAC-1 Term Alliance Contract (2016) clause 1.11, Appendix 2 Joining Agreements and the recognition of Operation as a feature of Improved Value.
57 Under the FAC-1 Framework Alliance Contract (2016), the TAC-1 Term Alliance Contract (2016), Schedule 1 Success Measures and Targets.
58 Directive 2014/24/EU, 26 February 2014, on public procurement and repealing Directive 2004/18/EC.

5.2 The FAC-1 contract for integration

The FAC-1 contract signed by the members of the team successfully provided the legal basis for optimising relations among parties and obtaining added value. The client drew up a series of annexes according to the functions and schemes that support FAC-1 and adapted the standard contractual model to the specifics of the project. The client included all important parties in the multi-party FAC-1 alliance contract in order to ensure better information exchanges, not only with the general contractor but also with subcontracted supply chain members.

An objective of the collaboration set by the client was "monitoring of the time and cost provided for in the Programme Contract and its annexes" and all the features of the agreement were based on that assumption. The FAC-1 agreement was the legal foundation used to assure and control the information workflows that are essential in a data-driven process, and guidelines were created to support the platform for sharing information. The CDE (Common Data Environment) and BIM guidelines were included as Template Documents in the FAC-1 alliance agreement.

FAC-1 provided a collaborative framework for the Liscate school project and helped enable a deep synergy between the "Alliance Members", namely, the client, the contractor, the design team, the construction manager and the safety coordinator plus subcontracted "Supply Chain" members[59]. FAC-1 collaboration included joint "Risk Management" of unforeseen events so as to minimise delays and additional cost. The FAC-1 agreement was designed to include, among the "Alliance Activities" data sharing, BIM model management and maximum involvement of subcontractors and suppliers through "Supply Chain Collaboration".

FAC-1 was used to link workflows to digital project controls, setting out not only agreed "Success Measures" but also the computational codes for achieving the required results, the accountable team members for each of the agreed "Objectives" and the joint system for performance measurement. Alliance Members used joint Risk Management strategy to maintain alignment of their commercial interests and to encourage proposals designed to ensure they could reach their pre-defined "Targets".

The FAC-1 multi-party structure enabled the integration of BIM models and efficient information delivery using guidelines set out in the "Framework Documents" that were accepted by all the Alliance Member. The guidelines defined how to use the CDE platform for managing workflows and sharing information, and they specified the required information for built models.

Each Alliance Member provided details for inclusion in the FAC-1 Timetable showing not only the operations to be carried out on-site, but also the procurement of materials and the entry on site of subcontractors and suppliers. To enable better sharing of information, weekly meetings included all interested Alliance Member and enabled through FAC-1 joint Risk Management of problems that would otherwise have caused delays in the operational sequence of activities.

The CDE platform[60], plus the "Timetable"[61] and guidelines adopted for information management, were inserted in FAC-1 as the formal basis for communication. They governed both the information requirements and the procedure for exchanging information that is essential to the success of a data-driven approach. This information data management is a key concept for the efficient implementation of the BIM platform, i.e. the loading, updating, sharing, verification and consultation of documents and information according to the needs of the client, the rules of filing, nomenclature and responsibility, as well as the additional information (metadata) related to each type of document. The CDE improved and streamlined control of the information flow, structuring processes and information which were subject to validation, correction and archiving. The platform provided for collection of interconnected data and was used to access, update and manage this data. This platform also digitally archived the documents and monitored approvals. It was assimilated to a database with a web-based interface and was therefore accessible anywhere.

The FAC-1 Risk Register helped to prepare the team members to deal with risks arising. Risks were identified with a 0-5 range according to their probability and impact, highlighting potential problems in advance and assisting in their responsible and systematic management. The Risk Register not only demonstrated foreseeable problems, but also identified a person responsible for monitoring the relevant risks, the control

59 See D. Mosey, ´Collaborative Construction Procurement and Improved Value´, John Wiley and Sons Ltd, 2019, Chapter 24.

60 The Common Data Environment platform was designed according to the needs of the *Client on the 'Alfresco Platform', which is an open-secure system that intelligently activates process and content in order to accelerate information flows. The information-sharing procedures were built on the necessity of bringing Client content under control with seamless information governance.*

61 Schedule 2 of Framework Alliance Contract (FAC-1).

intervals and, above all, countermeasures to the problems. The global analysis of risks was an example of the "Improved Value" [62] that derived from the use of FAC-1.

5.3 The ability of FAC-1 to help manage digital data

Through the CDE under FAC-1, each user could enter, share, modify, manipulate and display data (depending on the rights granted to them) following the pre-established information flow connected with digital objects. In this way, each user had predefined tasks, depending on its agreed role in the project, allowing them to access certain data, to accept or request changes to documents and to use the database linked to the BIM models.

The client established the levels of information required at each stage both for technical elements and environmental units. The level of information required at each stage was determined according to the appropriate quality, quantity and granularity of the graphic and alphanumeric information, linked to the information requested by other service providers and according to ISO19650-1:2018 standards. Establishing these requirements in FAC-1 can allow for structured management of the data contained in the models and information databases of an entire real estate portfolio. It also enabled the management of an ISO-compliant BIM process.

Digital management of information through the CDE under FAC-1 updated the BIM model and provided stakeholders with the definition of robust workflows for the creation, archiving and updating of documents during and after construction. On the Liscate project, the data contained in the model was made available according to the needs and roles of each company, with different reading and writing privileges.

The CDE platform allowed all "Alliance Members" to have data control in real-time of supplies arriving at the site, of documents to be approved and of the materials to be accepted. Documentation was automatically sent in digital format to people in charge following the regulatory flow, which ensured timely inspection and control procedures on site. This data management system also enabled cost management and the monitoring of quantities delivered and to be delivered, so as to have a computational knowledge of the progress of work. In this way, together with weekly coordination meetings, the interests of all "Alliance Members" were aligned and information asymmetries between the parties were removed.

6. Conclusions

This paper has examined the capacities of the FAC-1 alliance contract to support and manage BIM processes. We have considered the history of traditional construction contracts and procurement models, and the emergence of successful new approaches. We have examined what we mean by an alliance and how a contract, such as FAC-1 provides the legal clarity and practical integration that alliance members require.

We have also looked at some of the legal issues arising in the development of a project using BIM processes. The collaboration achieved on the Liscate project through the use of BIM and the FAC-1 contract provided improved value and increased the quality of the built asset. Example quality of performance improvement to the "Project" made by FAC-1 "Alliance Members" are:

- The use of cross-timber instead of natural timber for beams. This solution was proposed by the general contractor and by the wood supplier. The improvement guaranteed better quality and reduction of lifecycle costs in terms of maintenance. In return, the client agreed to shorten the payment period.
- Improvement in the quality of the wood floor. The general contractor offered at no additional cost a material that requires less maintenance as well as reduced delivery time and reduced on-site activities.
- Anticorrosion treatment of the external steel stairs. This new treatment was proposed by the general contractor instead of anticorrosion painting in order to improve maintenance and reduce on-site activities.

The collaboration among "Alliance Members" prevented or reduced significant problems and errors and enabled the alliance members to deliver improved results. The results on the Liscate project could only have been achieved under an agreement where data transparency and team integration were spelled out in a multi-party contract structure that was driven by agreed objectives.

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For these purposes, the FAC-1 alliance contract enhances project transparency and supports the agreement of the alliance members' aims and objectives, enabling them to exchange BIM data accurately and in confidence.

The use of the FAC-1 alliance contract was not perceived by the Liscate team members as a contractual formality, but as an element that was essential to creating collaboration and efficient exchange of information. Without it, the relational frictions that traditionally occur could not have been avoided.

The Liscate case study has also shown how FAC-1 clarifies and governs the integrated processes and relationships needed to meet the ISO19650 requirements for collaborative actions among the different parties involved in the successful implementation of BIM.

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