



How to Create and Manage a Team to Apply Collaborative Methods in Construction (IPD) in Spain

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Summary

"Teamwork is the ability to work together towards a common vision. The ability to direct individual achievements towards organizational objectives. It is the fuel that allows ordinary people to achieve uncommon results." Andrew Carnegie.¹

Abstract: The Collaborative Methods² in Construction (Integrated Project Delivery or IPD) are based precisely on a good functioning of the team. IPD is built around it. The formalization of these techniques is still incipient in Spain, very little by little there are beginning some works by applying them, it is necessary that we expand our knowledge to improve the efficiency and productivity of the construction sector in our country, and its successful application spread as it is already doing in others. Construction is an inefficient industry in Spain because it is not developed with collaboration, if we manage to introduce this collaborative methodology, our results will improve.

Keywords: Team, Collaborative Methods, Integrated Project Delivery, IPD

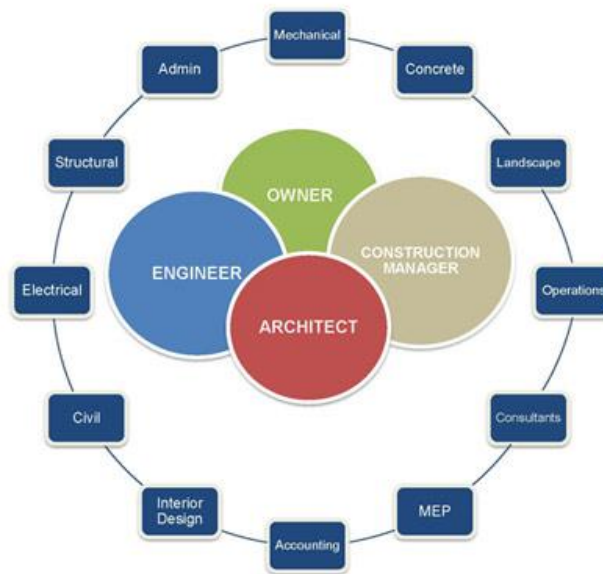
1. Introduction:

Without a team IPD would not work. In the Collaborative Methodology "the management of the team is not a work of supervision but of leadership" (Deming, 1982), and in that sense it is very important to know how to implement it and exercise it without impositions. We will develop in this article the way to carry out a collaborative work that motivates the team and contributes to achieving its objectives.

According to the latest IPD definition of the American Institute of Architects (AIA, 2014) a collaborative team must be composed at least by: The property, the technicians and the builder, however, as the work develops and grows, other stakeholders are going to be part of it, as we see represented in Figure 1, and therefore the management of its components will be more complicated.

¹ American businessman and philanthropist native from Scotland, UK (1835-1919)

² Along this text we will use alternatively the synonym expressions: Collaborative Methods, Integrated Project Delivery or IPD indistinctively.



INTEGRATED PROJECT ORGANIZATION

Figure 1: Integral Project Delivery as the collective effort of a coordinated team for the development of the project (SSA Engineers, Prahadevi, Mumbai, 2009)

We will study how good preparation is necessary for an effective team management. To maintain the motivation and objective between the ones of the project, communication and information are essential, all the components of the team must know the achievements and failures which occur in the development of the assigned tasks, as well as act proactively based on the same. The use of Building Information Modelling (BIM) tools is an important support to achieve it. How to give that information and implement an efficient communication is also another objective included in the article.

Finally, another aspect of vital importance for the good development of the IPD team, the sharing of content, which is essential for a true IPD methodology, sharing duties and profits is a point of support for the whole team to feel united, to feel that has a single shared objective, that all members are aligned, and that the participation of each one of them depends on the objectives of the project. This vital aspect is also analysed, based on the experiences which have already been applied in the United States and other countries, as well as the results obtained in them.

2. The Preparation of the Team

The early incorporation of key participants is one of the more important basis for the IPD project success, this is managed by committees with members representing these key participants, as minimum: Property, technicians and contractor, is what is called as "core team" or leading team. His main responsibilities are (Ashcraft, 2011):

- "Establishment of the Objectives of the Project.
- Provision and allocation of resources.
- Financial supervision.
- Select the members of the functional teams.
- Tutoring of team members.
- Administration of contracts (work orders, corrections, etc.).
- Conflict resolution "

For the success of the IPD team, its components must really believe in the methodology, and support its development, it is impossible to carry out the purposes outlined above starting from an ignorance of what it really means to work collaboratively, from the renounce to "false individualism, the selfish and self-centred one, and assuming the true individualism, the one contributing to the group" (Hayek, 2009), and that of complementarity work among the members that should be sought with teamwork.



Since the constitution of an IPD team people from different cultures and coming from different organizations must be combined, it is fundamental that each one of them knows, and may have worked, with the collaborative resources. However, training in the IPD culture can be done from within, although a willingness to integrate and collaborate is a necessary starting point. It is better to dispense from the beginning of people who have not stayed in this form of work, than to try it against their will.

This is one of the basic points which needs the dissemination of the methodology in Spain, now, when we find an incipient knowledge of it must be incremented its teaching, so that from the knowing of its basis is where IPD application can come from, later the contracts and their development will come, but without previous culture this will not be achieved.

To form a good team, you must set clear and specific objectives, not of a general type such as: "We will be the best" or "We will achieve success", which have no effect, but determined and fixed along the whole process. A great help for this, establishing the construction as a set of processes, is the use of Building Information Modelling (BIM). The objectives must be aligned and be common to all, that is the great difference with the traditional method in which the confrontation between the actors of the construction takes place from the beginning of the project, and even more from the work itself.

All the members of the team must be recognized and self-realized, so that the tasks must be assigned, and everyone will feel responsible for their own and feel obliged to do things well, in this way, delegating is easy, because we will know that all will be involved in the same way, each one with its mission³.

Regarding the number of people who must compose an IPD work team, "the most effective teams are neither small (below 4 or 5 people) nor very large (above a dozen people). A good rule is to maintain them between five and nine members" (Robbins, 2011). If a task is too large for the team to be efficient it should be divided into subtasks. "Members of large teams have problems to coordinate one with another, specially under pressure." (Robbins, 2011). Nevertheless, organization of IPD teams vary considerably with different size and complexity of the building to be constructed.

"The biggest three mistakes made by the people, when they are going to compose a team. are the following:

- 1.- It is assumed that "the more members the better" and therefore too many people are put on the team.
- 2.- It is assumed that people who are like others will work better together, and therefore too homogeneous teams are composed.
- 3.- It is assumed that everyone knows how to work as a team, and consequently no attention is paid to the interpersonal skills of potential members." (Hackman, 2002).

In the United States, where the IPD methodology has been applied with greater extension and success, it is related that, by working together in the same physical space, what they call "big room", there is a greater sense of common responsibility and coordination among all team members.

Another aspect to consider is that interdisciplinarity components with different degrees of experience and points of view must be mixed, the personalities of the members which make up the team must also be considered, although often the latter is more an art than a science. "The better designed a team is, the greater is the internal collective motivation" (Hackman, 2011). "The teams composed by people of design, engineering, production, sales and marketing" (Deming, 1982), were part of the essential improvement recommendations proposed by W. Edwards Deming to the Western company.

The stability of the team is a factor that contributes to its effectiveness. "Teams that remain stable have more chances of success than those which have to fight permanently with new members and the departure of veterans." (Hackman, 2011). In those companies that have experience in IPD teams in the United States, always is added to the team someone who has previously worked with the methodology and who can contribute with "lessons learned" to others, an IPD facilitator, he/she will be who deliver part of the work of the IPD preparation and training in the methodology to which we have referred earlier.

The professor of social and organizational psychology at Harvard University (USA) PhD. J. Richard Hackman (deceased in 2013), whom we have cited several times, has been one of the greatest experts and who most deeply has written about the creation, management and development of work teams in Companies in general. Reviewing his writings, we see how much they have in common with the recommended techniques for the Collaborative Methods discussed in this article:

³ "England expects that every man will do his duty", Admiral Nelson message to his fleet before Trafalgar Battle, 1805.



"It's not how a leader's management style determines how well a team progresses, but how well a leader designs and supports a team, so that its members can manage themselves." (Hackman, 2002)

The five conditions that PhD. Hackman identifies in the teams which achieve success are:

- "Be a real team.
- Have a convincing address.
- Have a structure that enables people.
- Developed in a context of mutual support.
- Have the monitoring of experts." (Hackman, 2008)

Likewise, according to PhD. Hackman, what can be done to make work teams function well is:

- "Strengthen the essential socialization processes in collective work.
- Build a common goal, with the appropriate union of skills, strategies and coordination of tasks.
- Help team members solve problems and find emerging opportunities.
- Capture individual experiences and translate them into shared knowledge." (Hackman, 2008)

As a summary, we can say that a good preparation of an IPD equipment requires:

- Early incorporation to the project.
- Define clear, concrete and ambitious objectives.
- Involve all members.
- Establish indicators of the progress of the tasks.
- In addition to the final objectives propose intermediate challenges.
- Communicate and give feedback on the progress of the project.
- Feel all responsible members together.
- Analyse the critical points.
- Detect unforeseen risks and risks in general together.
- Avoid downtime, no one must be stopped at any time.
- Integrate all the people.
- Promote the team's versatility.
- Work based on continuous improvement.
- Generate new ideas, creative collaboration.
- Share knowledge for the improvement of the whole.
- Encourage empathy among team members.
- Foster confidence and self-leadership.
- Work on a team basis between 5 and 10 people, at most.
- If necessary by the size of a task, divide it into subtasks to fit it to that ideal team size

3. Communication, A Powerful Weapon

"The "core team" IPD has to clearly communicate the values and objectives of the project to all participants in it and continue to reinforce these objectives and values through repetition and recognition during the development of the project" (Fischer, Ashcraft, Reed and Khanzode, 2017). The teams require communication, clarity and consistency, and: "To communicate well it is necessary to listen before" (Covey, 2006).

The coordination must be increased by means of the regular and complete transfer to all the components of all the information available about the project, not only by computer means, with common servers, but even with notes or posters placed in places of public view of all, and of course being reflected in the BIM model, which will grow as the project progresses.

This information should cover all aspects of the project, including the economic aspects. Collaborative work cannot be requested if information is withheld from the team members. IPD is based, among other things, on mutual loyalty, which is embodied in communication and information, is what is called "open books". "Confidence and transparency must prevail, if this does not exist there will be no progression of improvement in the team" (Ashcraft, 2011).

"The effectiveness of the team requires clear communication and the ability to disagree without damaging personal relationships, although mild levels of conflict related to tasks and processes increase productivity. But this skill requires strong doses of empathy" (Fischer, Ashcraft, Reed and Khanzode, 2017). It is achieved by training the team in these functions from the beginning, both in terms of communication and conflict resolution.



"Good planning requires good information: The information systems that support team development are those that mix reliable data on the situation at all times, with predictions that suggest how those requirements will change in the future" (Hackman, 2002).

It is not only important to give good and complete information of the present to the team, but also to anticipate the tasks that will be necessary to develop in future stages, and even evaluate how the performance has been in the past and compare it with the objectives planned.

For the resolution of conflicts between the members of the team, it is also essential to apply the communication, individual culprits should never be sought, since the overall culture must prevail always, it is very discouraging for any of its members, and for the team, that someone be held accountable individually, whether it is a success or a failure.

Regarding the resolution of conflicts related to discrepancies between the members of the team, on how to solve a problem that has been raised in the project, a good method to reach consensus, which is in line with the Lean Culture and was also created by Toyota within the Toyota Production System or TPS, for the resolution of this type of conflict, is the called A3 Report, because this sheet size is used to reflect it. In Figure 2 we can see the succession of actions that will be reflected writing in it:

Background	Future State & Countermeasures
<ul style="list-style-type: none"> - Why do we need to work on this? - Context - Importance 	<ul style="list-style-type: none"> - Actions being taken to address the issue (what, who, when) - Quick fixes (Containment actions) - To Be process map
Current State	Impact
<ul style="list-style-type: none"> - Problem statement/definition - As Is process map - Scale of the problem (data) 	<ul style="list-style-type: none"> - Results achieved - Trend graph (before/after)
Objective	Follow-up
<ul style="list-style-type: none"> - Target level of performance - Desired outcome 	<ul style="list-style-type: none"> - Actions still required (what, who, when) - Learning points to share
Root Cause Analysis	
<ul style="list-style-type: none"> - Fishbone diagram - 5 Whys - Data (Pareto, Scatter diagram) 	

Figure 2: A3 report on conflict resolution

In the first place, the problem is clearly defined, then the current situation is described, in third place, the causes of the root of the problem are analysed, then the situation where you want to arrive is defined, the one that constitutes the objective, a plan of action is established in a next step to achieve it, and then a follow-up of the same, to finally verify the results, repeating cyclically this process in case the desired objective is not achieved as a result. It is a very practical and effective way to reach consensus when there are discrepancies about the solution to a problem.

Communication among team members must take place in a climate of trust and transparency, "members of effective teams trust each other, as well as their leaders. Interpersonal trust among team members facilitates cooperation, reduces the need to control each one's progress and extends the belief that nobody is going to take advantage of others effort." (Robbins, 2011).

Transparency is another essential component in IPD equipment, for this we must banish the idea that who wins a dispute is the one who is capable of deceiving the other, in an environment of these characteristics is where the production process usually occurs in Spanish construction sector, that reason is why it is not wanted to facilitate all the information to the intervening ones in the development of a project, it is to be able to take



advantage in a certain moment of the information that each one owns. IPD is the opposite, it is information shared in the search for a true team spirit based on trust and transparency, communication and empathy.

"The research says that in face-to-face communication attitudes and feelings are only 7% of what it is communicated and 38% is due to how it has been communicated, but 55% is body language" (Covey, 2006).

That is one of the reasons to look for work in "big room", for establishing that direct face-to-face relationship between the various members of the team, this produces a quality of communication that cannot be substituted by telematic means, even if it is shared. Keep in mind that the teams are made by people and we must use all the springs of interpersonal communication to achieve good coordination.

To focus on a concrete example of what we have discussed previously, we took the appointment of Cristina Ayats book: "Lean Diseño y Construcción. Un cambionecesario", which says about the communication in the Cathedral Hill Hospital project, San Francisco (USA), made with IPD methodology:

"From everything I've seen and learned until then, I concluded that the main problem in applying lean in construction was coordination, and that this should be worked through communication.

- It must be fluid, Clara pointed out, so that the message reaches all the members of the team. Each one of them must be able to transmit the changes made, in order that the team can coordinate with their most recent model. Otherwise, that coordination will be wasteful.

Then he went on to explain different ideas that were discussed in the Cathedral Hill Hospital project to transmit the information and that, finally, were standardized:

- Modifications at a structural and architectural level were communicated through weekly comparative archives, where what was eliminated was marked in red and what was moved in blue. These changes were transmitted through an e-mail in which the alterations produced since the last update of the virtual model were enumerated.

- The architects commented on the recent modifications of the virtual model in a joint meeting of 5 minutes.

- To transmit the team what structural elements were ready for its manufacture (and therefore could not be touched), the metal structure subcontractor passed a model where he distinguished, in green, what was already prepared to be built; in yellow, the areas where they were working; and, in red, those in which the team could modify the detail without impacting them.

- Every meeting had a person in charge, an objective and ended with a series of obligations, each with its responsible person and date of completion.

- Any action that needed a plan departed from the main meeting after having assigned the person in charge and assistants, so that they could meet later to resolve it. Without responsibility, these works would not have been carried out. "(Ayats, 2015).

We have found it interesting to quote this example, in which it can be seen very well how to standardize the way of communicating into the team for the good performance of the project.



Figure 3: Cathedral Hill Hospital, San Francisco (USA)

4. The IPD Contract, Expression of the Team:

To achieve the objectives of a good team collaborative work, it is essential that all parties feel comfortable with the agreed contractual conditions, so we will briefly analyse this type of contracts, which present very peculiar characteristics and whose adequate adjustment is going to determine to a large extent the success of the work, and therefore of the project.

Indeed, in the beginning of the application in real projects of the methodology in USA, about the year 2.007, this was a major problem, the idea was underway, but the rules of the game of this new way of working had to be translated into a paper, and after the experience developed by the Sutter Health Company, a pioneer in the application of the methodology, with the first Integrated Form of Agreement (IFOA) written by the lawyer Will Lichtig, the first complete IPD contract was prepared, which came to light with the collaboration of numerous institutions: The American Institute of Architects (AIA), the Lean Construction Institute (LCI), the Associated General Contractors of America (AGC) and the Sutter Health company, this document, which continues to serve as the basis for IPD contracts, is known as ConsensusDoc 300.

After, the AIA has published its own IPD contract, based on the previous, including a law firm in California: Hanson Bridget LLP, through one of its partners, a construction specialist, and specifically in this type of contracts: Howard W Ashcraft, who has developed the subject with great diffusion in academic and business forums.

These three are basically the most used contracts in USA for IPD: The ConsensusDoc 300, the AIA and the Hanson Bridget LLP. In Spain, in parallel with the knowledge of this way of working, it also opens a good possibility of developing IPD contracts adapted to our legislation, for those law firms that want to join this current.

The Collaborative Methodology approaches the constructive fact in a totally different way to the traditional one in our country, the contracts that must be written to carry it out, must put a different focus on the rights and obligations of the interveners.

It is often said that in any contract the first thing is negotiation and then the drafting, but in the case that concerns us, it is necessary to start from some basic principles without which the contract would not be IPD, but something else, for this reason it is very important, as we said before, that the participants support the methodology and believe in it, that they accept these basic conditions of entry, and that based on them they build the contract with the specific characteristics of the project to be developed.

Recall the conditions that the definition of Integrated Project Delivery (IPD) of the AIA established in 2014:



"It is a method of delivering a project that integrates people, systems, business structures and practices, in a process that collaboratively puts to work the talents and visions of all participants to reduce losses and optimize efficiency through all phases of design, manufacturing and construction.

The Integrated Project Delivery Method contains, at least all the following elements:

- 1.- Continuous involvement of the owner, as well as key designers and builders.
- 2.- Business interests aligned through a shared risk / benefit system, including financial gains for risk, which depend on the results of the project.
- 3.- Control of the joint project by the owner, as well as key designers and constructors.
- 4.- Common contract between all the parties or with conditions of mandatory and specific participation.
- 5.- Responsibility shared by the owner, the designers and builders "(AIA, 2014).

These are the minimum conditions that an IPD contract must contain, from here the specificities of each case begin.

As well as to enhance the aspects of organization, development and communication in the team, we have said that many times someone who, with knowledge and experience in the field, acts as a facilitator by joining online wills of what IPD really is, could also in what refers to the drafting of the contract achieve much relevance by approaching criteria and improving relations.

Bear in mind that, when the IPD contract is drawn up, everything is estimated, what is going to be projected and what is going to be built is not yet fully known, and therefore the degree of uncertainty is important. One of the defects attributed to the Collaborative Methods is that for this reason you can only start a project with your own funds, since financial organizations do not want to work with uncertainties, they want to know as much as possible what they are going to finance. Once the starting point of the project has been reached, with the project defined, this can change, but not before.

"The general objectives of an IPD contract are:

- Remove impediments, stimulate communication, collaboration and creativity.
- Promote the early participation of key actors in the project.
- Distribute risks and rewards based on the results of the project.
- Exercise control of the project jointly.
- Reduce the exposure to responsibilities of the participants.
- Develop and validate the objectives jointly. "(Ashcraft, 2011)

To these objectives the AIA adds one more:

- " Decision-making in a collaborative manner. "(AIA, 2014)

Which is a generalization as to the form of these contracts, so Howard W. Ashcraft has not considered it, however, it does seem an interesting approach, since it covers the whole process, not just the control and the objectives.

The aspects that Howard W. Ashcraft (2011) considered as conflictive in the negotiation of these contracts are those related to the specificities of each project, in particular:

- "Project dimensions.
- Scope of the project.
- Form in which the project will be managed and how the decision making will be adopted.
- Compensations.
- Setting of Objectives.
- Contingencies and their adjustment to the objectives.

- Allowed costs and benefits.
- Measurement of the progress of the project.
- Risk management "

For example, the ConsensusDoc 300 favours decision making by consensus, and in case of a tie, the ruling opinion is that of property, but there are other models that prefer not to give that power to the property so as not to ballast the management of the project.

As for the setting of objectives, a technique that is usually associated with IPD contracts is to establish a prior Target Cost or Target Value Design (TVD). It consists of subjecting the design to that Target Cost and not deviating from it throughout the entire development of the project, for this purpose it uses a continuous evaluation of alternatives and implications that can influence the budget from the design, it is helped permanently by the BIM methodology, which makes it possible to optimize this work. It is about delivering the highest possible value to the client within a prefixed maximum cost throughout the development of the project.

About the allowed costs and benefits, a base budget of necessary costs for all the actors is usually established (by each one of them), also a margin for possible contingencies that could arise, although using the TVD control so that this margin is minimum, and an adequate benefit for all the participants, depending on the achievement or not of the objectives of the project. In an IPD project the efficiency is rewarded and the inefficiency is punished.

Given that IPD is a method based on collaboration and trust between team members, those consultants who work for the component technicians of the "core team", and subcontractors of the construction company chosen, should also be integrated in this way of working and should do it collaboratively with the other parts of the team, so that the application of the methodology is complete.

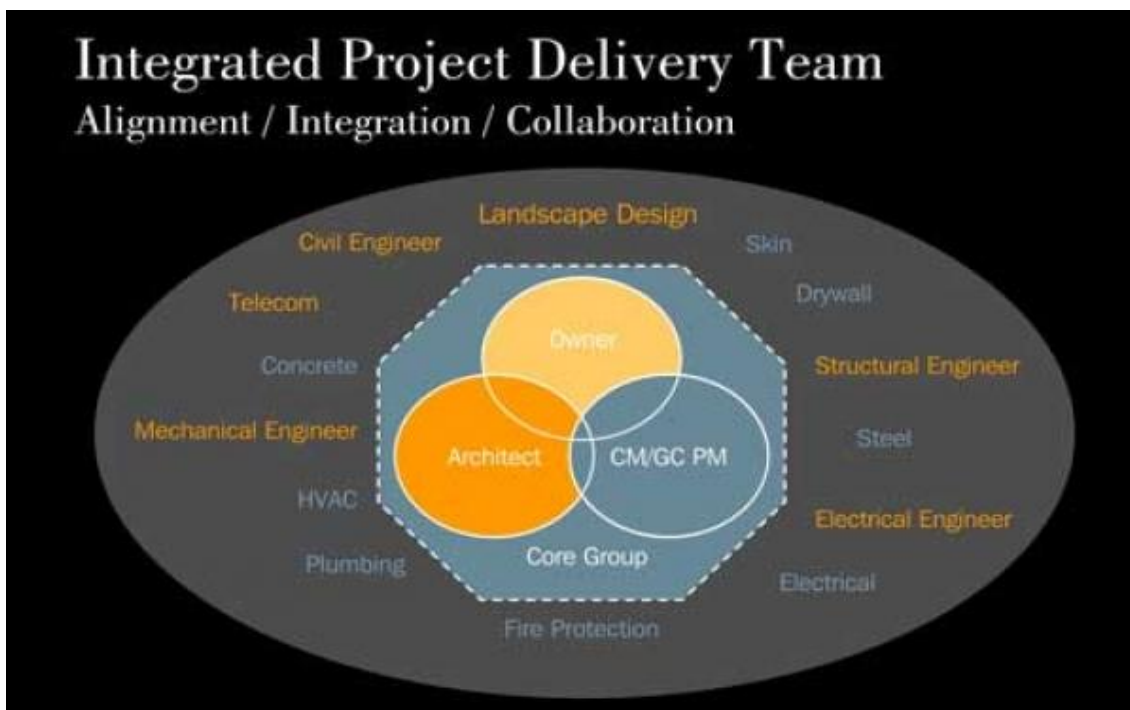


Figure 4: IPD scheme (DPR Construction Inc., 2009)

Obviously IPD brings new conflicts or manages traditional conflicts in construction in another way, it is not a panacea, to be successful in negotiating an IPD agreement, all team members must understand it from the beginning perfectly from a theoretical point of view as well practical.

"Researchers from the University of British Columbia, University of Washington and Scan Consulting, led by Renée Cheng, have recently completed an in-depth study of 10 Lean IPD projects (Cheng, et.al., 2016). The researchers tried to determine if construction was improved with IPD, arriving at the conclusion, based on their own research, and on the one made by others, that the Lean IPD methodology produces better results in the



delivery of projects, achieving a cost, and a deadline for delivery below those of the market, and that the projects studied responded to this result. Although the study was limited in the number of IPD projects examined, it offers the most detailed examination of IPD projects, done to date." (Fischer, Aschcraft, Reed and Khanzode, 2017).

In the United Kingdom many years ago, various researchers proposed formulas for improvement in the British construction process, through teamwork, in lines like what we have been defining as Collaborative Methods or IPD. The Latham Report of the year 1994, already recommended these techniques, which were developed with greater depth and approximation to the formulas applied in USA in the Egan Report of 1998. Based on these reports, PhD. David Mosey drafted the first collaborative contract that was made public in that country: The PPC2000, which greatly influenced the ConsensusDoc 300, and this considering that at the time it was written, BIM did not have the development and implementation that it has today, and none could think of the advantages that its use would bring for the application of these techniques.

In Australia and in the Nordic Countries, such as Finland, Denmark and Norway, they are also working based on Collaborative Methods and drafting contracts adapted to the legislation and customs of each of these Countries but based on the basic principles that we have outlined above. The collaborative techniques in construction offer much better results than the traditional methods and hence the increase of its implantation throughout the world. In Spain, in the same way that progress is being made in the adoption of BIM, we must work on the knowledge and application of IPD to improve our results in the construction industry.

5. Conclusions

- IPD is based on a good functioning of the team.
- This good functioning, in turn, is based on communication, clarity and consistency.
- It is essential that the members of the IPD team believe in the methodology and have the will to integrate and collaborate.
- The early incorporation of the members of the "core team" is essential for the future development of the project.
- It is convenient to incorporate to the team, from the beginning, an IPD facilitator who motivates and contributes to achieving its objectives, also keeping it aligned with the methodology and with good preparation in the same.
- In an IPD team, trust and transparency must prevail.
- An IPD team must have clear and concrete objectives.
- A great help is to work with BIM, which allows the best information for all the members of the team and considers the construction as a set of processes.
- It is important the stability of the team over time, as well as the face-to-face work in "big room".
- Communication and information among team members must be clear, permanent and complete, using an "open books" system.
- Good planning requires good information.
- The contract that binds all parties is essential to develop a true IPD.
- All parties must feel comfortable with the agreed contractual conditions. The IPD facilitator has a great job to do in this field, both at the beginning and throughout the project.

All these principles must be applied in IPD teams, with the particularities that construction has and are the basis for the methodology to work properly, the teams are made by people and only with an adequate involvement of all its members can the project achieve its target.

"We make people before we make cars"

Fujio Chó

(President of Toyota Motor Corporation 1999-2005)

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