

STRUCTURING APPROACH AND CURRENT STATUS OF INTEGRATED PROJECT DELIVERY (IPD) IN GERMANY

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ABSTRACT

The construction industry has been striving for some time to find efficient ways to ensure the successful delivery of project goals for all project participants and stakeholders, while at the same time improving the quality of collaboration and overall productivity. In addition to the use of collaborative methods and tools, Integrated Project Delivery (IPD), developed in the early 2000s, represents an innovative approach to deliver construction projects. Due to the positive results of initial pilot projects, IPD is increasingly attracting international interest. Since 2018, IPD approaches have also been used in pilot projects in Germany. This article presents the current state of research on the development of IPD in Germany and highlights the status of its practical application. Twenty IPD projects in Germany are identified, documented, and analyzed based on various criteria. For the first time, this paper creates transparency on an international level about the five-year development of IPD in Germany. It also provides a basis for more in-depth analysis, particularly regarding the qualitative aspects of the IPD pilot projects carried out in Germany.

KEYWORDS

Integrated Project Delivery (IPD), Germany, structuring approach, framework, implementation, collaboration.

INTRODUCTION

Integrated Project Delivery (IPD) is a project delivery approach that emphasizes increased integration and collaboration among construction project participants. The goal is to minimize waste and maximize efficiency in all project phases. (The American Institute of Architects, 2007) The term IPD was first introduced in the United States in the early 2000s (Lahdenperä, 2012). Due to the limitations of traditional contractual structures, construction and design firms have developed a new approach to align the interests, objectives, and practices of project participants. This approach facilitated better coordination, cooperation, innovation, and optimization in construction projects. (Matthews & Howell, 2005) Initial studies demonstrate that project objectives were achieved significantly better compared to traditional project delivery approaches (American Institute of Architects [AIA], 2012; Cohen, 2010).

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Since the early 2000s, IPD has developed in various directions, influenced for example by collaborative approaches from Australia and the UK (Lahdenperä, 2012). The evolution of IPD can be described using the characteristic feature of a multi-party agreement in international practice. This includes project delivery approaches such as 'Project Alliancing' and 'Integrated Project Delivery' (IPD) as well as approaches from the UK such as the 'Project Partnering Contract' (PPC2000). (Haghsheno et al., 2022)

In recent years, there has been significant research on the implementation of IPD in various countries. The studies address the challenges and opportunities associated with the global spread of IPD. Several studies have examined the implementation of IPD in different regions. For example, Rached et al. (2014) explored the implementation and challenges of IPD in the Middle East, while Forero et al. (2015) investigated the perception and disposition towards IPD in Colombia. The studies by Li and Ma (2017), Aslesen et al. (2018), Erazo et al. (2020), and Dargham et al. (2019) examine the barriers and challenges to implementing IPD in China, Norway, Peru, and Lebanon, respectively. Additionally, Attouri et al. (2023) investigated the legal feasibility of IPD implementation in France.

Examples of German academic research on Integrated Project Delivery (IPD) in an international context include studies on trust in IPD, as presented by Haghsheno et al. (2021), the development of an simulation demonstrating the functioning of IPD elements, published by Russmann et al. (2022), and analyses of the implementation of co-locations in IPD projects, as presented by Szyperski et al. (2023).

RESEARCH DESIGN

A systematic literature review on IPD in Germany was conducted in the first part of this paper. The review examines the development of IPD in Germany in theory and the current state of research. Relevant theoretical studies in English and German were identified.

The analysis of current IPD projects in Germany was conducted using a multi-layered research methodology. To achieve a comprehensive market analysis, various sources of information and types of interaction were combined. A thorough review and evaluation of available information and data from secondary sources was undertaken through comprehensive open-source research. The evaluation process involved analyzing scientific publications, industry analyses, company announcements, and documents and presentations from conferences, seminars, and market information events. Public tenders were also considered. Additionally, targeted bilateral discussions were conducted with market participants to gather additional data, especially data that is not publicly available. Excerpts from the analysis results have already been published in the annual IPD report at the German IPD conference.

DEVELOPMENT OF IPD IN GERMANY AND CURRENT STATUS OF RESEARCH

The construction industry in Germany is facing numerous challenges. Conventional project management is characterized by a lack of integration between project participants, inadequate risk management, a lack of partnership-based cooperation and insufficient conflict resolution mechanisms. In addition, many projects experience cost increases due to errors in cost calculation or tendering, changes by the client or price increases. (Kochendörfer et al., 2021)

Between 2000 and 2015, over 40% of federal building construction projects exceeded their budget and more than 35% did not meet their deadline targets (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit [BMUB], 2016). This is also reflected in the sector's productivity. While productivity in the German manufacturing industry rose by 27.1% between 2006 and 2016, the construction industry only recorded growth of 4.1%. (Schober et al., 2016)

To address these issues, optimization and innovation potential should be utilized throughout all stages of building creation. This requires collaboration and integration among various service providers and clients. (Girmscheid, 2016)

In 2016, a federal construction reform identified nine areas for action. One of these areas is the implementation of partnership-based contract models to address the lack of sustainable, long-term, and trusting cooperation between project participants. The reform aims to achieve this through early integration of contractors, increased use of risk and rewards regulations, transparent calculation documents, and partnership-based pilot projects. (BMUB, 2016)

Integrated project delivery has been implemented in initial pilot projects in the German construction industry since 2018. The term was initiated by the 'Initiative Teambuilding', which was founded in 2016 and consisted of about 40 organizations from practice and science, which examined approaches for better collaboration already established abroad for the German market. In 2018, a private client organization launched the first IPD pilot project, followed by a public sector pilot project in 2020. (Haghsheno et al., 2022)

The Initiative Teambuilding led to the founding of the 'IPA Zentrum' (The Competence Center for Integrated Project Delivery or IPD Center). The IPD Center is a central platform to enable stakeholders in the construction industry to successfully implement complex construction projects through the use of IPD models in Germany. It significantly contributes to the demand-oriented and resource-efficient construction and maintenance of built infrastructure. The main goal is to create an inclusive networking platform that facilitates the sharing of knowledge and experience, thus promoting the implementation of IPD models in the construction sector. The IPD Center is comprised of more than 80 carrier organizations from across the construction industry. An advisory board, consisting of representatives from eight universities and over 20 professional and trade associations in Germany and Austria, provides strategic guidance to the leadership and incorporates perspectives from politics, professional associations, and academia. Volunteer experts from the IPD community collaborate in various working groups to develop concepts and publications. (IPA Zentrum, 2023)

IPD – A STRUCTURING APPROACH FROM RESEARCH

The 'House of Integrated Project Delivery' is a structuring approach that was published in 2022 by Haghsheno et al. As illustrated in Figure 1, the structure consists of four pillars based on a foundation. The approach is based on previous work to structure the model of IPD such as Darrington et al. (2009) or Lichtig (2005). The structuring approach includes framework conditions, requirements, and experiences from German IPD projects. In this structured approach, IPD is based on values and a multi-party agreement. The values define fundamental principles of cooperation, while the multi-party agreement provides the legal framework and sets out common rules for cooperation.

Structuring Elements

IPD is based on a multi-party agreement as a legal framework with common rules and values as the basic principles of cooperation. Building on this foundation, the structuring approach consists of four pillars: culture, organization, economy, and methods. The culture pillar describes approaches for establishing shared values. In order to fully exploit the advantages of the model, a change in the project culture and the behavior of the team members is required. Developing a shared understanding of values and creating a sense of belonging are lengthy and complex processes. Various tools can be used as part of project management, such as the development of a project charter, team building, onboarding activities, and structured team reflections.

The organizational pillar refers to integrated structures for communication and decision-making. Efficient decision-making and flat hierarchies require an integrated and interdisciplinary organizational structure to react quickly to changing conditions. In terms of

economics, value-based financial incentives are set, and risks are allocated. IPD is most effective when the economic incentives of the partners align with the project goals. Positive economic incentives replace penalties such as liability or contractual penalties. The methods pillar outlines processes for promoting transparency, collaboration, and efficiency. Therefore, Lean Management is a crucial component of IPD, especially the ideals and principles of Lean Management which help in implementing IPD and establishing the right project culture. Methods such as the Last Planner System, Target Value Design, Building Information Modeling, or Choosing by Advantages are utilized. All four pillars are important for the stability of the project and therefore are critical to its success.

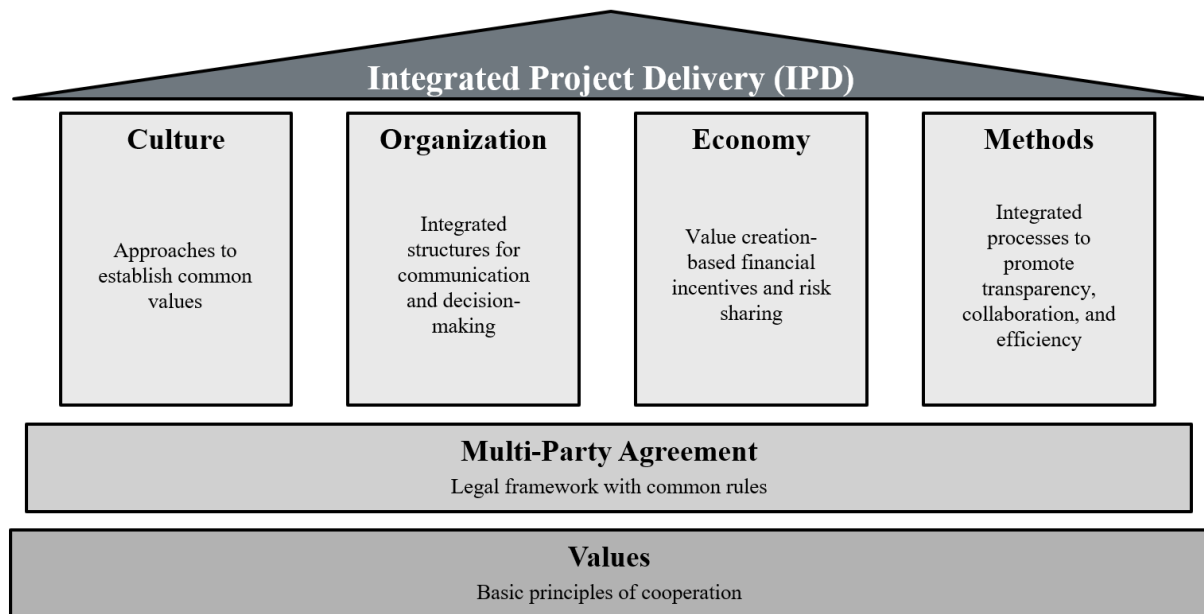


Figure 1: House of Integrated Project Delivery (Haghsheno et al., 2022)

Elements are assigned to the categories of the House of Integrated Project Delivery as sub-items. These elements enable the precise characterization of specific models of integrated project delivery and the classification of projects, considering the implemented elements.

IPD – A STRUCTURING APPROACH FROM PRACTICE

Also in 2022, the IPD Center initiated a conceptual framework for the German Integrated Project Delivery model. The characteristics and model components were developed based on initial experience gained from the implementation of IPD in Germany by experts from science and practice. The framework was developed due to the observation that many projects were adopting the new project delivery approach and referring to themselves as 'IPD projects', despite significant differences between the projects. The framework was considered a necessary step to ensure a common understanding in the industry, to enable the identification of IPD projects, and to provide transparency on the underlying concepts.

IPD Characteristics and Model Components

Figure 2 displays the model, which comprises eight characteristics and 21 assigned components. To be classified as an IPD project, a project must cumulatively meet these relevant success factors. Therefore, all 21 model components must be utilized in the project.

One of the key characteristics of a successful collaboration is the establishment of a multi-party agreement in which at least three parties are involved in the rules of cooperation. The early involvement of key stakeholders through a competition of competencies is of significant importance. Besides competencies, skills related to effective teamwork, such as behaviors and attitudes, are also relevant. In addition to joint risk management, which involves identifying,

evaluating, and managing project risks and opportunities at an early stage, there is also joint decision making based on shared responsibility for project goals.

The compensation model's incentive system aims to align participants' behavior with project goals. Collaborative working methods aim to enhance effective cooperation, transparency, and collaboration within the project team. This is achieved through the use of BIM and Lean Construction methods.

The framework treats conflicts as a potential for value creation and aims to resolve them as quickly and constructively as possible through solution-oriented conflict resolution. In a final step, understanding and aligning behavior with shared values, the cooperative attitude of the participants, is a mandatory prerequisite for the success of an IPD project. (IPA Zentrum, 2022)

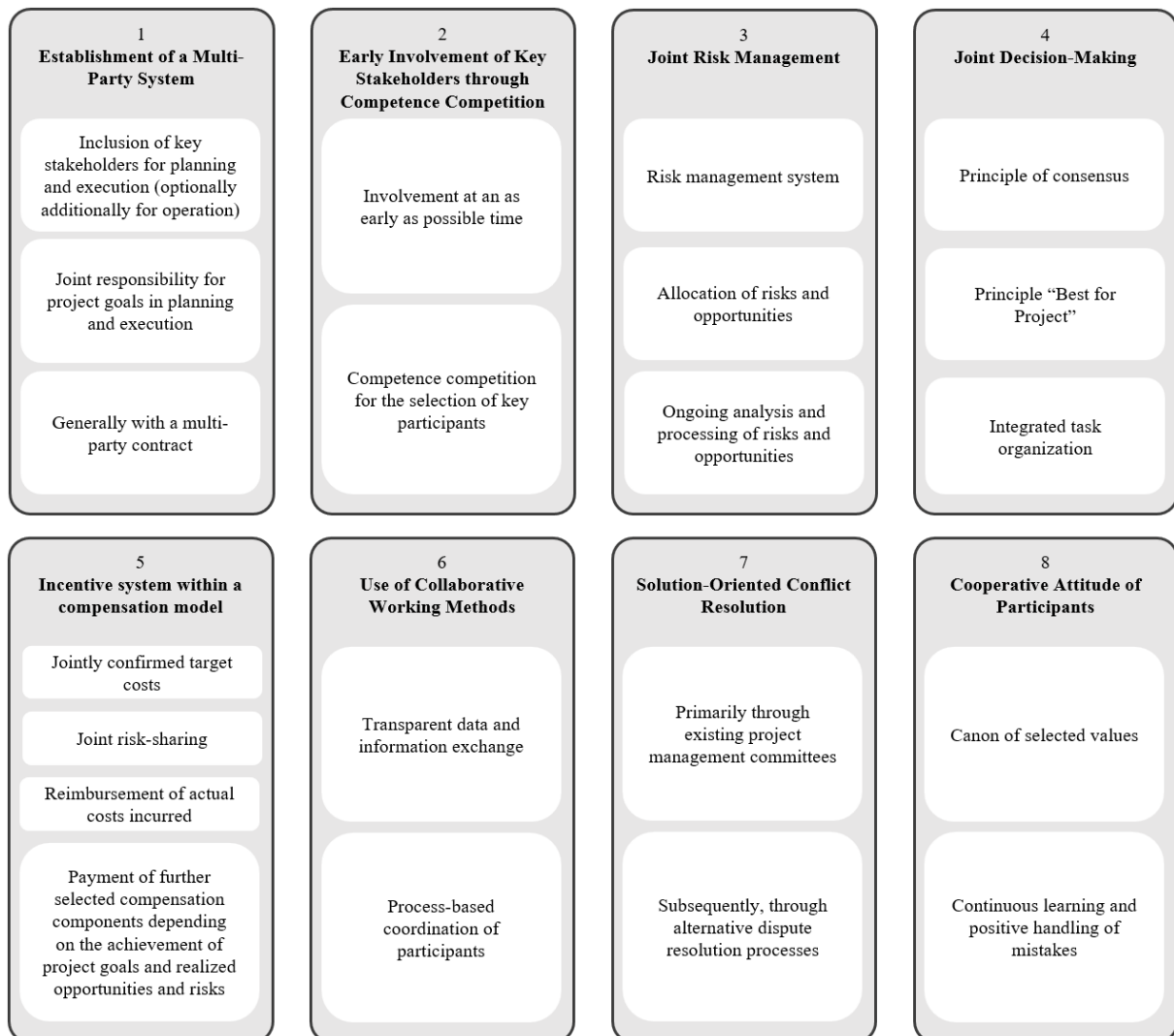


Figure 2: IPD characteristics and model components (IPA Zentrum, 2022)

The structuring approach of Haghsheno et al. (2022) and the framework of the IPD Center are not contradictory, but rather complimentary. Therefore, the essential contents of both approaches are comparable.

CURRENT STATUS OF IPD IN GERMANY: PROJECTS IN PRACTICE

The following section constitutes a comprehensive report, synthesizing pertinent details concerning projects executed through Integrated Project Delivery in Germany. The criteria for

an IPD project to be listed are that the IPD characteristics as defined by the IPD Center are present or (foreseeable) and that at least the partner selection phase has begun. The data collected dates back to 2018, when the first IPD project started in Germany. Figure 3 provides an overview of the IPD projects in Germany. In addition to the project name, they are categorized according to project costs. The timeline displays the individual phases of the IPD projects at the respective points in time. As of 2023, there are a total of 20 IPD projects that have either been completed or are currently ongoing, at least in the partner selection phase. Out of the 20 projects, one has been completed, seven are currently under construction, and six are in the 'Integrated Planning' phase. One project is currently on hold, while five others are still in the 'Partner Selection' phase.

IPD Projects in Germany		2018		2019				2020				2021				2022				2023			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project name	Project costs																						
Havelufer Quarter	€200M - €500M																						
Kattwykbrücke iPAK 5	€15M - €50M				P		PS				IP												
BMW FIZ WS	€100M - €200M							P		PS													
LIFE Hamburg	€50M - €100M											P		PS									
3 Schools Bremerhaven	€100M - €200M											P		PS									
DB - New Plant Cottbus	> €1B											P		PS									
BEA	€100M - €200M											P		PS									
Siemensstadt	€100M - €200M											P		PS									
Amprion A-Nord	€500M - €1B											P		PS									
BAM GBD 149	€200M - €500M											P											
ITZ Bund Ilmenau	€15M - €50M															P		PS					
Paul-Ehrlich-Institut	€500M - €1B															P							
Shift Hub	€200M - €500M															P		PS					
DB - Pfaffensteigtunnel	€500M - €1B																P						
DB - Eüen Köln	€200M - €500M																	P					
Luisenblock Ost	€500M - €1B																	P					
DB - New Plant Neumünster	€200M - €500M																	P					
Salzgitterkai	€100M - €200M																	P					
DB - FBQ (Rail Infrastructure)	> €1B																			P			
DB - FBQ (Immersed tunnel)	> €1B																			P			

P = Preparation	Sorted by the beginning of the 'Partner Selection' phase.
PS = Partner Selection	
IP = Integrated Planning	
IC = Integrated Construction	
O = Operation	

Figure 3: IPD Projects in Germany

In comparison to 2022, there have been two discontinued IPD projects due to a re-evaluation of investment activity in response to changed circumstances, which led to the projects being discontinued for economic reasons. During the period from mid-2022 to mid-2023, eight new IPD projects have been identified and are currently ongoing.

In addition to the IPD projects listed, for which at least the partner selection phase has started, seven other IPD projects are currently in preparation. These are projects for which it is known that a decision has been made in favor of IPD as the project delivery model. IPD is also being intensively discussed as a project delivery model for other projects. However, a final decision has not yet been made on these projects.

Project Costs and Client Structure

In Germany, the smallest IPD projects fall within the project size category of €15 - €50 million, as shown in Figure 4. Analysis of IPD project distribution reveals a preference for implementing the project delivery approach in larger projects. The reasons for this preference are varied. IPD

is particularly well-suited for complex projects. Complexity can arise from various factors such as many participants, technical challenges, or large project sizes.

According to the definition provided by the IPD Center, an IPD project must fulfill eight characteristics and 21 associated model components to be classified as such. This may result in increased costs, especially during the initial phase of construction projects. For example, there may be extra expenses for the assessment center to choose partners or for team building activities. Ideally, the initial costs are offset by improved collaboration during the planning and construction phases of the project. For larger projects, the higher initial costs account for a comparatively smaller proportion.

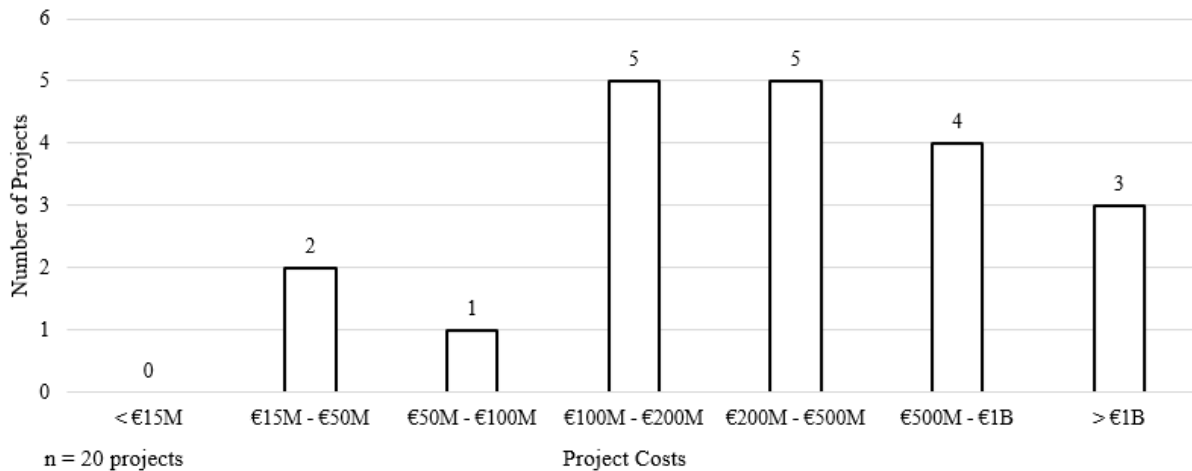


Figure 4: Project costs of IPD Projects in Germany

The distribution of IPD projects clearly shows that IPD is used primarily in larger projects. Out of 20 projects, 17 have a project volume exceeding €100 million. Due to the increase in IPD projects in the area of transport infrastructure, there is a trend towards larger projects. All three projects with a volume of over €1B are assigned to transport infrastructure.

In total, 14 of the IPD projects are being carried out by public clients, while six are being carried out by private clients. A comparison between 2023 and 2022 shows an increase in the proportion of IPD projects in the public sector. The Deutsche Bahn (German Railway) is making a significant contribution to this by driving forward an increasing number of pilot projects.

Type of Use

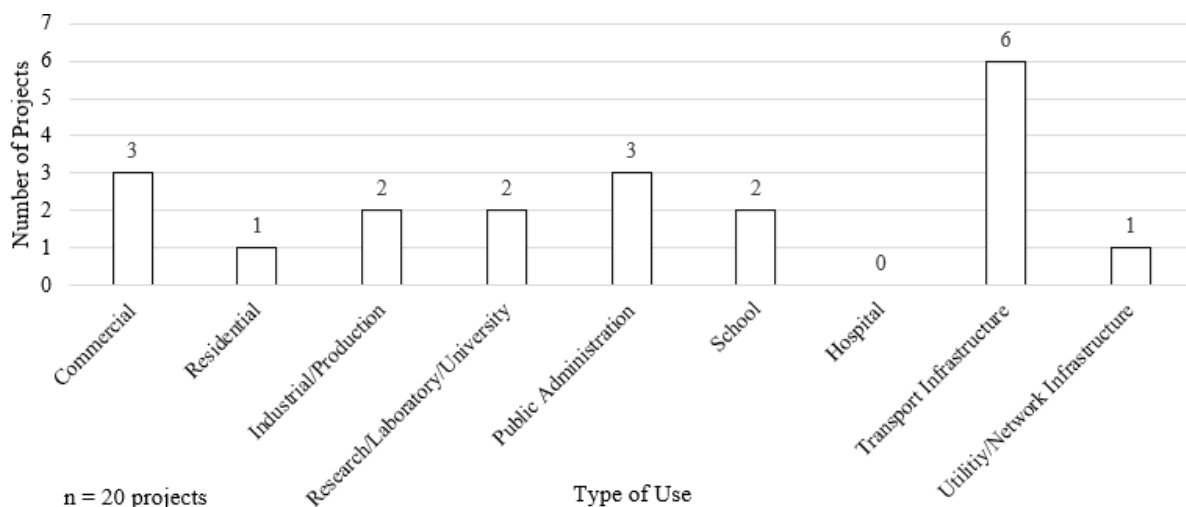


Figure 5: Types of use of IPD-Projects in Germany

Figure 5 displays the distribution of IPD projects by type of use, indicating that the projects can be assigned to a wide range of uses. Three of the analyzed projects can be assigned to the commercial construction sector, one to the residential construction sector, two to the industrial/production sector, and two to the research/laboratory/university sector. Additionally, three projects are intended for public administration use, two for educational purposes, and one for the utilities/network infrastructure sector. As stated in the previous section, six IPD projects were dedicated to transport infrastructure, which accounts for the largest share. The evaluation indicates that IPD is utilized in completing projects in both building construction and civil engineering.

A comparison of new and existing construction projects reveals that the majority of IPD projects concentrate on new construction activities. In cases where projects involve both new and existing construction components, the classification is based on the primary focus of the construction task. While 17 projects are classified as new construction projects, only three projects primarily relate to measures in existing buildings. Existing building measures are typically associated with increased uncertainty and specific requirements. It is to be seen whether the use of IPD for existing building measures will be increasingly preferred by building owners in the future. The benefits of IPD could arise in particular from the flexible management of risks.

Number of Contractual Partners

A further differentiation between the IPD projects is whether the team is put together through separate tender or selection procedures with individual applications or through team applications. 18 IPD projects use the concept of individual applications, while team applications have only been used in two IPD projects.

Figure 6 displays the distribution of IPD projects based on the number of contracting parties in multi-party agreements. The diagram depicts a single project with small dots, and two projects on the same axis with large dots. The IPD Center defines a multi-party agreement as having a minimum of three contractual partners: the client, the key planner, and the key contractor. Criteria for determining the necessary number of key partners generally include the scope of services, their influence on the project's success, their contribution to value creation, and the significance of their expertise for product development and process flows. (IPA Zentrum, 2022)

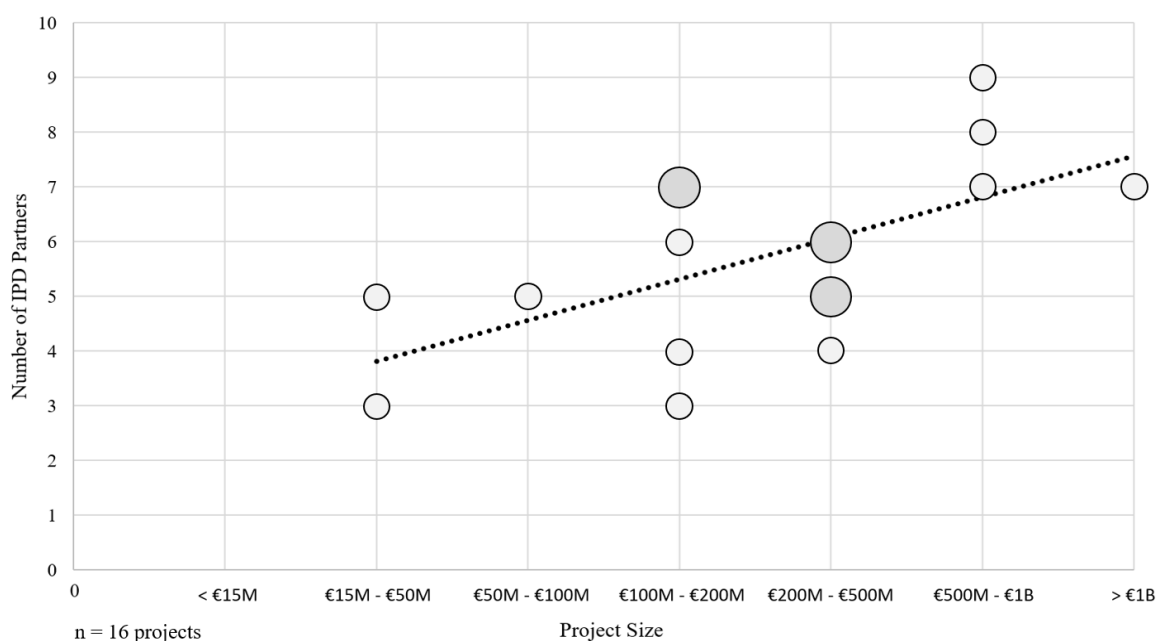


Figure 6: Number of IPD partners in comparison to the project size

The number of contractual partners is also determined by the construction task and the market structure of potential providers. The appropriate team size is being considered in relation to integrated organizational structures and decision-making in committees, without overburdening those involved. This is especially important as the parties involved are undergoing an intensive change process that is accompanied by the implementation of IPD.

The sample relates to 16 projects due to incomplete information on all projects. The distribution indicates that four projects have five contractual partners, while another four projects have seven contractual partners. Two projects have the minimum number of three contractual partners. With nine contract partners, one project has the maximum number of all projects in the sample. Beyond this survey, a trend towards the implementation of projects with even more contractual partners in the German IPD market can be observed in projects currently in the preparation phase. The linear trend line confirms the theoretical explanations that there is a tendency towards more contractual partners with higher project volumes. However, there is no clear correlation between the number of contractual partners and the type of use or other characteristics.

Experience in Completed and Advanced IPD Projects

Experience with IPD projects in Germany has been positive to date. The following section presents experiences from individual projects. For example, the 'Kattwykbrücke iPAK5' project, a lift bridge located in the port of Hamburg, was built to the desired quality and within the planned costs, but the construction time was significantly reduced compared to conventional project delivery. This was accomplished by prioritizing problem-solving over assigning blame when issues arose. The project claimed that Integrated Project Delivery represented a new paradigm of collaboration for them. (Hacker & Schulz, 2022)

The '3 Schools Bremerhaven' project, the parallel construction of 3 schools in Bremerhaven, is drawing positive effects as an interim conclusion, particularly from the earliest possible start of the alliance based on the results of the preparation phase and the client's conditions of satisfaction. In addition, IPD, particularly in combination with BIM and Lean, offers optimal framework conditions for achieving genuine collaboration and a focus on objectives in the project. (Hamel & Rodde, 2022)

The 'Siemensstadt' project in Berlin involves the construction of a high-rise and an atrium building. According to one of the construction companies involved, the risk/reward profile is balanced, and the worst-case scenario can be effectively managed through risk management. The fact that influence can be exerted early in the planning phase and that all partners work together as equals is also highlighted as a positive aspect. Challenges mentioned include complete transparency, i.e. the profit rates and overhead rates known to all, which may be new to the corporate cultures, and the lack of co-determination rights in the selection of other construction partners in the project. During the preparation and validation phase, success factors and advantages were identified, including a realistic client budget, early definition of key systems, and high levels of management support within the client organization. Additionally, the establishment of a project culture based on partnership was successful, and there was a high willingness to try out new processes and roles. The increased time and cost required for validation due to IPD was offset by significant savings in the planning phase and binding cost statements from the construction companies. (Clesius & Warlich, 2023)

Experience from various validation phases of IPD projects shows that a high level of personnel deployment and regular presence in the colocation is necessary. The new project delivery model requires experienced and well-trained personnel. Each contractual partner must have an authorized decision-maker. Project management should be a joint effort of the team and not underestimated. (Schedensack & Büchner, 2023)

CONCLUSION AND FUTURE WORK

Integrated Project Delivery has been utilized in Germany since 2018. An analysis of the theoretical work on this topic in Germany shows that there are two structuring approaches. One approach is the concept of the 'House of Integrated Project Delivery', while the other examines the characteristics and associated model components.

In practice, the authors' research shows that a total of 20 projects based on the definition of the IPD Center had been carried out in Germany by 2023. Most of these projects have a volume of over 100 million euros. The percentage of IPD projects executed by public client organizations is presently on the rise. The evaluation indicates that IPD projects are present in nearly all forms of use and construction. This highlights the potential of the IPD project delivery model for various segments of the construction industry. It is worth noting that the IPD partner selection process also allows for team applications in addition to the established individual application approach. The number of contractual partners in the multi-party contracts range from three to nine.

The analysis demonstrates that the momentum started in 2021 is continuing in terms of the number of IPD projects launched. Therefore, an increasing number of market participants can experience IPD through practical implementation, and initial findings can be evaluated for desired results. In addition to the analyzed projects, several other IPD projects are currently in the decision-making phase. The extent to which the positive development of IPD will continue remains to be seen and will require further monitoring.

In this article, a descriptive analysis was conducted on the gathered data. Research on the documentation of IPD projects in Germany has predominantly taken a descriptive approach, focusing on quantitative core information and framework conditions. However, to not only document but also comprehensively evaluate IPD projects in the future, a qualitative study is necessary. Design features that could be analyzed include compensation mechanisms, risk-sharing contributions, risk and rewards systems, tender criteria and their weighting, the timing of IPD team formation, target cost agreements (planning status), collaborative methods, decision-making rules, and alternative dispute resolution arrangements. This aims to provide additional insights and a more comprehensive understanding through supplementary parameters and qualitative data collection.

As part of a research project funded by the German Federal Ministry for Housing, Urban Development and Building, the authors aim to complement the existing descriptive approach with a qualitative and structured evaluation of information. The objective is to identify correlations between design elements and the processes and outcomes of an IPD project. The study aims to determine the extent to which different design elements influence the processes and outcomes, and what impact they have on the overall process and the achievement of the overall project goals, in order to derive specific recommendations for practice.

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