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Project delivery systems in Finnish new building construction – a review of the last quarter century

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Abstract

The project delivery system (PDS) is the key means by which the owner creates preconditions for successful realization of a project. Thus, it is worthwhile finding out which systems are used in different instances. This paper aims to increase general knowledge in this area first by introducing the results of an analysis of data on more than forty thousand new building construction projects launched in Finland between 1989 and 2013. Annual shares of different PDSs are determined separately for residential, industrial and business premises, as well as other buildings – mainly public service buildings. The paper also sheds light on changes in the market structure to the extent that they influence the use of different PDSs in order to discover the key factors which could possibly hamper making conclusions about general trends in, and the impact of the economic situation on, the selection a PDS for a project. As to the results, the study shows that the separate contracts method is used the most while the share of construction management is the smallest. In-house construction, design-build and the traditional comprehensive contract are other systems used whose shares fall between the above two extremes. Changes in market structure over time most likely influence the use of different PDSs in housing construction.

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1. Introduction

The *project delivery system* (PDS; or *procurement system*) is a key factor in enabling successful implementation of a building project. The right system may help avoid problems and be key to attainment of project-specific goals.

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These goals may include quick project completion, low price, practical allocation of risk between the parties, and providing the owner the possibility to affect the details of the design solution and the amount of in-house work, etc. Although a certain PDS may be best suited for certain project types, there is also much variation due to the numerous factors determining the selection of a PDS. In addition to project properties, the owner's objectives, and available know-how and resources, the market situation may also have an impact on the selection of the PDS.

A lot of work has been done to explain the rationality of the use of alternative PDSs, and several selection methods have been developed internationally to facilitate decision-making by the client/owner with respect to certain goals and boundary conditions. There exist also numerous case and other studies on the success of a PDS in certain conditions and cases. The actual decisions of clients and the way in which various PDS are used in different situations industry-wide have, however, received less attention. For this reason, this review aims to shed light on the shares of different PDSs used in Finland over the last twenty-five years in different types of new building projects. The analysis is based on quite broad empirical data that cover a significant share of the targeted business over the period 1989 to 2013.

Yet, the general nature of the data and the missing information about the owner's objectives and project properties (apart from building type and monetary value) allows only analyzing general trends and the influence of market fluctuations and project size on the decision to use different PDSs (as in the case of the study based on the first ten years of the data by Lahdenperä, 2000). Such a mechanistic approach may not, however, be very reliable without first delving into the market data in more detail, since market structure is likely to vary along with economic fluctuations and for other reasons: most likely the owners and customers and project types and selection situations vary at various points in time which means, for instance, that it is not just a question of selecting a different PDS for project implementation in accordance with the current economic situation.

Thus, the aim of the study is, firstly, to determine the quantitative use of different PDSs for different building types and, secondly, to find out if there have been changes in the market which have had an indirect impact on used PDSs. For instance, the data are delved into to determine roughly the types of owners in various groups. All in all, the study is expected to offer a platform for more systematic analysis of the influence of economic fluctuations on the selection of a PDS. Yet, it does not go that far, but is only an interim study on the way to the final target.

2. Research method and material

The study is based on hard data on the use of PDSs in the market whereas the resulting information is subjected to debate with experienced practitioners in order to discover any underlying factors possibly impacting on the use of different PDSs; the existence of these factors is then authenticated from literature for critical review.

Data on the use and shares of PDSs derive from a project database which includes data on a huge number of building construction projects in Finland. The project data is updated continuously and cross sections are captured annually for study purposes (the latest: RPT Docu, 2013). It is the very same source used in the earlier studies by the author (Lahdenperä, 2000; 2001) referred to as *Rakennusfakta* in accordance with its name. The project data are generated mainly to serve the direct marketing needs of various construction sector firms.

The database contains data on, for instance, the parties and their contact information, building types, key structural solutions, schedules, volumes and locations, and PDSs. The data are acquired primarily from owners. The starting point is information on building projects disseminated through various media and continuous contacts with a significant portion of the clientele. The material is not restricted to a certain subarea of building, but the aim is to cover the entire field including new construction and renovation projects of all types of buildings. Another goal is to achieve national coverage, which also appears to have been realised to a large extent.

The study at hand is confined to new building construction. All single-family houses and holiday homes have been excluded as other projects of similar size. The PDS of all projects is not known, and the data set underlying the study is only a subset of the entire data. Some sort of data mining has been implemented in order to improve the coverage and exactness of the sometimes incompletely recorded project information.

The projects for the project delivery system (PDS) analysis were selected on the basis of construction commencement time. The calculations were based on projects started during the annual review period, and no

advance information was used (with few exceptions) in order to minimize the risk of including in the reformed data set projects that will later be postponed. Due to the timing of the material's annual updates (in our case), the review period ends at the end of September of each year; therefore the data are not based on the literal calendar year, but the projects of a year consist of ones whose construction was launched during the period between October of the previous year and September of the year in question. The resulting bias is minimised by the fact that in Finland most launches take place during the second and third quarter of a year due to our northern location and climate.

The reformed data set includes a total of more than 41 000 projects quite evenly distributed over the target period consistent with economic trends. Just over half of the projects are housing projects. Both industrial and business premises comprise a good tenth of the total (the smallest groups). The share of the 'other buildings' group is thus a good fifth of the total.

The analysis of the data set produced the figures presented later in the paper which are supplemented by data on annual construction activity from official statistics (Statistic Finland, 2014a). A dozen practitioners were interviewed based on the figures with the aim of finding the most important factors that explain the changes in the shares of PDSs. All the practitioners had long-term hands-on experience from industry practices and were decision-makers as regards the applied procedures and arrangements. They include both public and private owners and contractors. The interviews focused on changes in market structure during the study period, other factors explaining the use of different PDSs, trends in industrial practice as to different PDSs, and impact of the economic situation on PDS selection. The last two issues are not dealt with here. The gained understanding was deepened and verified later by a literature review effectively directed by expert interviews.

3. Examined project delivery systems

The implementation of a building project involves the co-operation of many parties: the owner, various designers, contractors and suppliers. There are numerous PDSs for establishing the division of labour between the parties, contractual relations, and other ground rules. In this study the breakdown is the following:

- *In-house construction* (IH), where the owner designs or commissions the design, supervises site works and possibly performs part of the technical construction work (incl. speculative building by contractors).
- *Design-build* (DB), where a contractor under contract to the owner is responsible for the project's design and construction as an entity (incl. projects implemented on the contractor's plot).
- *Comprehensive contract* (CC), where the owner assumes responsibility for design and the project is implemented on the basis of a single contract (i.e. traditional design-bid-build method); no subsidiary contracts are used.
- *Separate-contracts* (SC), where the owner assumes responsibility for design, and construction is implemented on the basis of a few parallel contracts (i.e. design-bid-build with subsidiary contracts).
- *Construction management* (CM), where a separate project management organization manages the overall project and implementation is realized through numerous partial contracts (CM with a fee or at risk).

The PDSs are presented only in broad outline and no information is available on variations within a category or interpretations of the data of special cases. The most common PDSs are covered, even if at first it seems that Project Alliance and public-private partnership projects, like Design-Build-Maintain (DBM) and Design-Build-Finance-Operate (DBFO), are missing. Very few building projects involving private financing (i.e. DBFO) have been carried out in Finland (obviously due to tax disadvantages). DBM is also used very seldom although its use seems to be increasing slowly. Both types of PDSs are, besides, implemented under several contracts, and actual construction takes place under a DB contract. Thus, the projects are basically/possibly included in the data set and their very small number does not in any case bias the analysis.

As regards the use of Project Alliance in Finland, it was first introduced in infrastructure construction and building renovations just a few years ago, and has not likely been used for new building construction during the study period. Later on there have been reports of alliancing having found its way to a few new building construction projects as well. Considering that, the above list of PDSs is comprehensive and reasonable and corresponds also roughly to customary breakdowns.

4. Use of various project delivery systems

This section reviews the use of various PDSs in 1989–2013 by year. The results are presented separately for the four different groups of building types. The contents of the following main categories were derived from classifications of official statistics (Statistic Finland, 1994) (with only minor exceptions):

- *Housing*: Residential buildings (including the sub-categories of attached houses and blocks of flats; excluding detached and semi-detached houses)
- *Industrial buildings*: Industrial buildings, warehouses
- *Business premises*: Commercial buildings, office buildings
- *Other buildings*: Transport and communications buildings, buildings for institutional care, assembly buildings, educational buildings, fire-fighting and rescue service buildings

In building type-specific charts (Figs. 1–4), the number of projects implemented by various PDSs is the basis for computing their shares of the total number of projects (indicated by the primary vertical axis). The figures also show the overall volume of new building construction (based on the building-type categories of the research material) and the volume of the building-type group in question (scale indicated by secondary vertical axis on the right).

5. Factors impacting use

Residential construction is the building type-specific group where variation in the use of different PDSs is clearest at different times. Variation is naturally greatest in *in-house work*, which in the case of this building type consists specifically of speculative development by construction companies, where they establish a housing company, on whose behalf they act, and whose shares entitling to occupy dwellings they subsequently sell to consumers (traditionally). The equity/shares are divided in such a way that they grant an exclusive right of possession to a certain dwelling unit (see Lujanen (2010) for more information on the Finnish housing company model). Thus, this activity is clearly linked to demand and economic conditions and does not involve actual selection between alternative PDSs in a client-initiated project.

Despite this straightforwardness, forming an overall picture of the residential market is yet hampered by the fact that when property development has been down, state-subsidised production has been at its highest in the 1990’s, at the beginning of the review period, and later in 2001 and 2009 (e.g. ARA, 2002; 2013). Thus, the volumes of construction company-implemented property development and state-subsidised production vary quite inversely to each other. The typical obligation to organise tender competitions and the traditional operating culture of state-subsidised production, again, generally lead to use of the traditional design-bid-build forms of contract (*separate*,

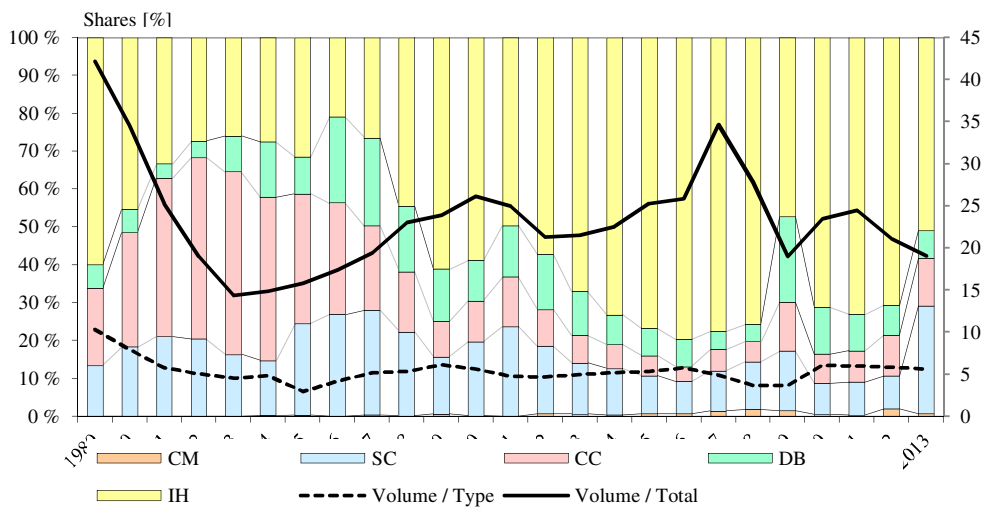


Fig. 1. PDSs of new housing construction.

comprehensive) even if other client-initiated construction often adheres to other forms. Thus, the market structure has changed essentially along with economic conditions, which can be assumed to overemphasise also the changes in the shares of the PDSs.

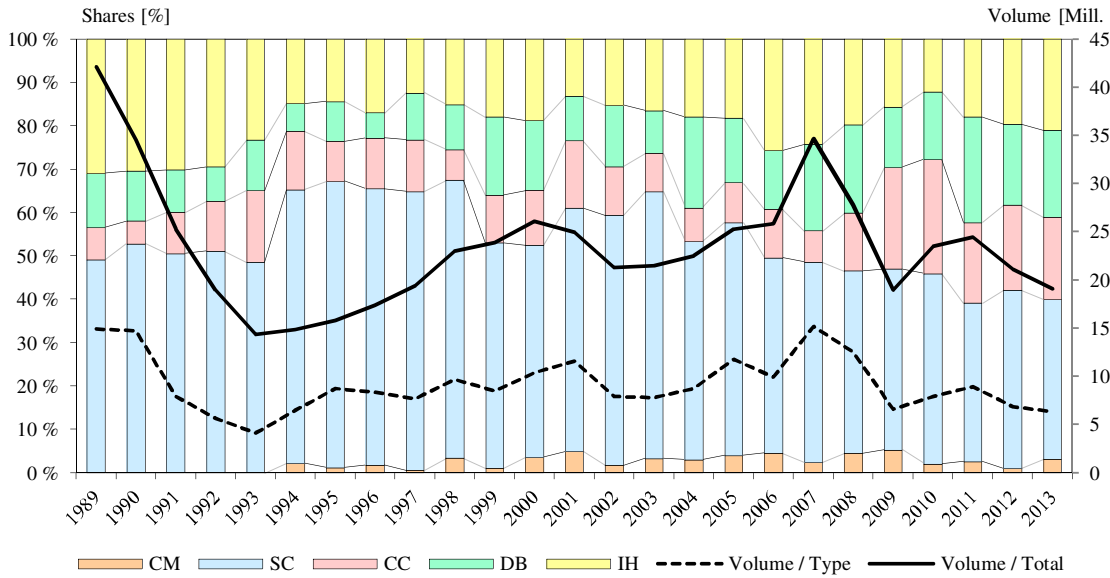


Fig. 2. PDSs of new industrial construction.

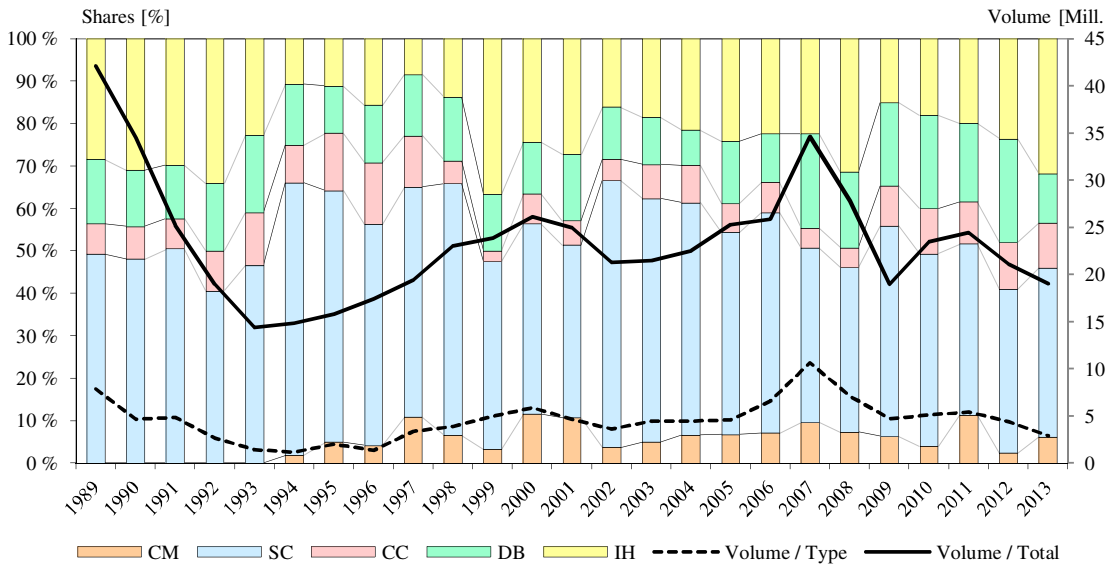


Fig. 3. PDSs of new business-premises construction.

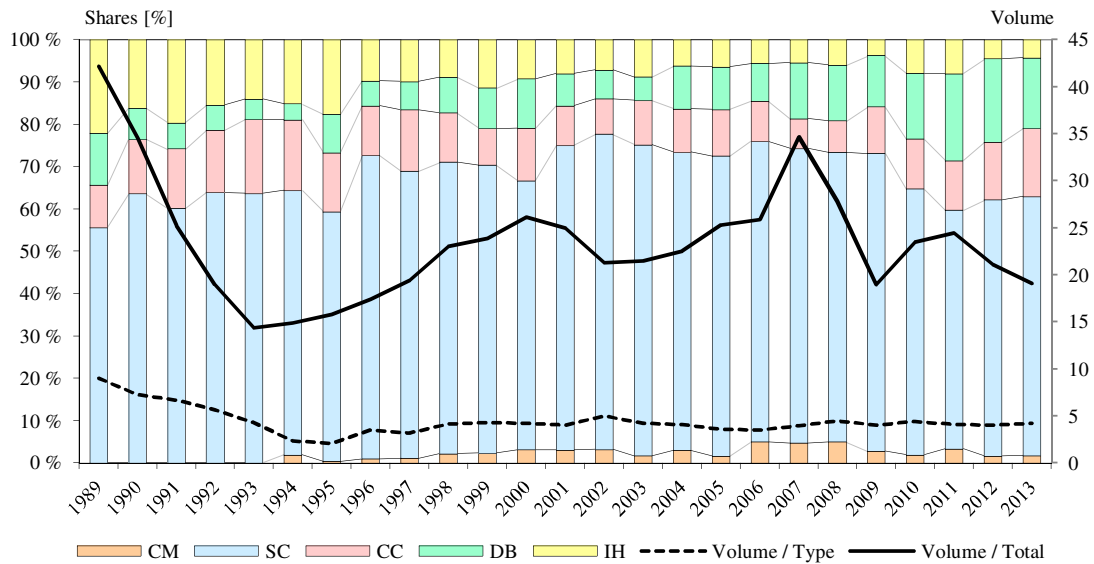


Fig. 4. PDSs of new construction other than housing, industrial and business premises.

A special extra factor affecting market changes are the dwellings built based on the so-called 'intermediate model' whose construction was launched as part of state-subsidised production in 2009–2010 as a counter-cyclical measure to maintain sector employment when in-house production of construction companies came to a virtual standstill (ARA, 2011). A partial solution was to relax the conditions for state support temporarily which aimed (successfully) to direct projects already under preparation by construction companies toward production of rental housing. Such projects were mainly launched on the basis of the negotiated procedure (ARA, 2013), which likely caused the 2009 PDS distribution essentially different from others especially as concerns *design-build*.

In weak economic conditions contractors are generally more eager to offer their stock of plots to clients although – especially due to the perceived low supply – own plots are primarily used in property development which is more profitable. Consequently, availability of plots is likely to promote somewhat the use of *design-build* in a weak economic situation, although on other grounds it is believed to gain more popularity particularly in favourable economic conditions when challenging projects require a collaborative approach. Thus, plots are sold when speculative development decreases essentially in order to ensure the best possible stock of work and thereby avoid a situation where plots strain the balance sheet as preconditions for in-house development projects do not exist.

The market structure of the housing sector has also been affected by institutional investors and funds investing in dwellings. During the international financial crisis, they have increasingly starting looking for less risky returns also from the housing sector driven partly by changes in taxation and the above described housing production based on the so-called 'intermediate model'. This activity has focused largely on buying finished dwellings, or perhaps to a large extent entire housing companies, which has kept *in-house construction* volumes higher in the last years of the review period than they would have been due to the current economic situation (or traditional consumer demand alone). Investors operating without an in-house construction procurement organisation seem to rely mostly on the development model familiar to contractors although some may also have resorted to *design-build*.

In the case of other building types, less clear market structure-changing motivations are discernible: there are many procedural variations whose segmentation into groups and factors to be examined in the light of statistics is

difficult. For instance, the *in-house projects* would seem to be for the most part genuine client projects with the exception of commercial and office buildings; as concerns them, the group comprises both owner-initiated *in-house* projects and speculative development projects of construction companies. At the same time, changes in the shares of *in-house work* are clearly larger in the group of business premises than in the two other groups, and correspondingly smaller than in housing construction. The *in-house construction projects* of the group 'other buildings', again, consist partly of municipal projects that are still being carried out in the case of small projects although the actual dismantling of the strong construction organisations of municipalities occurred mainly already before the review period in the 1980's. However, due to the used building type classification, for instance, multi-storey car parks of construction companies are also included.

Construction management contracts are also used more with commercial and office building projects than in other markets. Their share also seems to follow the economic cycle meaning that *construction management* contracts are used more when the economic outlook is good. The likely explanation is that the model is used logically particularly in very large projects, such as shopping centres, which are launched mainly when the economic outlook is good. Thus, it would not appear to be in essence business cycle-based selection of PDS, but rather timing of projects to be implemented under a *construction management* contract.

Based on the data, the effect of project size is explained in Fig. 5, which shows that independent of building type, *construction management* projects are, on average, much larger than others. The left side of the figure (a) depicts the average sizes of projects implemented by all delivery systems in the case of various building type groups during the first ten years of the review period whereas the right half (b) shows corresponding calculations for the subsequent ten years. Thus, the latter also validates, on the magnitude level, the former calculations, presented already earlier in an article (Lahdenperä 2001) which, however, was more accurate as it indicated, besides average project sizes, also their quartile distributions. It is also noteworthy that *design-build* was used in projects larger than those implemented under so-called traditional forms of contract although the difference is clear only in business premises construction. The comparison figures also reveal how project size/value increased over time, since all calculations are in 2013 money.

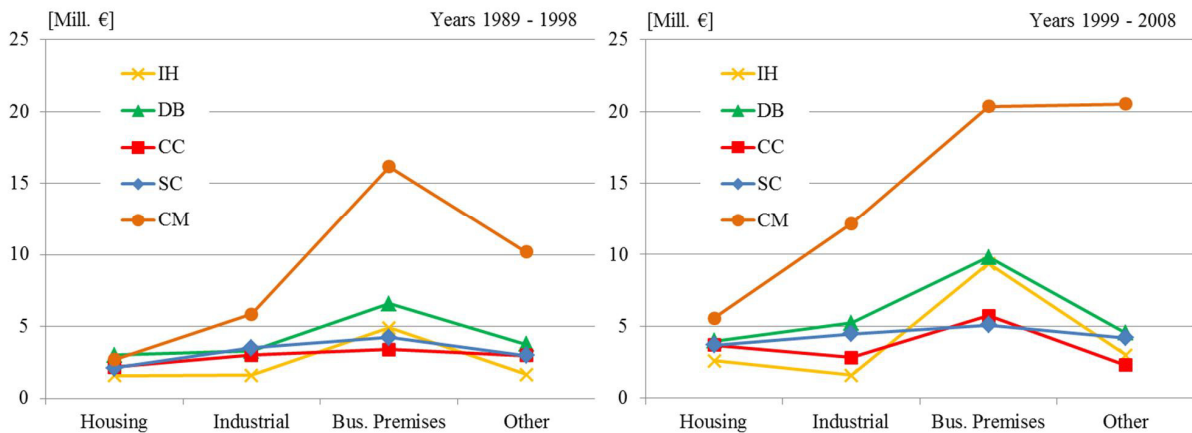


Fig. 5. Average project sizes in the first (a) and the second (b) decade of the study period (converted to 2013 euros).

6. Discussion and conclusions

This article looks at the use of various PDSs in Finland in the last quarter century. The analysis is based on extensive material which is why the depictions of trends and project sizes can be considered to represent the situation in the market fairly well. The value of the study derives especially from the extensive material. On the

other hand, the review is quite general and full understanding of various influencing factors and relationships would naturally require much more profound research. Yet, the work done has undeniably succeeded in shedding light on the use of the PDSs in Finnish new building construction in a way and extent that are unprecedented.

The review shows that changes occur in the use of different PDSs on the overall market level, and that the changes do not always necessarily indicate changes in the decisions of clients when selecting the PDS, since the use and shares of PDSs can also be influenced by, for instance, changes in the market structure and the timing of different project types. This is true especially in housing construction where the relative shares of construction companies' in-house work and state-subsidised production, and the different terms of the latter, have greatly influenced used PDSs. With other building types external motives are difficult to identify, unless launching of large commercial projects in good economic conditions is considered one. It is also puzzling that the data includes no construction management projects in the early years. When these factors are realised, the conducted study provides a good basis for evaluating the use of different PDSs and related changes on a general level.

As concerns the actual statistical material on the use of PDSs, the figures speak for themselves. Yet, we can say that *separate contracts* still play a major role in Finnish building construction practice, and that it is clearly the most widely used system in actual client projects. Although the situation is probably familiar to market actors, it can perhaps even be considered surprising taking into account that said delivery system as such seldom is mentioned in (international) literature. Keeping design as a separate commission is normal and safe from the perspective of many clients, and they also believe that transferring implementation risk to a single actor (as in the *comprehensive contract*) results in extra costs in the form of overlapping profits except in weak economic conditions, which makes separate contracts the most favoured solution for the great majority of projects.

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