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# Barriers and Opportunities for Offsite in the UK

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## Abstract

The UK still falls behind most equivalent economies in terms of the take-up of industrialisation in construction and techniques such as offsite construction. Interest in the UK in industrialisation and offsite has recently been increasing however, partly attributable to the increased demand for housing, and pressure by Government and industry to improve the performance of the UK construction industry, particularly its efficiency, quality, value and safety. This paper discusses the views of the UK construction industry on offsite. This work has been conducted by Loughborough University as part of a DTI and UK industry funded research programme on offsite technologies and prefabrication called prOSP*a* (*promoting Off-Site Production applications*).

This paper presents results from a recently completed questionnaire survey on offsite and prefabrication in the UK. A preliminary survey was used to guide and inform the development of a main survey involving three different questionnaires in order to target the three main groups of stakeholders involved with offsite - suppliers/manufacturers, contractors and designers/clients.

More than 90% of the respondents had used some type of offsite or prefabrication in at least one of their projects. Demand for offsite is clearly increasing in the UK and nearly three quarters of the suppliers surveyed thought that take-up of offsite by industry was increasing in their sector. The biggest advantages of offsite compared with traditional construction were thought to be the decreased construction time on site and increased quality. The belief that using offsite is more expensive is clearly the main barrier to its increased use.

**Keywords:** Offsite, offsite production (OSP), survey, questionnaire, prefabrication, industrialisation

## 1. Introduction and Background

This paper investigates the views of the UK construction industry on offsite production and technologies. It provides an indication of the opinions of the different sectors within the industry, including clients, designers and contractors, as well as the suppliers of offsite systems

and components. Due to the fragmented nature of the UK construction industry it is not practical to assess the views of every organisation in every sector and so this study aims to provide a snapshot of the UK construction industry's views on offsite at the current time.

This paper is based upon research carried out by Loughborough University as part of the DTI and industry funded prOSP a research programme, which commenced in July 2003. The prOSP a consortium is composed of Co-Construct members (BSRIA, CIRIA, The Concrete Society, SCI and TRADA Technology) and Loughborough University. The programme aimed to promote appropriate applications of offsite and thus help improve the performance of the UK construction industry.

Although interest in offsite has been increasing in this country in recent years, the UK still falls behind most equivalent economies in terms of the take-up of modern methods of construction (MMC) such as offsite. This increased recent interest in offsite in the UK is partly attributable to the increased demand for housing and to pressure by Government and industry to improve the performance of the UK construction industry, particularly its efficiency, quality, value and safety.

There is almost a consensus amongst major developers over the need for more prefabrication in the future, in contrast to the actual amount employed, and it is the public sector client groups that are currently leading the way in the introduction of radical new systems [1].

For this study, offsite is defined as the manufacture and pre-assembly of components, elements or modules before installation into their final location [2]. Many terms have been used in the past to define and describe offsite, and many of these are still used today, including Off-Site Production (OSP), Off-Site Fabrication (OSF), Off-Site Manufacturing (OSM), Off-Site Construction (OSC), pre-assembly and prefabrication. This plethora of terms can at first be confusing for both the non-expert and expert alike, and so for this study we used offsite.

## **2. Methodology**

The data for this study was obtained from four main sources of data:

1. a detailed review of existing recent surveys and publications on the subject;
2. a preliminary questionnaire survey of six organisations;
3. a main questionnaire survey of 75 UK construction organisations, including clients, designers, contractors and offsite suppliers and manufacturers;
4. a workshop held on the 6<sup>th</sup> July, 2004 by the prOSP a Programme Steering Committee to debate and refine the main findings of the survey.

Three different questionnaires were used for the main survey, one for clients and designers, one for offsite suppliers and manufactures and one for contractors. Although the majority of the questions were the same, a proportion of the questions were specifically targeted at the different industry sectors. 75 main survey questionnaires were completed and returned, including 39 from

clients and designers, 13 from contractors and 23 from offsite suppliers and manufacturers. The types of organisation who participated in the main survey are shown in Table 1.

Table 1. Type of organisation.

Organisation type	% of respondents
Client / end user	27
Specialist supplier	24
Other	24
Main contractor	19
Architect / Designer	13
Specialist consultant / designer	12
Project / Construction Managers	8
M&E consultant / designer	4
Maintenance contractor / FM	1

Note: Some respondents selected more than one category.

The main ‘Other’ types of organisation listed by respondents included multi-discipline consultants, modular building manufacturers and specialist sub-contractors.

Several other studies from the last three years have examined different aspects of the offsite industry in the UK and the results of these reports have also been included within this study where relevant [1, 3, 4, 5].

### 3. Results

#### 3.1 Respondents Experience of Offsite

The overwhelming majority of the respondents from all the sectors had used some type of offsite in at least one of their projects (Table 2). A very small proportion of the client/designers had not used offsite before and 8% of the contractors surveyed were not sure if they had or not.

Table 2. Percentage of respondents who have used offsite on any of their projects.

	% of respondents	
	Clients/designers	Contractors
Yes	97	92
No	3	0
Maybe	0	8

Figure 1 shows the type of offsite product or system which is most commonly considered for construction projects by the clients and designers, and contractors in this study. Most of the types of offsite were used by more than half of the clients and designers surveyed, with framing systems, volumetric modular buildings, cladding systems and bath/toilet/kitchen pods all being

used by approximately 70% of the respondents. More than half of the contractors surveyed had also used most of the types of offsite listed, with the exception of volumetric modular buildings and building services, which had been used by less than half of the contractors surveyed.

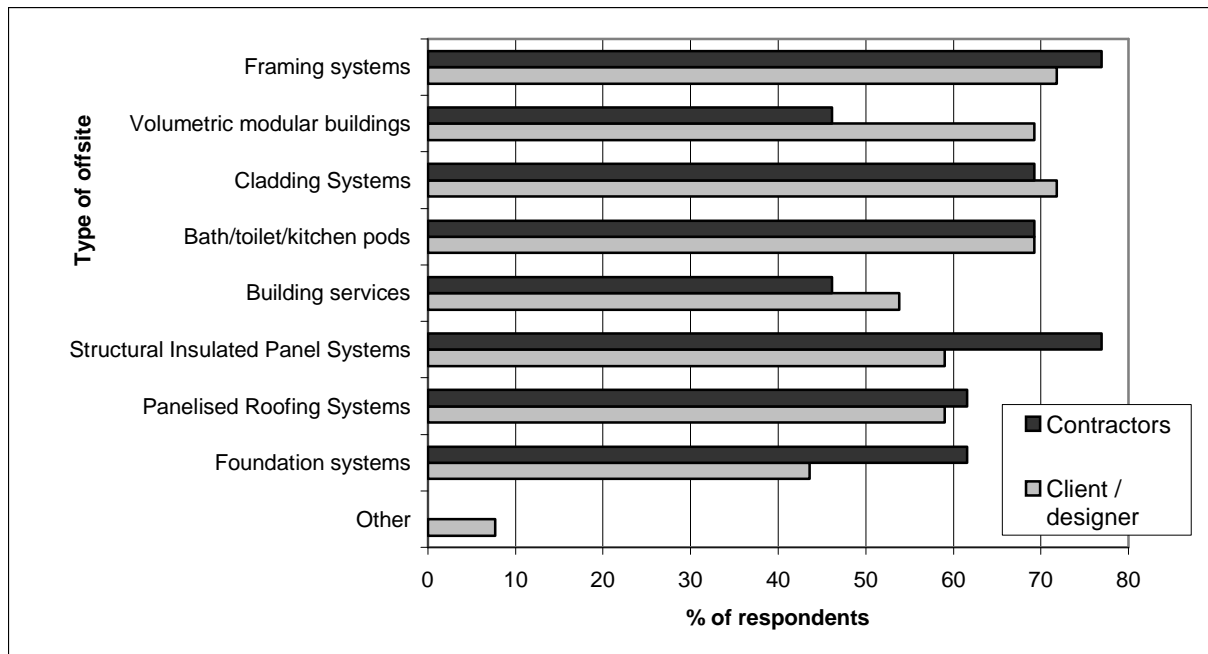


Figure 1. Type of offsite most commonly considered for projects.

### 3.2 Advantages, Barriers, Drivers and Take-up of Offsite

The majority of clients and designers surveyed (73%) claimed that they were sufficiently aware of the relative advantages and disadvantages of offsite over traditional construction, compared with just over half (54%) of the contractors surveyed. However, less than a third (30%) of the suppliers questioned thought that their customers were aware of the relative advantages and disadvantages of offsite over traditional construction.

This difference in awareness and knowledge of offsite is a frequent source of frustration for suppliers, with customers believing that they are aware of the relative advantages and disadvantages but suppliers knowing, or believing, that they are not. Some suppliers believe that there is an extraordinary lack of understanding in all sectors of the construction industry for the full benefits that offsite can bring and that the general understanding of offsite to some people just means volumetric modular boxes, usually grey. Many customers in the industry routinely use products and methods such as precast concrete without appreciating that this is a form of offsite. Conversely, some contractors complain that suppliers are not always fully aware of how tendering works in traditional construction, what the price means in contractual terms, and the importance of early notification if anything is done in the design development that will cause costs to rise.

The biggest advantage of offsite compared with traditional construction is thought to be the decreased construction time on site. This was stated by about 90% of respondents, including clients, designers and contractors (Table 4). Unsurprisingly, this factor is of particular benefit to contractors, with 69% ranking this as their number 1 advantage. Increased quality also ranked highly by all respondents. A more consistent product and reduced snagging and defects were also seen as advantages by the majority of respondents, although more so by the clients/designers than by contractors. Of the remaining possible advantages, a higher percentage of the client and designer respondents selected each of the possible advantages compared with the contractors who responded. This probably reflects the higher proportion of clients and designers compared with contractors who said that they were aware of the potential advantages of offsite.

Table 3. Advantages of offsite.

Advantages	Clients/designers		Contractors	
	% of respondents	% as 1st choice	% of respondents	% as 1st choice
Decreased construction time	87	38	92	69
Increased quality	79	28	77	15
More consistent product	77	18	54	0
Reduced snagging & defects	79	8	69	0
Increased value	51	5	23	0
Increased sustainability	49	3	31	0
Reduced initial cost	44	3	15	8
Reduced whole life cost	41	0	15	0
Increased flexibility	33	0	15	0
Greater customisation options	33	3	0	0
Increased component life	28	0	15	0
Other	18	15	8	8

Much research has been conducted into the barriers, both perceived and real, that are hindering the increased uptake of offsite in the UK construction industry. The study by Robert Gordon University [1] was based upon the premise that house buyers are so strongly influenced by negative perceptions of post-war ‘pre-fab’ that they will resist any innovations in house construction which affect what a ‘traditional’ house looks like.

The main barriers found in this survey stopping clients/designers and contractors from using more offsite are presented in Table 4.

Table 4. Main barriers hindering the increased use of offsite.

Barriers	Clients/designers		Contractors	
	% of respondents	% as 1 <sup>st</sup> choice	% of respondents	% as 1 <sup>st</sup> choice
More expensive	67	54	77	38
Longer lead-in times	46	8	62	8
Client resistance	38	13	31	23
Lack of guidance and information	33	5	46	0
Increased risk	36	0	15	0
Little codes & standards available	33	3	23	0
Other	31	18	15	8
Negative image	28	0	46	8
Not locally available	18	5	15	0
No personal experience of use	18	3	38	15
Obtaining finance	18	3	8	0
Insufficient worker skills	21	0	23	0
Reduced quality	13	0	15	0
Restrictive regulations	13	0	31	0

The belief that using offsite is more expensive than traditional construction is clearly the main barrier to the increased use of offsite in the UK, even though a large proportion of the respondents thought that one of the advantages of using offsite was both a reduced initial cost and a reduced whole life cost (Table 4). Suppliers often argue however, that offsite is not more expensive as costs are not compared in the right manner in order to take into account advantages such as reduced on-site construction time and economies of scale [3]. This issue is also addressed by the IMPREST (*Interactive Method for Measuring PRE-assembly and STandardisation benefit in construction*) tool developed by Loughborough University, which seeks to provide a framework for comparing solutions in a holistic manner. Other advantages such as increased quality and reduced snagging are rarely included in costings and many projects are still judged purely on first or initial cost, either intentionally or unintentionally.

Longer lead-in times were also a significant barrier to clients, designers and contractors. This was a barrier to a higher proportion of contractors however, presumably because the use of offsite could delay the beginning of the project on site.

Who usually drives the idea of using offsite for a particular project depends upon who you speak to, as can be seen in Figure 2. Clients and designers think that it is the client who usually drives the use of offsite on a project, together with the contractor, designer and architect. Contractors however, feel that it is more themselves and the architect who are the drivers. Suppliers on the other hand, think they themselves are one of the drivers, together with the client and the contractor and that the designer and architect are less so.

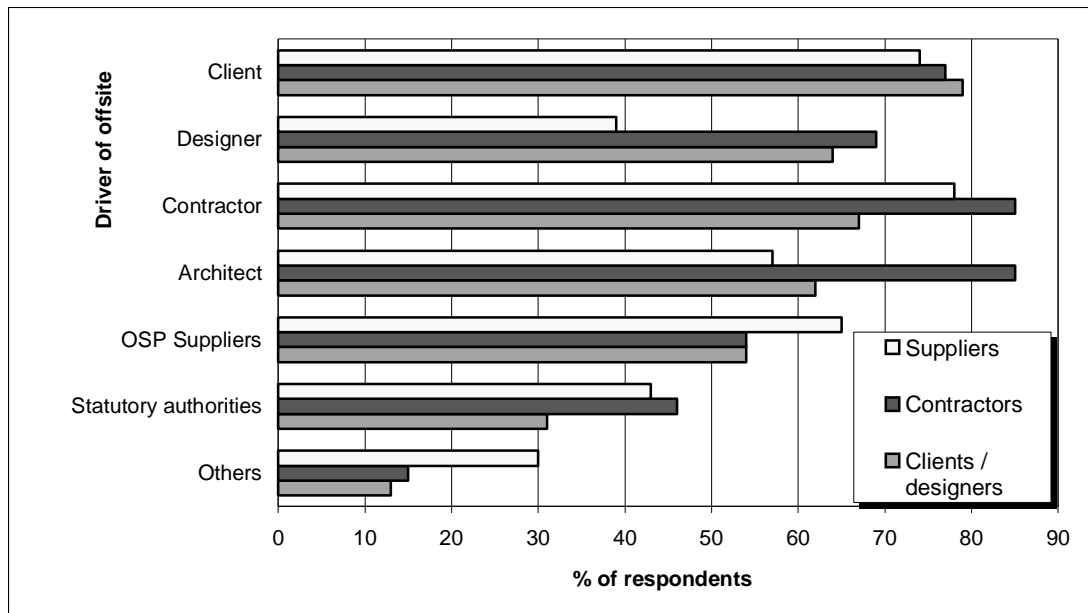


Figure 2. Main driver of offsite on a project.

### 3.3 Supply and Demand of Offsite

Nearly three quarters of the suppliers surveyed thought that take-up of offsite by industry was increasing in their sector, and only one respondent thought that it definitely was not. This agrees with other reports, which predict growth of 9.7% per annum (by value) by 2010 [4].

The main barriers stopping clients/designers and contractors from using more offsite were discussed earlier and presented in Table 5. Suppliers were therefore asked what means they used in order to overcome their clients' resistance to the use of offsite. The main method used was the provision of examples and case studies of previous successful uses of offsite (Table 9). The other main methods included client experience and increased partnership and marketing, all different ways of informing, educating and/or convincing the client of the possibilities and advantages of offsite. Reductions in price were only used by about a quarter of the suppliers in this survey, even though the increased expense of offsite was the main barrier to use quoted by clients/designers and contractors (Table 5). The majority of suppliers presumably sold the use of offsite on other factors such as speed of construction, quality and value rather than cost.

Table 5. Overcoming clients resistance to offsite.

Means of overcoming resistance	% of respondents
Provision of examples / case studies	68
Client experience	55
Increased partnership arrangements	55
Increased marketing / information	50
Price reductions	27
Other	23



### 3.4 Refurbishment

The suppliers in this survey were asked what percentage of their work was attributed to new build and how much to major refurbishment and maintenance. All of the suppliers were involved in new build, with almost 60% of the respondents being involved in new build *only*. About 40% of the respondents also supplied products for major refurbishment but only one supplier surveyed supplied products for maintenance.

When asked if the suppliers thought that there *was* a market for offsite in refurbishment in the UK, only about one third said definitely yes (Figure 4). Interestingly, this proportion was less than the number actually currently supplying products for this market. More than half of the suppliers surveyed were not sure if there was a market for this in the UK or not. This could be due to these suppliers waiting to see how the market for refurbishment develops before deciding what to do.

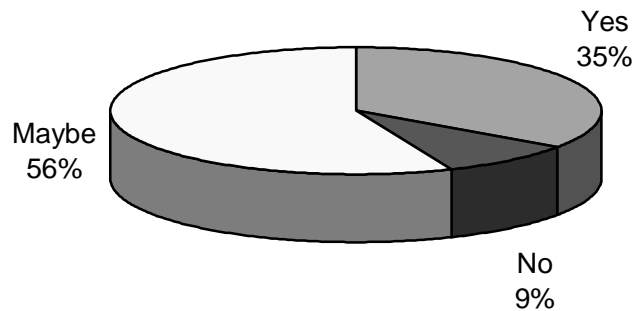


Figure 3. Proportion of offsite suppliers who thought that there was a market for offsite in refurbishment in the UK.

In recent years however, nearly half of all construction expenditure in the UK has been spent on refurbishment and repair compared with new construction. Furthermore, in the house building sector this proportion rises to approximately two thirds [6]. Refurbishment and repair is therefore a potentially large market for offsite in the UK into which it has already made some progress, but for which there is potential for significantly more. Not all of this market is suitable or practical for the application of offsite however, as a significant proportion can be classified as domestic DIY, but potential still exists for further expansion within this sector.

### 3.5 Labour and Skills

The UK construction industry has a historically low level of training compared with other countries and it is estimated that between 70 and 80% of the workforce in construction in the UK has no formal qualifications [7]. A large proportion of the workforce are labourers, many of them self-employed, and their skill-base is narrow and their training is limited. There is also an estimated annual turnover of between 65000 and 75000 people per annum in the UK construction industry [8].

Electricians, joiners and bricklayers were the three skills generally cited the most by all the sectors questioned as being in short supply and contributing to the increased demand for offsite products (Table 12). Contractors seem to be feeling the effects of the skills shortage as plumbers were the only trade which they felt was not increasing the demand for offsite to a significant degree. Conversely, the majority of suppliers thought that the lack of concreters, steel erectors and steel fixers contributed little to the increased demand for offsite. The other main skill mentioned by respondents which was not on the list was plasterers, which also seem in particularly short supply.

*Table 6. Skill shortages contributing to the increased demand for offsite.*

Skill	% of respondents		
	Client/designer	Supplier	Contractors
Electricians	65	38	67
Joiners	59	76	83
Bricklayers	44	71	58
Steel-fixers	35	19	42
Steel-erectors	32	10	33
Other	29	48	42
Concreters	26	10	50
Plumbers	12	33	8

It would seem at first that, with this general lack of skills, the UK construction industry would be perfectly placed for the increased use of offsite. Clarke [9] reports however, that a skilled workforce is required to enable innovations such as offsite to be applied. Workers here in the UK are generally not provided with an initial broad-based training after which they specialise. Instead, they are usually trained for just one role which consequently makes adapting and multi-skilling difficult, which is what is required for an increased uptake in offsite.

All respondents were asked what steps they thought could be taken by manufacturers, trade bodies and/or the Government to encourage people to enter careers in offsite in order to reduce the skills deficit. More written responses were received to this question than any other in this survey, reflecting both the importance and the far-reaching consequences of the skills deficit.

The two subjects that were mentioned most frequently were training and education and raising the awareness of offsite. Respondents mentioned that investment was needed in training and education at all levels, from school leavers through to university courses. The lack of, and need for, modern apprenticeship schemes was mentioned up by several respondents, as was the need for NVQ's in offsite and multi-skilling. Government training grants were suggested by several respondents, both for offsite manufacturers and for training colleges. Partnerships between local colleges and offsite suppliers were also discussed, as was the inclusion of offsite topics in University courses for building professionals. Raising the awareness and increasing the perception of offsite, particularly to clients and the general public, was mentioned by several respondents in order to relieve the technology of its poor historical 'pre-fab' image. This could

be done by promoting and marketing the benefits and advantages of offsite more widely, both by individual companies and by the Government, and by highlighting good practice.

## 4. Conclusions

This paper has presented some of the views of the UK construction industry on offsite production and technologies. It provides an indication of the opinions of the different sectors within the industry, including clients, designers and contractors, as well as the suppliers of offsite systems and components.

More than 90% of the respondents from all the sectors surveyed had used some type of offsite in at least one of their projects. Nearly three quarters of the clients and designers claimed that they were sufficiently aware of the relative advantages and disadvantages of offsite over traditional construction, compared with just over half of the contractors surveyed. However, less than a third of the suppliers questioned thought that their customers were aware of the relative advantages and disadvantages of offsite over traditional construction.

The biggest advantage of offsite compared with traditional construction is thought to be the decreased construction time on site, together with increased quality, a more consistent product and reduced snagging and defects. The belief that using offsite is more expensive when compared with traditional construction is clearly the main barrier to the increased use of offsite in the UK, even though a large proportion of the respondents also thought that two of the advantages of using offsite were both a reduced initial cost and a reduced whole life cost.

Who usually drives the idea of using offsite for a particular project generally depends upon whom you ask.

Nearly three quarters of the suppliers surveyed thought that take-up of offsite by industry was increasing in their sector. The preferred method used by suppliers to overcome the resistance of their client to the use of offsite was the provision of examples and case studies of previous successful uses of offsite.

All of the suppliers questioned were involved in new build, with nearly 60% of the respondents being involved in new build *only*. Approximately 40% of the respondents also supplied products for major refurbishment but only one supplier surveyed supplied products for maintenance. When asked if the suppliers thought that there *was* a market for offsite in refurbishment in the UK, only about one third said definitely yes.

Electricians, joiners and bricklayers were the three skills generally cited the most by all the sectors questioned as being in short supply and contributing to the increased demand for offsite products. The two main methods suggested to encourage people to enter careers in offsite in order to reduce the skills deficit were training and education and raising the awareness of offsite.

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