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the economics of construction

THE ECONOMICS OF CONSTRUCTION

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PREFACE

The construction sector shares many of its economic features with other industries but the combination of features in the construction process makes it unique. Rather than making a particular product or service for consumption, the construction sector is an enabling sector. It enables the rest of the economy to function. For example, it enables people to work in offices, make their purchases in retail outlets, travel between home and workplace by road or rail, and it provides the homes for people to bring up their families.

Construction is a highly fragmented project-based industry, with very low profit margins and a high risk of failure for the many firms operating in a very complex supply chain. In this book we try to explain how the industry functions and how the many firms throughout the supply chain collaborate on projects. We look at how construction markets operate, how firms survive in the industry, and how their business models work. We look at auctions and the tendering process and go on to discuss the construction procurement process in general, whereby construction firms are engaged by developers.

We also account for the conflicts in construction and argue that it is in the nature of the industry that disputes frequently arise in the construction process. We also discuss productivity and explain that the low productivity in construction, compared to other industries, is the price that the economy pays for a construction industry, in which business models tend to focus on the volatility of demand and managing risk at the expense of improving efficiency and productivity.

With this perspective on the construction industry, we hope that this book will enable at least some constructors to explain the reasons for the difficulties

found in construction. They may then be able to give a reasonable account of their activities so that a new generation of developers and construction clients will appreciate the problems facing their contractors. Indeed, it is to be hoped that policy makers will also take note of the lessons to be found in this book when it comes to passing legislation and managing the regulation of the building process and all the firms engaged in it. This book is, therefore, written with all the key stakeholders involved in every aspect of the building and civil engineering sector in mind – from construction practitioners and policy makers to architects and site managers, from the directors of the many small- and medium-sized enterprises, often subcontractors, up to the main contractors, from the chief executives to the craft and skilled workers on site, and even to the building labourers on site, who are often the newest entrants to the industry.

Indeed, another feature of construction is that it is a labour intensive industry employing over two million people in the UK. It is a major employer of both skilled and unskilled labour and their contribution to national income is significant. There is a duty on the part of construction firms to ensure that health and safety regulations makes the construction industry improve the working conditions and treatment of its workforce. One of the distinguishing features of this book is that we include the role and contribution of the whole construction supply chain to include construction product manufacturers.

Although construction occurs in every country, the culture and practice of construction invariably has national characteristics. For example, in the UK, there is a quantity surveying profession, which generally exists in only those countries that experienced British rule at some point in their history. Even though the United States was part of the British Empire until 1783, there is no widely accepted profession as quantity surveying in the US. This book only discusses the UK construction industry although lessons can be drawn from the practice in the UK that will throw light on how the construction industries of all countries operate. The construction industry represents a microcosm of the economy and society. Its actual manifestation in the construction process varies from country to country.

While most economics text books assume that the firm is in a position to decide on the level of output in order to maximize its profits, this book highlights that this does not apply in the construction sector. In construction the level of a contractor's output is generally determined by the client or the

planning constraints on site. This has implications for the relative performance of contractors, impeding their ability to obtain a similar level of profit on turnover that firms in other sectors achieve.

We have attempted to make this book more realistic than many books on the economics of the construction industry. We hope it reflects the way firms behave and gives a reasonable account for their behaviour. Misunderstanding the construction industry can lead to an undeserved criticism of the industry for its relatively low productivity compared to other sectors of the economy as well as an underestimate of the size and importance of the construction sector to the economy as a whole. In turn these misunderstandings may contribute to a poor image of the building industry and deter people from joining a vital sector of the economy, further prolonging the poor reputation of the construction industry as a consequence. We therefore seek to present construction activity, with all its shortcomings, as a necessary, vital and worthwhile economic process, essential for economic development and progress.

We begin in Chapter 1 with a survey of the data that describes the size and make up of construction in terms of the firms and specialisms within construction. This leads us on to discuss the many markets or submarkets within construction in Chapter 2. We then consider the management of firms within the industry in Chapter 3 showing how the firms have little capital compared to the value of the projects they undertake. In Chapter 4 we analyse the reasons why firms may not rest on their laurels even when they enjoy a good profitable year. To remain competitive they need to expand continually and grow. One way of achieving growth is through increasing productivity and this is discussed in Chapter 5.

We give an account of how firms navigate through the vagaries of the market place to ensure they continue to expand. One method of understanding how firms survive in the market is based on game theory and Chapter 6 provides a game theory account of the behaviour of firms. Game theory shows how firms may collaborate and also how they behave towards each other. In Chapter 7, we go on to describe the underlying causes of conflict between firms in construction (and, indeed, all sectors of the economy) to understand how divided all production processes are and yet must somehow come together for production to take place. In Chapter 8 we present an account of the irregular changes taking place in the economy, which impact on construction firms, factors that lie outside their control.

Construction is a project orientated industry with, as far as contractors are concerned, each project having a beginning, middle and end. In Chapter 9, we turn to the projects themselves and describe the nature of projects through feasibility studies, which model both the financial and non-financial costs and revenues generated by projects to assess their economic and financial viability. In Chapter 10, we conclude with a discussion of some of the approaches to managing projects adopted by the team that built the London Olympics to see what lessons might be learned from the experience gained.

While we are very grateful to Steven Gerrard at Agenda for his encouragement and support throughout the production of this book and to our families and friends for putting up with the pressures on our time in writing it, we are of course to blame for any shortcomings and errors in the book.

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GETTING TO GRIPS WITH CONSTRUCTION INDUSTRY STATISTICS: CONSTRUCTION INDUSTRY OR CONSTRUCTION SECTOR?

Construction can be seen as an industry concerned with the production of the built environment. As an industry, its inputs cover a large variety of skills and materials. Its output covers many different types of products and services. As a sector of the economy, it includes the assembly of buildings and structures on site, the production of materials and building components and, indeed, the whole supply chain. This includes architects, surveyors, civil and structural engineers, plant and tool hire, construction product manufacturers and distribution. The construction sector is treated as one sector but, in fact, it covers a wide variety of work across many different areas. Construction output covers everything from the building of housing, commercial and industrial properties, education and health facilities to the building of vital infrastructure for water, energy, roads, rail, telecommunications and ports.

Whatever an individual or collection of individuals may wish or need to do in the economy or society, they will require construction to have taken place first to be able to do it. People need houses to live in, schools and universities to undertake learning, clinics and hospitals to make or keep us physically fit and comfortable, and offices to work in and shops to buy goods in. Even if we work from home and shop online then we still need the internet infrastructure to have been built. In addition, we need roads to drive on, rail infrastructure for trains to travel on, clean water for drinking and bathing, electricity and gas to power heating and lighting. As the built environment has grown over many years, the current buildings and infrastructure have developed over time, and, as a consequence, the repair, maintenance and improvement of existing buildings and infrastructure is also vital.

To measure the scale of investment in construction as part of the whole economy, the *United Kingdom National Accounts*, also known as *The Blue Book* (see Office for National Statistics 2017), contains a chapter entitled "Gross Fixed Capital Formation" (GFCF), which presents the total invested by the economy in plant and equipment and buildings and structures. This investment is essential if the country is to survive and remain competitive, in much the same way as companies need to invest in machinery in order to survive.

Fixed capital is the value of assets that usually last longer than one year and are usually used to aid production. The concept of capital formation describes the production of the means of production. The term "gross fixed capital" is used to indicate that the plant and machinery and buildings are measured at brand new values before any depreciation has been deducted.

In terms of the whole economy, investment in the built environment, which includes buildings and structures, such as infrastructure, is a vital component of the United Kingdom's fixed investment. Fixed investment is defined as long-term investment in plant and machinery, transport equipment, information technology, buildings and structures as well as major improvements to existing buildings and structures. The built environment accounts for over a half of all GFCF each year. Figure 1.1 shows that, in 2016, 52.8 per cent of all UK GFCF was in the built environment. The importance of this is that fixed investment enables increases in the productive capacity and productivity of the whole economy, by facilitating the production and movement of goods, capital, services and people.

Data covering construction

To understand a sector of the economy, you need to be able to measure it. The construction sector is certainly no exception to this. No one set of data fully explains the construction industry. However, there are three key types of official data that cover the construction sector, and each set provides a piece of the puzzle.

The first set of data is provided by the UK government's Department for Business, Energy and Industrial Strategy (BEIS) and includes all firms registered to pay value added tax (VAT), combined with an estimate of

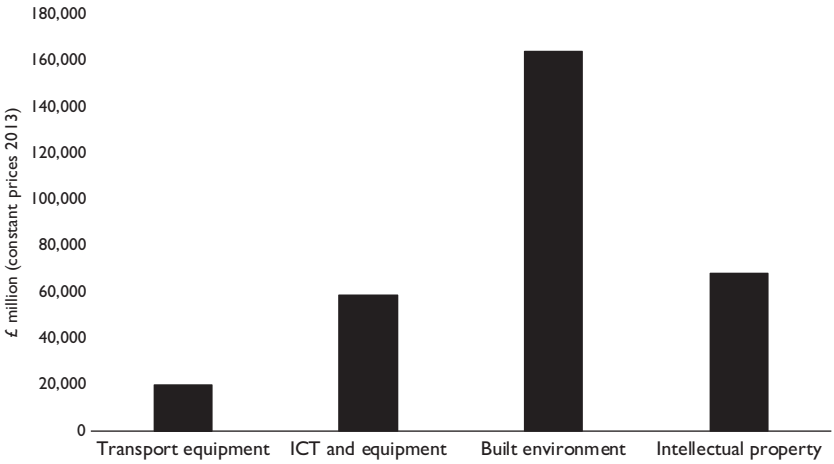

Figure 1.1 UK gross fixed capital formation (2016)
Source: ONS

very small firms that are below the VAT threshold and so do not have to pay VAT.

The benefit of this data is that it allows us to look at the basic structure of the industry. The majority of the focus tends to be on the largest firms within the construction sector. Clearly, though, the sector is dominated by small and medium-sized enterprises (SMEs), defined as firms employing fewer than 250 employees. According to the BEIS, in Figure 1.2, as much as 75 per cent of the £272 billion turnover in the construction sector in 2016 occurred within the SMEs, with 25 per cent of turnover in construction accounted for by the largest firms, which are defined as those employing 250 employees or more.

Figure 1.3 shows that the difference between large and small construction firms is even greater. Of the 2.3 million people employed in construction in 2016, 86.4 per cent were employed by SMEs, while large contractors employed only the remaining 13.6 per cent of the total construction workforce.

Furthermore, the percentage of SMEs within construction amounted to 99.9 per cent of all firms in Figure 1.4. However, a key point to note is that the largest 0.1 per cent of firms still account for 25 per cent of the total turnover of the construction industry.

The BEIS business population estimates are useful at a general level. However, they suffer from two key issues. First, the definition of construction

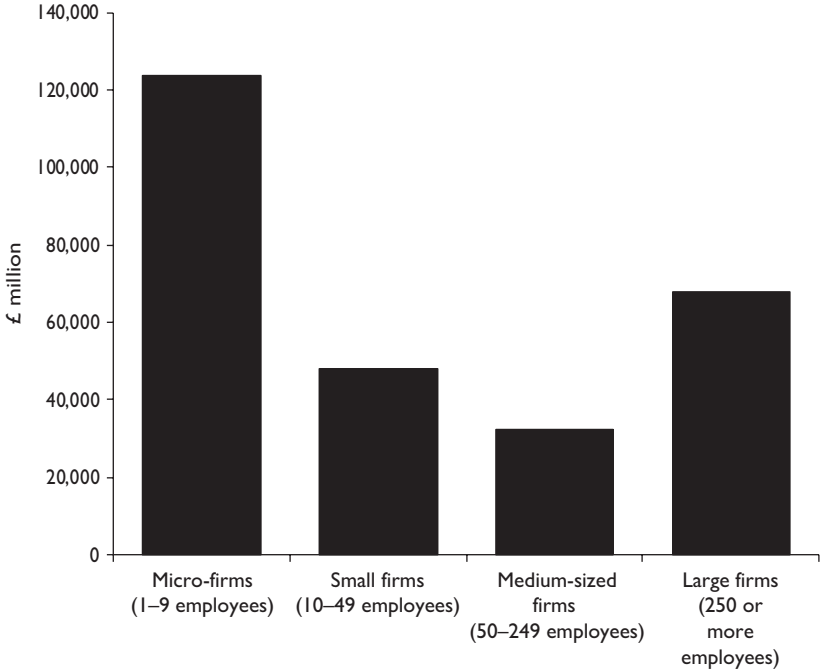

Figure 1.2 Turnover in UK construction (2016)
Source: BEIS

covers only the number of firms and employment of the contractors – those firms that operate on the construction site itself. Yet this is only one part of the whole construction supply chain, as construction is a very complex sector. Defining construction as only including contractors on site ignores the contribution of the supply chain of all the building components and materials and the design and civil and structural engineering inputs and other specialists.

Construction is a process involving architects and professionals, contractors, merchants and distributors, plant and tool hire, in addition to minerals and products manufacturers. All but the contracting element of this process is neglected in the BEIS statistics. As a result, the BEIS statistics are likely to underestimate the value of the construction sector to the UK economy.

The supply chains that supply the goods needed for on-site construction include the product manufacturers, builders' merchants and distributors, plant and tool hire. Product manufacturers produce all the materials and

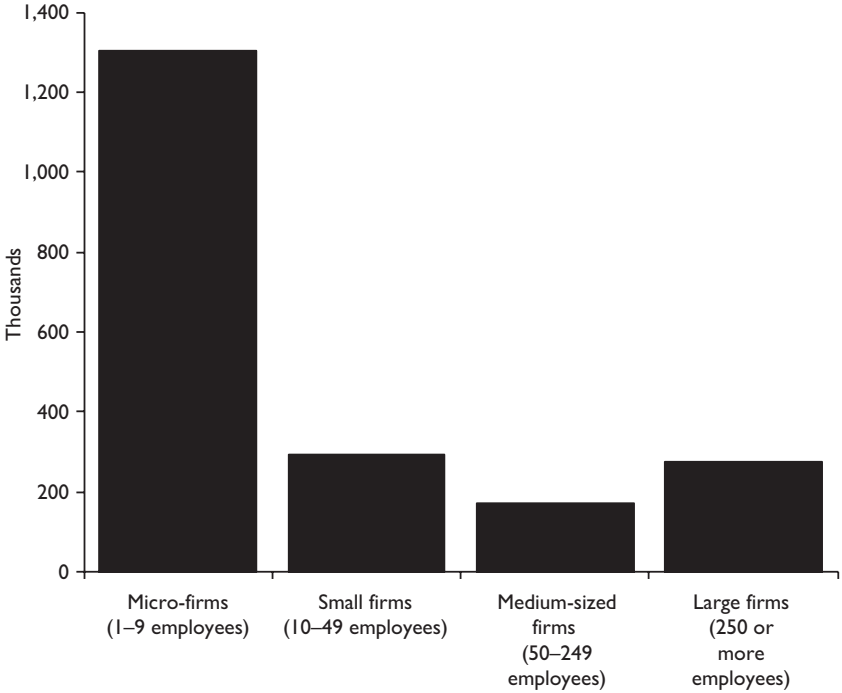

Figure 1.3 Construction employment in the UK by size of firm (2016)
Source: BEIS

products that go into the construction of a facility, and can be split into two broad categories: heavyside products and lightside products. Heavyside products include, but are not limited to, sand, bricks, concrete, asphalt, steel and glass, and tend to be used on the exterior of a building. Conversely, lightside products, which include lighting, heating and ventilation, air-conditioning and electrics, tend to be used in the interior of buildings. Builders' merchants and distributors act as wholesalers and retailers of building materials and products. Tool and plant hire firms exist to provide additional capacity for heavy machinery or tools that are needed on site to complete the project but are not currently owned by the contractor or subcontractor, which may be vital given that the bespoke nature of construction, with every end product in each project being different, means that different sets of inputs may be needed across projects. Directly owning machinery and tools for activity across all

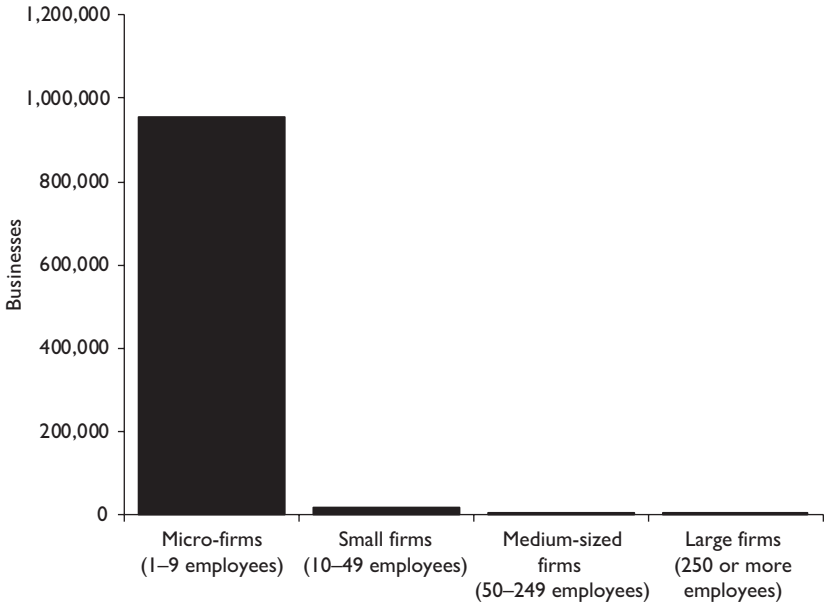

Figure 1.4 The number of firms in UK construction (2016)
Source: BEIS

areas of construction would mean considerable periods of unproductive inactivity whenever there is little work in certain sectors. It therefore makes economic sense to hire plant and machinery only when required.

In addition, even within the contracting side, there may be many layers or tiers of contractors depending upon the size of the project. For example, Figure 1.5 illustrates that, even on a small project, with only one SME contractor involved, parts of the supply chain may be hidden, including when the contractor purchases materials and products from builders' merchants and distributors and hires additional machinery and tools when needed.

However, on large projects, as in Figure 1.6, there may be more than one major contractor, operating as a joint venture, as a result of the high degree of risk and the large scale of production involved. As they are usually multi-million-pound projects, and even multi-billion-pound projects, only the largest contractors have the size to take on the risk involved. The major contractors subcontract work out to those with skills in specific areas: specialist contractors and civil engineering firms. As with machinery and tools, direct

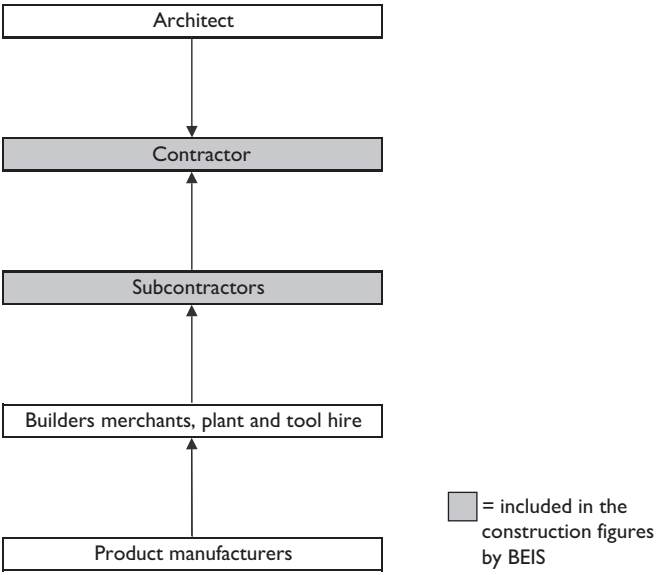

Figure 1.5 The supply chain on a small project

employment of those with specialist skills would mean significant periods of unproductive inactivity when these skills were not needed. Subcontracting out specialist skills and activities ensures that the major contractors do not suffer the burden of unproductive cost when there is a period of inactivity. At the same time, it frees up the specialist firms to find work with other main contractors, which is an efficient way of using the resources of construction firms by making it possible to have continuity of work instead of periods of idleness. Subcontracting also explains why the construction industry contains a large number of small firms, which are taken on with other subcontractors to carry out large projects. In essence, the main contractors effectively undertake the role of winning projects and managing them.

In addition, for some construction products used in large quantities, the main contractor may purchase products directly from manufacturers in order to take advantage of economies of scale or savings of size. Economies of scale exist where the purchaser can obtain a product at a lower price by purchasing large quantities because buying in bulk reduces the cost per unit.

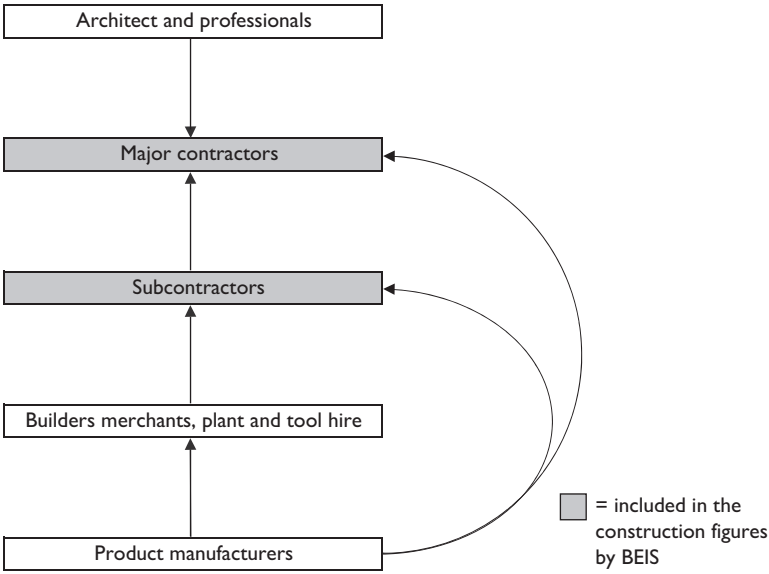

Figure 1.6 The supply chain on a large project

The Office for National Statistics (ONS) provides two other key sets of data that cover the UK construction sector. The first set of data is designed to help in calculating the total value of the output of all the industries in the economy as a whole. After steel is produced in the steel industry it is passed to the construction industry to be assembled as the steel frames of buildings. Similarly, glass is manufactured in the glass industry to become the windows as part of constructed buildings. If all the inputs to the construction industry were counted as part of the industries they come from, they would be counted twice if they were included in the value of construction output. Construction output is, therefore, only the value added to the materials and components by the contractors and subcontractors on site. Therefore, annual construction data measures only gross value added (GVA). Construction output, or construction gross value added, measures only the selling price of output minus the cost of materials, which, when taking all firms in the construction industry together, is what it provides to the UK economy after subtracting the inputs that go into construction from other industries, including designers and engineers. It is, effectively, the

turnover minus the total amount spent on goods and contracted-out services. Using this method avoids double counting. Double counting would mean, for example, counting the work of subcontractors twice: once as a subcontractor, and twice when the same work was included in the value of the main contractor's sales.

Table 1.1 illustrates the GVA in UK construction during 2015, which was £119.2 billion. Sixty six per cent of this GVA was provided by building contractors, which included major contractors, specialist contractors, civil engineering contractors and the subcontractors in the construction trades. The importance of utilizing GVA rather than turnover is clear from Table 1.1, which shows that the GVA of contractors was £78.7 billion, while the total turnover or sales of contractors was £214.8 billion. Seventeen per cent of UK construction GVA is provided by manufacturers of construction products, with materials and products distribution providing 8 per cent of the GVA in the construction supply chain, while architects and professionals provide 5 per cent.

Table 1.1 The UK construction supply chain (2015)

	Gross value added £ million	*Employment*	*Number of firms*	*Capital expenditure £ million*	*Turnover £ million*
Construction products manufacturing	20,828	288,000	22,235	2,806	55,028
Building contractors	78,694	1,293,000	257,551	6,925	214,775
Materials and products distribution	9,444	194,000	10,117	1,002	43,343
Construction plant hire	3,976	43,000	3,959	1,647	5,647
Building professional services	6,222	96,000	21,187	228	8,370
Total construction	**119,164**	**1,914,000**	**315,049**	**12,608**	**327,163**

Notes: Specialized construction activities include: demolition and site preparation; electrical and plumbing installation; finishing and roofing. Building professional services includes: architects and quantity surveyors
Source: BEIS