Principles of Basic Construction Economics in the 21st Century

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Andrew Ebekozien and Clinton Aigbavboa

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Chapter 1
The construction industry and economics

1.1. Nature and scope of activities in the construction industry

Globally, the construction industry has no universal definition, yet it is one of the most critical industries in the socio-economic development of developed and developing countries. The sector can influence most economic sectors (finance, industry and commerce), contributing significantly to infrastructure advancement and gross domestic product (GDP). It has been argued that the construction industry in fact comprises many industries (Ofori, 2015) and it has also been reported that the industry accounts for about 6% of global GDP (WEF, 2018). According to Ofori (2012), the sector contributes 3–10% of GDP and creates job opportunities for about 10% of a nation's employees. In developing countries (e.g. Nigeria, Ghana and South Africa), the GDP contribution is low compared with that in developed countries (e.g. Singapore, the UK and Korea). Understanding the nature, important attributes and the requirements of the construction industry – also known as the 'built environment sector' – is pertinent. The sector is important because it adds to personal satisfaction through engineering and services provided to end users (Ebekozien, 2022). Thus, it is a critical sector in every economy and one of the most significant economic industries across the world (Delgado *et al*., 2019). However, despite its economic importance, the industry is beset with inefficiencies, especially in developing countries.

The Nigerian built environment sector is a remarkable, complex and regularly divided industry. In its sectoral classification of the economy, it is also known as the building and construction sector. The built environment sector comprises a wide range of inexactly incorporated associations that builds, modifies and fixes a wide scope of various building structures, along with structural designing and heavy engineering work. The boundaries between these are obscured, but incorporate planning, guidelines, production, installation and the upkeep of structures. The sector has a duty regarding infrastructure advancement. In Ghana, the sector is the second largest GDP contributor (13.7%) and employs about 7% of the working population (Boadu *et al*., 2020).

The industry is multi-faceted, with evidence of encumbrances, especially in developing countries. Nigeria's construction sector faces impediments to project performance, which has resulted in a decline of the national GDP (Unegbu *et al*., 2022). Olanrewaju *et al*. (2020) found that Nigeria has enhanced non-collaborative work practices in some construction projects. Developing countries, Nigeria included, have been identified as fertile ground for the

construction industry (Akdag and Maqsood, 2019). However, some studies (e.g. Ebekozien, 2020; Nwachukwu and Nzotta, 2010) have noted the poor performance of construction projects (roads, bridges, buildings, dams etc.) in many developing countries. This can be traced to several factors, including corruption and lax utilisation of project management best practices. In Ghana, several small organisations characterise the industry (Boadu *et al*., 2020), possibly because of relaxed entry requirements. In other words, business entities and individuals without the basic requirements and personnel can register as construction organisations (Ofori-Kuragu, 2013). The industry accumulates little capital compared with the manufacturing and processing industries. The built environment sector could be regarded as an assembly sector, coupling the finished goods of other sectors on site. Contract building plans and other relevant documents depict the architect's original goals, and trained workers are guided by professional supervisors designing, constructing and coupling various construction parts on site. Division 45 of the Revised 2003 (as cited in Winch (2003)) defined the construction industry by Standard Classification as follows.

- General building and civil engineering construction.
- Construction and repair of building projects – the developing, upgrading and renovating of structures. This includes specialists engaged in segments of development and maintenance work such as block-laying and the erection of steel and concrete works.
- Civil engineering: construction of pipelines, tunnels, runways, roads, railways, airports and so on.
- Installation of fixtures and fittings (plumbing, electrical fixtures etc.).
- Building completion – for example joinery, plastering, painting, decorating and so on.
- Heavy engineering work: construction of power generating plants, turbines, petrochemical factories, gas plants, refineries, farm tanks, cement plants, sugar plants, shipyards, aluminium plants and the like.

In advanced countries such as Singapore, the UK and Korea, the construction industry is the largest in terms of job creation. In developing countries such as Ghana and Nigeria, the agricultural sector ought to be the largest employer, followed by the construction sector. However, this is not the case today in Nigeria. The construction industry is thus critical in the drive for the economic development of developing nations. Construction is a global task centred on infrastructural and industrial advancement (Asare *et al.*, 2022). In 2013, the World Bank reported that

- many Nigerians lack access to basic public services (electricity, roads, pipe-borne water etc.)
- where they are available in cities, the facilities need to be improved (World Bank, 2013).

The industry cannot impact the demand for outcomes or regulate the supply. This implies that several factors (social, economic and environmental) influence the degree of activity in the sector. The need for construction projects is influenced by several variables, as reported by Ebekozien and Aigbavboa (2024).

- The built environment is susceptible to economic impacts, as witnessed by the world economic downturn in 2008. This is possibly one of the reasons why governments

regularly used the construction sector as a mechanism to regulate the economy. This can take the form of fluctuating interest rates to control the demand for residential buildings.
- The public sector is the client/employer of about 50% of construction works. This makes it easy to cut public sector spending on construction works such as roads, hospitals, school buildings and so on.
- Demand can come from a variety of sources – from the construction of one-bedroom apartments to megaprojects, such as World Cup tournaments.
- An optimistic construction market needs accessibility to realistic cost credit.
- State and federal governments can influence the demand for construction by allowing tax breaks for some projects.
- The repair and maintenance section of the sector's output covers about 50%, and this can be negatively affected in times of economic downturns.

1.2. Characteristics of the construction industry

The construction industry engages in the production and operation of buildings and civil engineering works. The many subsectors involved makes the construction industry unique (Ashworth and Perera, 2015; Mokhtariani *et al*., 2017). The subsectors include design (consultancy inclusive), construction, installation, and construction management. The subsectors' activities include survey and design, construction, installations, construction management/supervision and consultancy of construction projects. The global construction market is projected to grow by 85% to US$15.5 trillion by 2030 (Regona *et al*., 2022). For this to happen, technological advancements will be pertinent. Some relevant characteristics are as follows.

- Manufacturing differs from the construction industry because of the systematic nature and complexity of construction, meaning that 'systems thinking' is needed in construction activities.
- The industry is measured by on-site production.
- The products from the industry contribute to industrialisation.
- In the 21st century, products are shifting from labour-intensive to technology-based via advanced construction digitalisation.
- The industry is a conglomerate of industries or a meta-industry.
- Uncertainties are high in construction projects because of the turbulent environment, requiring semi-predictable configurations of expertise and supply industries.
- No two construction projects are alike.
- Construction activities are conducted on the site where end users will use the product.
- Construction activities are influenced by weather and many tasks cannot be conducted in controlled factory conditions.
- The end products are immobile.
- The 'production' procedure includes a multi-faceted combination of trades, skills and materials.
- The sector is more of a service than a manufacturing industry because it renders service activities.
- The sector includes a few very large construction companies and larger numbers of small firms.
- Many of the companies that produce construction products are small or medium sized businesses.

- The industry is embracing innovation, including digitalisation and fast growth century (industrialisation of construction).
- The industry is embracing and growing an inter-related ecosystem of software and hardware attributes (sustainable construction).

1.3. Major stakeholders in the building industry

Many construction projects involve a variety of stakeholders. Stakeholders in this context imply individuals or any group who can influence the achievement of a corporate goal. Besides influencing to achieve a goal, a stakeholder may have a vested interest or share in an undertaking. In a building project, numerous stakeholders are involved, including organisations, the natural environment, government agencies and ministries, guests to the facility, community representatives, insurance firms, financial institutions, construction workers, legal authorities, service providers, suppliers, subcontractors, shareholders, designers, project managers, users of facilities, managers and owners/clients (Jin *et al*., 2017). This section focuses on the major stakeholders in a building project – the clients/employers, design teams and contractors/housing developers. Their actions or decisions can influence the progress of a construction project. And these actions or decisions are in turn influenced by the stakeholders' main responsibilities, attributes, experience, approach to risk management and professional background. Clearly, this can sometimes be complicated. The construction sector can be subgrouped into three major areas (Ebekozien and Aigbavboa, 2024) – building, civil engineering and heavy engineering work. Each group complements the others and there are relationships between them. Figure 1.1 shows the major stakeholders in the building industry, which are the design team, client employer and housing developer/contractor.

1.3.1 Design team

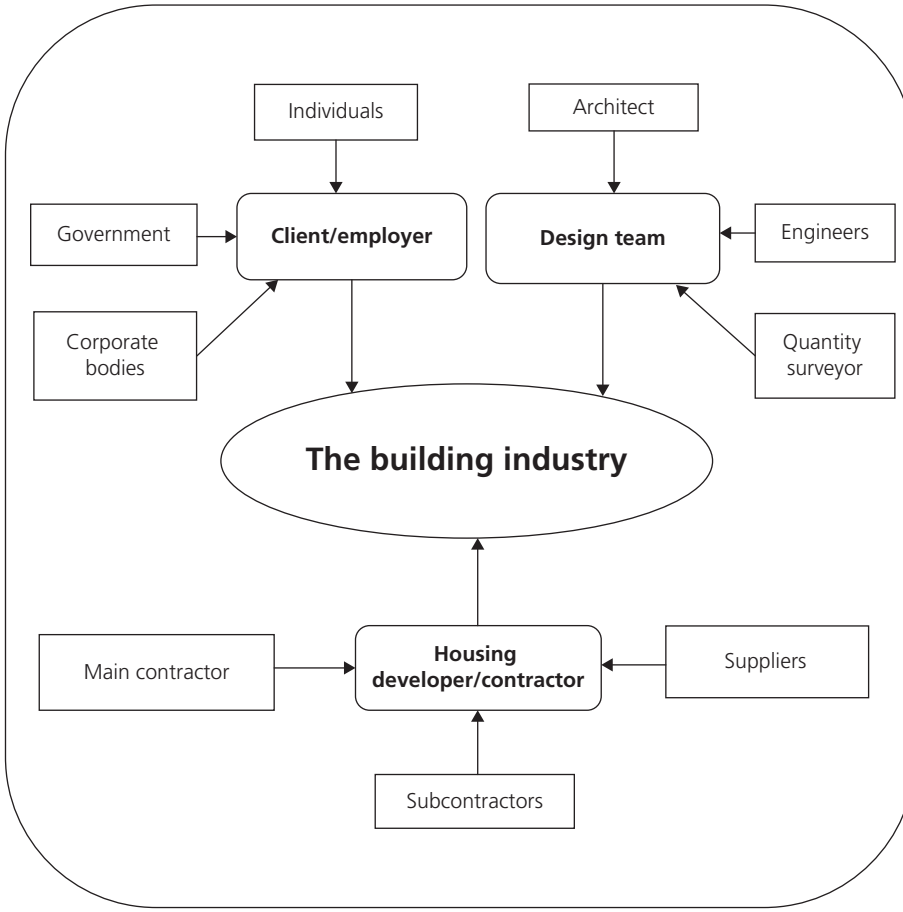
The design phase of a building project is fragmented into several specialties and requires information flow to achieve the goal (Herrera *et al*., 2020). If not mitigated, poor interactions within the design team can lead to poor building project performance. This implies that the performance of a building project can improve when the design team's performance is improved (Ashworth and Perera, 2015; Senaratne and Gunawardane, 2015). Thus, the design team's effectiveness is key in integrated building project delivery. Successful design team management is pertinent via collaboration and good teamwork practices – from the pre- to post-construction phases – for timeliness, cost-effectiveness and quality of building projects.

1.3.1.1 Quantity surveyor

A quantity surveyor (QS) is a construction cost manager who offers financial services and economic consultations for projects. Background training in construction technology, information management, construction economics and contractual law gives a QS an important place in the industry. Quantity surveying involves project construction cost management, procurement and contractual matters. Understanding the dynamics of construction costs is critical to the QS. The Nigerian Institute of Quantity Surveyors (NIQS, 1998) defines a QS as

> a cost and procurement management expert concerned with financial probity and achieving value for money in the conceptualisation, planning, and execution of building, civil, and other heavy engineering projects

Figure 1.1 Major stakeholders in the building industry



A QS is the cost manager and engineer in construction projects. Thus

> quantity surveying is primarily concerned with the detailed calculations and assessment of quantities of materials and labour required for all construction activities such as building, civil and heavy engineering (NIQS, 1998)

The QS should be acquainted with construction projects and allied subjects. As a cost adviser or technical accountant on site, a QS is involved in a building project from commencement to its ultimate financial settlement. One function of a QS is to prepare a bill of quantities (BOQs). Other contract documents prepared are the specification of materials and workmanship or preambles, preliminaries bills and contract conditions (Ashworth *et al*., 2013; Chandramohan *et al*., 2022). The duties of a QS can be summarised as follows.

- The QS is available to guide the employer and architect on the proposed construction's cost-effectiveness, including a sustainable advisory role.
- The QS advises on the financial aspect of construction projects. This includes heavy engineering, civil and building projects.
- The QS prepares an approximate construction cost estimate.
- The QS prepares BOQs. Where this is impossible due to the absence of adequate information, schedules of prices or bills of approximate quantities are prepared.
- The QS prices the BOQs or schedules of prices in line with best global practices.
- The QS prepares the documents necessary for procuring competitive tenders.
- The QS advises on the form of contract and payment terms. This is important to mitigate or prevent construction disputes.
- The QS evaluates the construction work in progress and recommends to the architect the payment to be issued on the interim certificate.
- The QS conducts the technical checking of accounts presented by the construction contractor. These accounts are based on the construction contractor's costs.
- The QS provides expert evidence on construction disputes.
- The QS prepares and settles construction contractors' final accounts.
- The QS is an expert in construction procurement because of their expertise and skills.

1.3.1.2 Architect

For decades, the role of the architect (building designer) has continued to evolve and shift (Burr and Jones, 2010). The 21st century has opened up new opportunities for technological advancement and collaboration with the design team to achieve specific goals. The International Union of Architects (IUA, 2011) describe architecture as involving '…everything that influences how the built environment is planned, designed, made, used, furnished, landscaped, and maintained…' and so '…Architectural education constitutes some of the most significant environmental and professional challenges of the contemporary world…' (Feria and Amado, 2019; IUA, 2011). The duties of an architect can be summarised as follows.

- The architect should have discussions with the client, collect briefs and visit the site to facilitate the preliminary design.
- The architect should crystallise the preliminary design (brief) into a factual foundation for the building project.
- The architect should ensure that the preliminary design complies with statutory requirements.
- After checking with other consultants, a sketch design is produced and the client's approval is sought.
- The architect checks with the QS to see if the cost matches the budget.
- In the detailed design phase, the architect considers the client's requests in consultation with other team members.
- The architect heads the design team – this is not a right, but is determined by many factors (e.g. the scope of work and the client's discretion).
- The architect prepares tender/contract drawings and coordinates with other consultants.
- The architect is fully responsible for ensuring what has been designed is actually constructed, if included in the agreement with the client.
- The architect issues certification of work done and interim certificates at agreed intervals.

- The architect issues a practical completion certificate to the contractor/housing developer at practical completion.
- The architect also issues a certificate of making good and where defects/faults, if any, have been made good. This is usually after a defect liability period of 6 months.

1.3.1.3 Engineers

Electrical, mechanical and structural engineers are engaged in most building projects during the design phase. Engineers play a crucial role in achieving a successful building project (Gaur, 2023), including planning (during design), monitoring and controlling (during construction) the building project. Collaboration and information sharing are key among the engineers and other stakeholders to positively impact project costs and time performance. Briefly, the duties include the following.

- The engineer works with other team members, including the architect and the quantity surveyor, to achieve the project goal.
- The engineer ensures that the proposal is adequate and can be realised.
- The engineer is responsible for generating relevant detailed calculations, schedules and specifications to enhance other team members in advisory decisions to the client.
- The engineer ensures that the scheme satisfies local and international statutory requirements.
- The engineer supervises the project and modifies the scheme when necessary. This could be optional if not covered in the contract with the client.
- For some construction projects, especially in civil engineering, the civil engineer becomes the main consultant and the services of an architect may not be required.

1.3.2 Client (employer)

The client could be an individual, an organisation or a government agency (federal, state or local government). Ideas for projects usually emanate from a client, except in speculative development. Thus, the client plays an important role in developing the right conditions for project performance via innovation (Lindblad and Guerrero, 2020). According to Lindblad and Guerrero (2020), clients often work in partnership to address the issue of uncertainty and other emerging matters in construction. This is in agreement with Loosemore (2015), who noted that, in some instances, housing developers/contractors depend on clients with regard to innovation since project constellations are involved. Briefly, the client's main duties include the following.

- The client's responsibility starts with conceptualising a design brief. The brief sets out the components of the project, including the aim of the project.
- The client needs to employ the services of experienced consultants to handle projects. Sometimes, this action is taken too late and the project suffers the consequences.
- To comply with the contract terms, the client should have a feasible budget and predictable cash flow. Many clients have defaulted, including public projects in Nigeria, Ghana and South Africa. Examples of failed projects due to funding issues in Nigeria included the Ilorin–Jebba–Mokwa–Birni Gwari expressway, the Enugu–Onitsha expressway and the Benin–Auchi expressway (Olawoyin and Ukpong, 2018). In 2017, it was reported by Ghana Web that most suspended or abandoned construction projects

are due to non-payment of work certificates, costing the state about GhC,μ 30 million (£1.8 million) (Kuoribo *et al*., 2021).
- The client should settle all payment certificates as they are due.

1.3.3 Contractor

Contractors are project-based firms. They are decentralised where construction projects are managed (Haglund and Rudberg, 2023). Contractors range in size from one-person outfits to large multi-national conglomerates. In developing countries, selection and recruitment processes are fraught with issues (Evarist *et al*., 2023). If not checked, unqualified construction workers can result in poor project delivery. Contracting firms not only vary in size, but also in capability and reliability. Some contractors have teams that can handle all facets of construction, while others rely on the services of subcontractors for specialist jobs. Generally, the following are some of the expected duties from an engaged contractor.

- On 'winning' a contract, the contractor should accept to handle it.
- The contractor should conduct a site investigation for abnormal conditions before submitting a final commercial bid.
- The contractor should give the client and consultants duplicates of the priced BOQs, if required, for ease of cost control.
- The contractor should raise queries on drawings in cases of discrepancies during the pre-contract and contract phases.
- The contractor should host regular site meetings and update the participants.
- The contractor should provide site facilities for consultants, other site staff and support subcontractors.
- The contractor should provide consultants with enough information to help them monitor progress.
- The contractor should take out insurance cover as required by the contract agreement.
- The contractor should adhere to the contract conditions, rectify defects and complete the work on schedule.
- Nominated subcontractors and suppliers have obligations to the contractor.

1.4. The construction industry as an economic regulator

Since the Second World War, many developed and developing countries' governments have used the construction industry as an economic regulator. Governments are major clients and links to other industries, and the high proportion of public expenditure in total construction output is another factor to consider (Ashworth and Perera, 2015; Ball, 2014). Expenditure on construction-related products within limits thus becomes a means of reflation, making it a soft option for the treasury knife (i.e. public expenditure cuts). Governments remain major clients in the construction sector in many developing countries, including Nigeria and Ghana. Some scholars have argued that the construction sector is an economic regulator but this should not be exaggerated – governments may concede or drop projects for different reasons. For example, decreasing public sector borrowing often makes an impact. Public expenditure cuts can occasionally have a large effect on construction, yet are frequently accompanied by different measures (Abdullahi and Bala, 2018; Olanipekun and Saka, 2019). In addition, the cancellation of awarded contracts after extensive pre-planning and design can be dangerous to the system and whether these can be referred to as an example of regulation is debatable.