

ADVANCED CONSTRUCTION TECHNOLOGY

Executive summary

This assignment focuses on understanding the construction industry and the operations that are conducted in the same. The manner in which the construction industry focuses on improving their approach by application of modern technology is also highlighted in this assignment. The report provides brief details about the execution of project supply chains through the validation of sustainable procurement approaches. The definitions of distinctive construction project utilities along with resources will be provided in this report.

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Introduction

Construction industry is a fast growing industry in the modern market and with the growing demand of the same there is high need or the same to be modified and developed in the best manner possible. Modernization has led to the increasing need for the application of technologies to gain tactical advantage in the operations. Sustainability is one of the most vital aspects that are needed to be focused on by the Construction industries. Sustainability will not only help the organizations and the industry to enhance their productivity but will also impact their efficiency in the long run. The aspects of the deteriorating condition of the atmosphere are also likely to be controlled by the use of modern technologies and reduction of carbon footprints.

This assignment also focuses on understanding the sustainability design of construction and assesses the quality management that can be beneficial for the evaluation of the operational flow. In addition to this the supply chain of the construction industry are also highlighted in this assignment which aims to help in gather insight related to the operations. This will allow in proper assessment of the market and help the industry to apply the methods in the best manner to modify their approaches to.

Emerging Advanced construction technologies

In the modern times the construction industry has modified to a great extent. One of the main reasons behind the same is the dynamic condition of the market and the manner in which the market conditions are evolving in the current times. According to the information provided by Akan, Dhavale and Sarkis (2017), the modern projects that are being constructed in the United Kingdom are based on the application of modern technologies that can be applied to improve the efficiency of the projects. It has been found that the carbon footprint of United Kingdom construction industry is high in the recent years. The rate of growth of the GHG emission can be fatal for the future of the country as well as the world at large. In the year 2017 the GHG emission was equivalent t to 14,051.8 thousand metric tons of CO₂ emission. In the following year it increased to 14,239.48 thousand metric tons of CO₂ emission (Ali, Ali and Bayyati, 2018). The government has taken multiple steps to control the emission rate and decrease the use of traditional methods that are found to be having a stronger carbon footprint.

The applications of the modern technologies are likely to be beneficial for the industries as it is likely to decrease the GHG emission to a great extent. As specified by the work of Alwan, Jones and Holgate (2017), the current projects that are developed by the government of the United Kingdom have strict policies of reducing GHG emission to control the growth of the GHG emission in the atmosphere. *The modern technologies will help in assessing the amount of emission and also reduce the same by application of such methods* that are beneficial for the construction industry as well and does not reduce the efficiency of the same. There are multiple modern technologies that are applied by the UK construction industry to enhance the productivity of the industry on one hand and reduce the emission on the other hand. This is important to improve the operations of the industry. As highlighted by the work of Bamgbade *et al.* (2019), the application of the modern method and the technologies to enhance sustainability is the key to the success of the future.

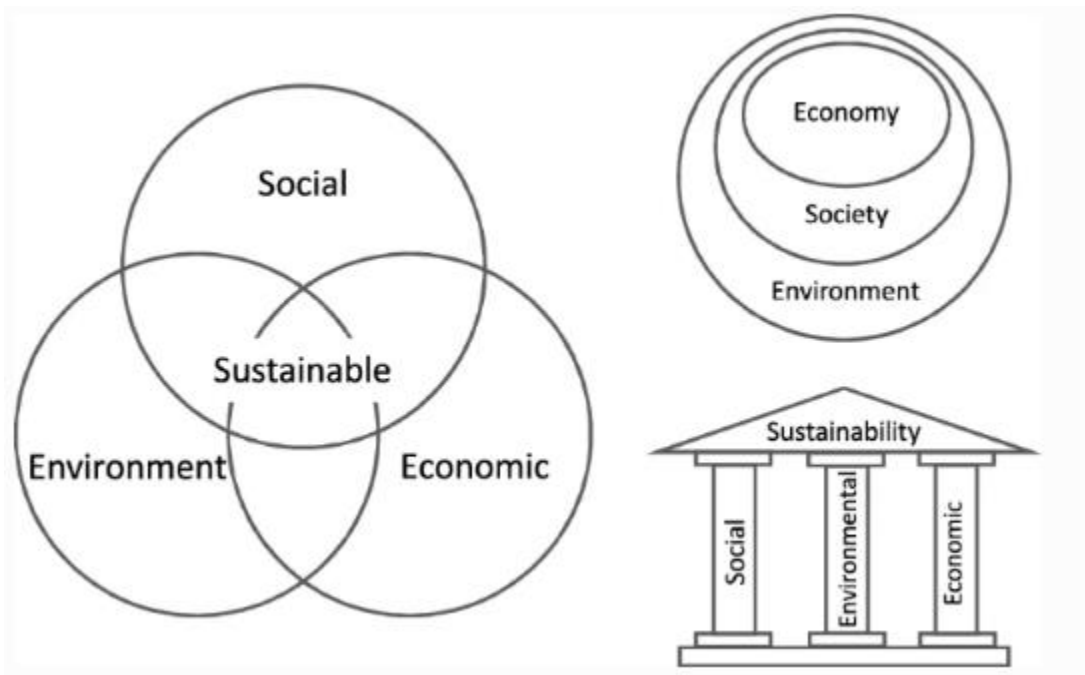


Figure 1: Pillars of sustainability

(Source: Carvajal-Arango *et al.* (2019))

Big data is one of the technological innovations that are used by the government of the UK and the construction industry to enhance their operations and improve their productivity. *The goal is to improve the knowledge of the companies and the insight related to the market.* According to

the work of Carvajal-Arango *et al.* (2019), the application of Big Data also helps in picking patterns and developing frameworks that are used to assess the probabilities and assess the risk factors of increasing security. The storage of data in big data can be used to compare and contrast the condition of the market and the manner in which the pattern can be developed. Big data helps in assessing the condition of the traffic, weather and other environmental conditions can be used to improve the efficiency of the industry and reduce the carbon footprint. Sustainability in the operations of the construction industry can be improved.

1. Sustainable Production/ Manufacturing

Sustainability is a vital aspect that is focused on in this assignment which helps in development of the approach of the industry to improve their future scope and development (Dixit *et al.* 2017). Sustainability is the key to success for the organization and especially in the construction industry the role of sustainability is high as it not only reduces the expense of resources for the future but also enhances the energy efficiency. ***The low maintenance and the operational cost is another major benefit that is provided by sustainability in the construction industry.*** The main advantage is to improve the operational cost and reduce the impact of the same. Sustainability is likely to reduce the expense resources in aspects where it is not need. ***This reduces the wastage of the materials and increases the scope of development of the project.*** The construction projects that were developed in the United Kingdom in the past had used up loads of raw materials as have been found from various statistics, however in the recent times with the modification of the technology and the application of the same in the construction industry of the United Kingdom has enhanced the efficiency of the industry as a whole.



Figure 2: Sustainability in construction

(Source: Duong *et al.* 2021)

In the conventional construction units there were variety in the buildings and diversity in the approach of construction. Every conventional building has its own key aspects. However in terms of the modern buildings there is no wastage of space on aspects that are unnecessary. Over the years it has been found that large areas have been waste in the conventional constructions. In *the new and modern constructions the wastage of the free areas have been reduced which is considered to be more sustainable*. According to the information provided by Duong *et al.* (2021) the footprint of the traditional buildings are higher than that of the modern buildings. One of the major reasons behind the same is that the traditional buildings cannot use man of the modern technologies. In modern times the use of technologies to develop smart homes and next generation insulation helps in reducing the cost of construction and carbon footprints.

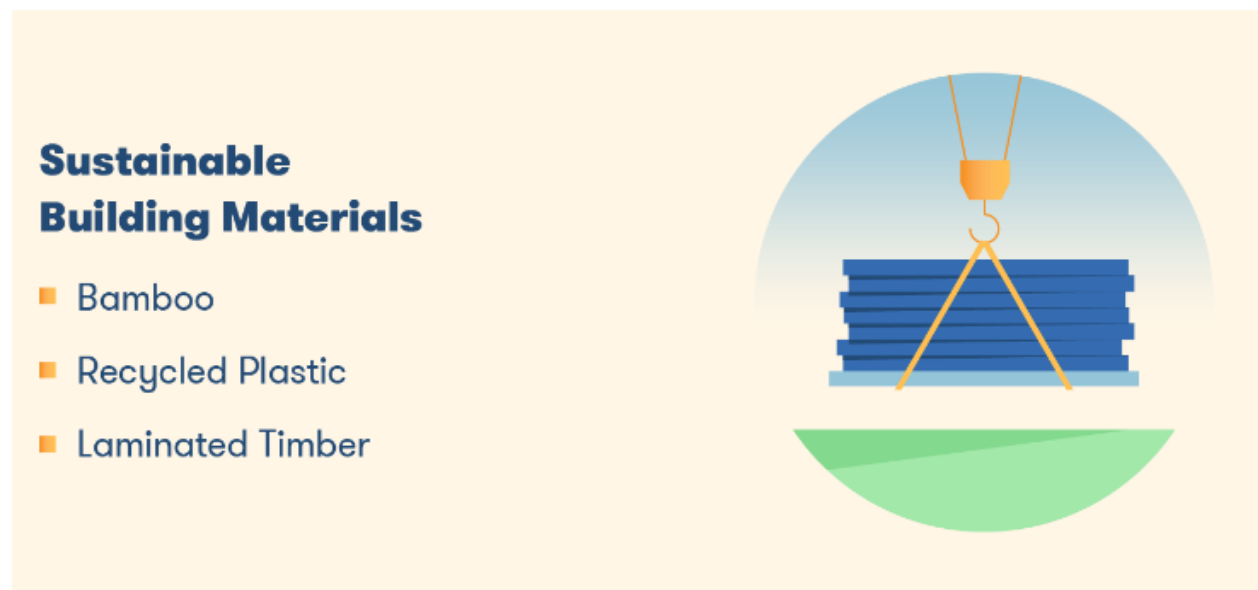


Figure 3: Sustainability methods in construction industry

(Source: Duong *et al.* 2021)

Modern buildings use *light pipe technologies* and *reflective roofing materials* to prevent damage and this can be used for a long period of time. This reduces the cost of maintenance. In addition to this, there are other aspects of technologies that are used in the modern buildings which include

multi-functional residential heat pumps which reduce the primary energy consumption to a great extent. This is used in the residential buildings to reduce the cost of energy thereby making the buildings more sustainable. As specified by the work of Enshassi, Ayash and Arain, (2019) it is clearly specified that, sustainability in terms of construction in the UK is focusing on the use of modern technologies which include Nano technology and other modern advancement to improve their aspects of construction. The basic sheets of metal and concrete that are used in construction can be greatly influenced by the use of *Nano technology*. The use of this technology makes the materials more durable and stronger. In addition to this the materials will be able to repair itself from minor damages. Air purifying is another major aspect that is used by this technology. The technology makes it easy to clean the materials as well which is highly beneficial for the future of the construction industry.

According to the information provided by Misopoulos *et al.* (2019), reduction of waste is one of the key aspects that are used in the modern construction industry of the United Kingdom. The *reduction of waste* will reduce the additional cost of the construction industry and this is likely to be highly beneficial for the future operations of the construction industry. Beside this application of green materials is another major aspect that is focused on by the modern construction industry which helps in the proper development of the industry and the application of the policies. *Green materials* are environment friendly and this reduces the carbon footprint of the entire industry.



Figure 4: Sustainability methods in construction industry

(Source: Duong *et al.* 2021)

Recycling of the materials is another major aspect that is needed to be focused on by the modern construction industry. This not only increases the potential for higher efficiency in terms of productivity but also reduces the cost of production thereby making the construction economic and sustainable. The efficiency of the materials and the resources will lead to higher efficiency in the industry. Local sources are used for the materials that are to be used for the construction and this increases the scope of efficiency. It is clearly interpreted from the work of Opoku, Ayarkwa and Agyekum (2019), the modern technologies that are used in the construction industry of UK is based on conservation of the energy and that can be beneficial for the long run of the industries. The energy conservation makes the entire operation much more sustainable and beneficial. During the conventional method the application of the methods were not simple and due to the lack of

technological advantage the energy conservation and recycling of the methods to reuse the same were not common.

Innovation in the construction industry has led to major advancement in the recent times. As mentioned by the information provided by Saiegh *et al.* (2018), the production process of the construction industry in recent times are modified by the use of modern technology and this has led to benefits in the construction industry. The carbon footprints are also reduced by the innovative methods. The application of robotics and artificial intelligence is used for 4D printing of the construction blueprints which helps in modern application of the methods. This allows the use of sustainable resources and decreasing the negative impact of the construction process in the environment. In addition to this it also reduces the impact of the construction on the environment (Akan, Dhavale and Sarkis, 2017). The reduction of the carbon footprint has helped the United Kingdom to act as an example for other countries that are focusing on gathering Intel of the modern methods used by United Kingdom and application of the same in their respective industries. Green buildings are targeted by the modern approach of UK to ensure that the long term sustainability of the production are upheld.

3. Sustainable Design and Construction

Around the globe, the public are becoming more concerned about the world around them and they are trying to change the way of things to gain a semblance in the environment around them. As mentioned in the works of Liu *et al.* (2017), in the process of sustainable building design and construction, the structures are created in a way that is environmentally friendly and the resources are rightly used in the process. The method is correctly followed throughout the life cycle of the building. As mentioned in the works of Ding *et al.* (2020), the method gets started from the selection of the site for design, construction, maintenance, operation, renovation and lastly deconstruction. It follows the basic structure of classic building designs, however it focuses more on the elements such as durability, comfort and utility. As mentioned in the works of Liu *et al.* (2017), the construction industry is a major part of the climate change issues. The industry is responsible for consuming 30% of the global energy and producing 20% of the greenhouse gases. There are different sustainable methods that the companies are using to reduce the environmental impact of the construction industry.

On the other hand, different methods such as sustainable refurbishment are becoming very popular. In the mentioned process, the companies work towards improving the existing buildings so that sustainable methods and materials can be used to make their environmental performance a bit better. The process is the same as the method of sustainable development and often new cities, buildings and industries are developed in the process. Often in the process of it insulation used and different related measures are used to reduce the energy consumptions of the buildings. Often different renewable sources of energy are used in the process such as solar water heating and others. Often in the process, the focus falls on the aspect of water reservation, elimination of overheating and others. The companies take the conscious step to make things better for the environment by engaging in providing better ventilation and making internal comfort better. The process basically helps the companies to reduce their overall waste, they end up using products that are environmentally friendly and recycled, reduce the use of energy and minimize production of noise and waste.

Among different issues related to the construction industry, waste management is definitely one of them. People around the world have seriously looked into the matter and are trying to bring a change. The best way to deal with construction waste is to adopt sustainable methods of construction so that the waste gets produced in minimal amounts. It will not only help the companies to deal with the environmental issues and on top of that, they will get the opportunity to deal with economic and social issues. As mentioned in the works of Ding *et al.* (2020), the waste management process follows a hierarchical structure, where the mentioned steps are followed one by one - prevention, minimisation, reuse, recycle, energy recovery and disposal. Then comes the process of modern methods of construction that are very sustainable and will help the companies to manage the waste effectively and largely reduce their environmental impacts. The methods followed in this process, helps the companies to reduce the time of construction, cost and maintain the overall sustainability of the project.

Furthermore, there are quite a range of construction methods that get used in the process. The **“Precast Flat Panel System”** is a popular method and in the process of it, the companies go ahead and build their floors and walls units outside of the site. In the process, separate factories or outlets are used. Once they are made, they get brought to the construction site and they need to work towards the matter. As mentioned in the works of Ding *et al.* (2020), this method is very convenient and in different repetitive methods of construction processes things can be done rightly.

Another process that is getting quite popular in the process of it is “*Flat Slab Construction*” and mainly because the versatile structure is largely versatile and it can be used in different construction projects quite rightly. It provides the minimum amount of depth and it takes less time to do the thing. As mentioned in the works of Lee *et al.* (2018), it is often used in different projects as it gets used to seal the different partitions. The mentioned slabs are very cost friendly options and on top of that it takes less time. It helps the construction projects to be more energy efficient as they can rightly exploit the thermal mass with the help of ventilation, heating and requirements for cooling.

Another popular method in the process is "Building Information Modeling" or BIM. It is a process that is actually the result of the support of different tools, technologies and contracts that involves generation of management and digital representation. As mentioned in the works of Liu *et al.* (2017), these are basically created in the forms of computer files and in the right time it can be rightly used to extract, exchange or network the support the decisions that will be made in terms of building assets. This software is not only used by individuals, but also businesses and governments. As it helps them to plan the whole process while operating and maintaining the things quite rightly.

3. Defect Analysis

Construction projects are usually massive in size and that is why it is only normal that they would work using many features in the process. The functions that are related to a construction project often span through different parties and trades. As mentioned in the works of Lee *et al.* (2018), in the process of construction, the importance of serving quality is really high and on top of that the projects are always under pressure to deliver things on time and work under the budget they are provided with. In different construction projects, the importance highly falls on the aspect of quality management and it largely depends on how the project will turn out. If the quality is not managed rightly, then the project can easily turn into failure. As mentioned in the works of Liu *et al.* (2017), often the construction can come with different defects and it is the responsibility of the company to deal with the situation rightly. The defects that take place within the construction structure need to be thoroughly looked at, otherwise it can lead to severe issues. Different kinds of defects can be seen in construction structure - structural movement, subsidence, thermal movement, condensation, damp ingress, timber decay, roof leaks and others.

Furthermore, all the mentioned issues are massive ones and later in time it is only natural that from minor inconveniences they can lead to fatal incidents. As mentioned in the works of Liu *et al.* (2017), often in different construction projects the managers tend to worry about the aspect of quality control and safety. As mentioned in the works of Ding *et al.* (2020), it needs to be thoroughly understood that the defects that take place in the construction sites can amount to large expenses, it can require complete reconstruction as well. As mentioned in the works of Lee *et al.* (2018), in recent years, the companies have largely become interested in the aspect of BIM and there have been multiple efforts from the government, the industry and the academic institutions to make the situation even better. As mentioned in the works of Ding *et al.* (2020), the mentioned method is getting used for different reasons such as assessment of benefits, calculations of quality in concrete, formwork and rebar, 4D scheduling and conflict management.

Moreover, the method has been used to make things better in quality management that was not even anticipated previously. Different policies have been made in relation to TQM and they have been implemented to make the operations more useful in the construction industry. The very method of quality management has been divided into three distinct stages so that things can be done rightly in the matter. As mentioned in the works of Liu *et al.* (2017), it has been named as the "Three Level Quality Management System". The very first stage in TQMS is Quality Control, then comes the process of Quality Assurance and lastly comes the stage of Quality Audit. As mentioned in the works of Lee *et al.* (2018), different parties in the process have been given the responsibility to look into the different stages that come with the process of TQMS. The very method of construction is highly complex and the companies need to effectively work on the site to understand different quality issues that are taking place. As mentioned in the works of Lee *et al.* (2018), if the workers are provided with effective tools of support, they will be able to improve efficiency in the matter of it. The following section of the report will try to showcase how with the use of BIM, the companies can very effectively document and analyse their defects to deal with the situation rightly.

Furthermore, the different companies often indulge themselves in just maintaining a thorough checklist to deal with the matter quite effectively. The companies need to deal with the situation in a much better way. As mentioned in the works of Ding *et al.* (2020), BIM is very advanced. The companies will be able to get the results they require in the matter and they will be able to identify

the mistakes quite rightly. It is an automated system that helps the companies to deal with the matter quite efficiently.

4. Project Supply Chains

The process of *sustainable procurement* is a specific technique that helps to increase the value of goods and services within the company in order to maintain the overall implications of the life cycle within the company. This mainly helps to integrate the implication of sustainable development tools by increasing the overall value of money for the authentication of high value of money within a very small interval of time (Chen *et al.* 2018). There are many categories of *sustainable procurement approaches* that can assist to increase the optimisation of the project supply chain in the future. The definitions of different types of sustainable approaches are provided below:

Public Private Partnership: The concept of public private partnership is mainly defined as the overall partnership between private and public sector that mainly helps to increase the competitiveness of business in order to maintain the attribution of business in the future (Koolwijk *et al.* 2018). Meanwhile, the partnerships between public and private matters mainly helps to engage the optimisation of resources based on the engagement of new business systems that can help to optimise the overall quantity as well as the quantity of products and resources in the future.

ICT supply chain integration: The ICT supply chain integration helps to maintain positive impact of business growth in relation with the procurement of enhancement and collaboration in the future (RezaHoseini *et al.* 2021). With the help of *ICT supply chain integration*, the quality of resource technologies related to construction projects can be improved between effective suppliers and buyers. The implementation of ICT supply chains are also very helpful to maintain the authorisation of definite project functions related to the optimisation of suitable procurement approaches in the future.

Web-based supply chain management: The idea of *web-based supply chain management* is mainly defined as the integrated tool and technology that helps to order the optimization of procurement systems in the future. This particular supply chain management can also offer the procedures of deliveries, invoices, payments and WBSCM in order to integrate the overall optimization of new business sources in the business for the future.

Design Integration: The idea of design integration is a specific function that mainly helps to increase the capitalisation of technology based on the effectiveness of different parts in order to serve design in a more effective manner (Wagner *et al.* 2018). Furthermore, the validation of design integration also helps to configure the optimization of project tools and deliverables for the attribution of new business management systems in the future.

Design Manufacturing: The idea of design manufacturing mainly helps to integrate the optimization of new tools in order to induce the effectiveness of new business management that mainly allow users to design new components for projects. Moreover, the integration of design manufacturing mainly helps to design optimum phases of projects.

Tracking of production process for new buildings: The software related to track the overall prosecution process of new business is very useful to validate results based on the configuration project tools and technologies (Wagner *et al.* 2018). In the project supply chain, the integration of new supply chain management mainly helps to implement the authentication of construction projects with the help of tracking software while implementing the ideas of new construction projects.

Conclusion

Hence, it is concluded that usability of the project supply chain is very important to increase the effectiveness of construction projects. It is recommended to utilise the appropriation of project tools and deliverables for the execution of new business functions in the future. It is also recommended to effective project teams to validate the configuration of construction projects with the help of supply chain management systems. Moreover, the limitation of projects is the lack of tracking software in order to execute the functional effectiveness of construction projects by utilising supply chain methods.

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