Benefits and Impact of Software Packages Application in Engineering Design: Inputs to Sustainable Business Operations

Asia Pacific Journal of Academic Research in Business Administration
Vol. 7 No. 2, 75-91
September 2021
P-ISSN: 2467-6691
E-ISSN: 2467-5148

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Date Received: August 19, 2021; Date Revised: September 7, 2021

Abstract – *engineering design, evaluate their benefits and impact on the business to provide inputs to enhance business operations. There were 148 respondents from various Engineering Design and Consulting (EDC) Companies in Qatar who were selected to participate in the survey. Data were gathered through a self-made questionnaire within the sort of 4-Likert scale questions. The results showed that the most useful software packages in the engineering design were AutoCAD MEP, REVIT BIM, CARRIER HAP, and ELITE. These software tools made significant benefits in the engineering design, which were compliant with the sustainability policies and guidelines in terms of economic, social, and environmental sustainability. Meanwhile, the impact of software package application on the company provided business sustainability and continuity in terms of operations, service quality, management responsiveness, cost-effectiveness, and marketability. Based on the findings, it was concluded that there was a significant relationship between the perceived benefits of software package application in engineering design and the impact of software package application on the business. This showed that the better the benefits of software package application, the greater is its impact on the business. Likewise, the researcher proposed an action plan that may be used to enhance the business operations in compliance with the economic, social, and environmental policies and guidelines.*

Keywords – *Competitive Advantage, Marketability, Software, Service Quality,*

INTRODUCTION

The critical challenge of the industries in today's world market and in a dynamic sector like the engineering design and consulting industry is managing, surviving, and succeeding in today's unpredictable market climate. In today's technologically dynamic market conditions, businesses must employ specific business strategies that result in a competitive edge. Technologies are providing the engineering design and consulting (EDC) industry with ways to maximize their contribution to the business strategies within the company. Technology has had a significant impact on business organizations in recent years, especially in management and control, marketing and analysis, operations, and decision-making [1]. It has speedily infiltrated workplaces and influences the world in areas most people are unaware of before it arrives at the front door. Globalization's impact on the industry has compelled most companies to become more creative and adopt newer techniques to maintain market share and achieve desirable profitability. Over the last few years, much work has encouraged using the most up-to-date technology in the engineering design and consultancy industry. One of the most promising options is software technology. The software package application will supplement the process if it is well implemented within the company system.

The market was buoyant at the onset of 2020 before the coronavirus (COVID19) crisis struck. Countries worldwide had issued quarantine orders by early March 2020, and work had stalled, if not completely halted, in some jurisdictions. The industries have to do something to deal with this crisis to sustain their company. One of the more effective options is software technology. Software tech can promote

business optimization and offer strategic benefits even during a pandemic crisis.

Software tech can enhance excellent staff morale, improve design quality, provide better coordination, adequate reporting, broader cooperation, more balanced decisions, fewer mistakes, scheduling and preparation, inventory control, and budget management. During a pandemic crisis, the company can implement a significant change in its working methods and adapt to a new way of working by using software packages. Employees can work from home and participate in meetings via video conference, if appropriate. Employees can collaborate while working from home using cutting-edge technology, which is especially important during the pandemic.

Despite the economic chaos created by the pandemic, technology-driven disruption continues to transform nearly every industry at an unprecedented pace, from anything we do, how we live and go to work. The technology world changes and progresses with each passing day – change is the only constant. Engineers would be able to work more effectively on the demands as technology advances, such as software packages. The problem with technological advances is that many practices are mindful of their value but do not know how to put it to use or where to start. The industry needs to adapt to the most current software packages to satisfy their clients' growing demand for building design efficiency, become more competitive in the evolving industry, and fuel company growth as emerging technologies advance. This is why the researcher recommends implementing the latest software packages in the building services engineering design. This is to address complicated market challenges, have strategic benefits, and eradicate engineering design's cumbersome role, and share design knowledge with members of a project team within the organization. Hence, the company must use the most up-to-date software packages available to enhance business operations sustainability.

It is undeniable that technological advances such as software packages significantly impact today's market processes and climate. In other words, technology is currently seen as the catalyst of creativity and development for new business activities, with SMEs being no exception.

However, it is alarming that despite the tremendous benefits extracted from software package implementation in engineering design and its positive impact on the business, most engineering design firms do not fully accept the immeasurable benefits of the most up-to-date software tools in their operations. Again, most companies have not yet experienced "no growth" due to their failure to use the most up-to-date technology solutions in their businesses. Several reasons have been advanced as to why certain companies should not use the latest software packages, ranging from high levels of illiteracy in the sector to cost implications and inadequate infrastructure growth.

As new technologies evolve, the sector needs to pivot to the most recent technologies to meet their clients' increasing demand for building design efficiency, become more sustainable in the evolving industry, and boost business growth. The industry can no longer rely on old technologies and must now speed up its technological transformation to deliver its products and services more effectively and extensively.

The study's primary purpose is to fill the gap by evaluating the perceived benefits and impact of the latest software package application in engineering design in the State of Qatar. The researcher aims to contribute to the body of knowledge on the most up-to-date software tools in the engineering industry since technology changes rapidly. Consequently, the study's output will serve as the source materials to provide knowledge and skills to all the practitioners in the industry.

This study is significant for all practitioners to effectively utilize the most up-to-date software package in engineering design, the main reason why researchers have to identify what concerns need to be solved. It is critical to examine the benefits and impact of software packages on business to provide inputs to enhance operational sustainability. Implementing the most up-to-date software tools in engineering design will undoubtedly bring about a revolution to the industry. Furthermore, as part of the researcher's support for Qatar's commitment to the Paris Agreement to minimize the effects of climate change, this study has been linked with the 2030 Climate Target Plan by the UN Intergovernmental Panel on Climate Change (IPCC). This study has suggested various strategies to help decrease greenhouse gas emissions that reach the atmosphere. Hence, this study will be a testament to the researcher's determination to contribute and work with the global community to preserve the world safe, secure, and habitable.

OBJECTIVES OF THE STUDY

The study's main objective is to evaluate the benefits and impact of the software package application in engineering design in the State of Qatar to provide

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inputs to enhance business operations. More specifically, the study identified the most useful software packages in building services engineering design; evaluate the perceived benefits of software packages application in engineering design in terms of economic, social, and environmental sustainability; assess the impact of the software packages application on business in terms of operations, service quality, management responsiveness, cost-effectiveness, and marketability aspects; test the significant relationship between the perceived benefits of software package and the impact of software package application; recommend an Action Plan to enhance business operations sustainability.

METHODS

Research Design

To guide data collection and analysis, a descriptive quantitative research design was used in this study. A survey questionnaire technique was used in this study [2] to investigate the most useful software packages in the engineering design; its perceived benefits in the engineering design in terms of economic, social, and environmental sustainability; and its impact on the business in terms of operations, service quality, management responsiveness, cost-effectiveness, and marketability. The results of the current study show numerical data, which is fitted for the descriptive quantitative design.

Participants of the Study

The study's target population, about 230, includes all experienced mechanical engineers from design and consulting firms and experienced professionals who are currently taking up an MBA/Ph.D. degree in the State of Qatar. But due to the pandemic, the researcher was not able to get the total population. The sample of the study consists of 148 who participated and responded to the survey questionnaire. The total sample of 148 with a response rate of 64 percent was deemed adequate for this study.

Table 2
Percentage Distribution of the Respondents Profile

Age	**f**	**(%)**
20 – 29 years old	7	4.70
30 – 39 years old	36	24.30
40 – 49 years old	71	48.00
50 – 59 years old	31	20.90
60 years old and above	3	2.00
Sex		
Male	133	89.90
Female	15	10.10
Total Years of Work Experience		
1 – 9 years	10	6.80
10 – 19 years	69	46.60
20 – 29 years	52	35.10
30 – 39 years	16	10.80
40 years and more	1	0.70
Educational Attainment		
College Degree	114	77.03
Masteral	31	20.95
Phd	3	2.03

Data Gathering Instruments

This study used a quantitative approach with a survey questionnaire, followed by a literature review. A questionnaire survey was used to collect data throughout the study.

In research writing, questionnaires are a standard method of data collection. Following an analysis of the research questions and relevant literature on the survey topic, the questionnaire topics were developed.

To achieve the researcher's objectives, the self-made questionnaire was used as the primary tool for data gathering. The questionnaire included a perceptual measure that was rated on a four-point Likert scale. The interpretation of the ratings for the third part of the questionnaire used the following: 4 - strongly agree; 3 – agree; 2 – disagree; 1 – strongly disagree. The fourth part of the questionnaire used the following interpretation: 4 – to a very great extent; 3 – to a great extent; 2 – to a least extent; and 1 – to a very least extent.

The survey questionnaire was divided into four parts: the first part mainly focused on the profile of the respondents in terms of their sex, age, employment status, job position, and years in service; the second part is about the most useful software packages in engineering design; the third part is about the perceived benefits of the software package application in engineering design with three (3) indicators; the fourth part is the impact of the software packages application on the business with five (5) dimensions.

Internal reliability analysis was used to validate the self-made questions in Parts III and IV of the survey questionnaires, which were about the perceived benefits of the software package application in engineering design in terms of economic, social, and environmental sustainability, and the impact of software package application on the business in terms

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of operation, service quality, management responsiveness, cost-effectiveness, and marketability aspects, respectively. The summary of the reliability test for the eight indicators is shown in Table 3.

Table 3
Summary of the Reliability Test

Indicators	Cronbach Alpha	Remarks
Economic Sustainability	0.953	Excellent
Social Sustainability	0.972	Excellent
Environmental Sustainability	0.976	Excellent
Operation	0.922	Excellent
Service Quality	0.978	Excellent
Management Responsiveness	0.885	Good
Cost Effectiveness	0.939	Excellent
Marketability	0.922	Excellent

Data Gathering Procedures

The first stage of the study was to collect related literature as secondary data. The second stage was the survey as the primary data gathering. The primary data collection process began with obtaining approval from the Dean of the School. The author personally conducted the survey, and the questionnaires were self-administered by the respondents. Due to the COVID19 pandemic, which restricts people's movement, survey questionnaires were distributed through google form with the link given to respondents via email, WhatsApp, LinkedIn, and other social media platforms. The author specifically clarified the intent of the study before the online survey. Following that, they were given the survey instrument. After completing the surveys, the author double-checked the responses to ensure they were complete. Data gathered were analyzed with support literature.

Data Analysis

To perform data analysis, the following statistical tools were used. Frequency and percentage distribution were used to describe the demographic profile of the respondents. Weighted means and ranking were used to evaluate the perceived benefits of software packages application in engineering design in terms of economic, social, and environmental sustainability; assessed the impact of the software packages application on business in terms of operations, service quality, management responsiveness, cost-effectiveness, and marketability aspects. The result of the Shapiro-Wilk Test revealed that the p-values of two major variables are less than 0.05, which means that the data set is not normally distributed. Thus, Spearman rho was used to test the significant relationship between the two variables. The following. In addition, all data were treated using statistical software known as PASW version 26 to interpret further the result of the study using an alpha level of 0.05.

Ethical Considerations

Since plagiarism is such a controversial topic in academia, ethical issues are crucial in this project. There are behavioral norms that differentiate between right and wrong, as well as appropriate and inappropriate behavior. In this report, some ethical questions were raised.

The participants were told that all data collected by the researcher would be used solely to achieve the research objectives. The guidelines were brief and easy to comprehend, ensuring that all research participants were well informed. Participants were given details about the project's priorities and told that their names would be kept entirely secret during the report to safeguard their interests.

Participants were told that their inclusion in the study was completely voluntary, with no bullying or inducement, and that they could opt out at any time without being asked. Participants were told that their privacy would be preserved and protected. No personally identifiable details would be used in the final study or any articles produced due to the project. Participants might refuse to participate or answer any of the questionnaire's questions if they did not want to.

The information gathered, including the participants' identities, was kept private and shared with third parties. In addition, the authors of all material from relevant sources, such as prior research, journals, published and unpublished books, were duly acknowledged.

RESULTS AND DISCUSSION

Table 4 presents the most useful software packages in building services engineering design. Based on the result, AutoCAD/AutoCAD MEP was the most useful since it obtained the highest frequency of 69 or 46.62 percent. This corresponds to most of the respondents indicating that they use AutoCAD/AutoCAD MEP in the design stage of the projects. AutoCAD has many benefits. It has a robust content editing function. It is used to help prepare architectural and engineering drawings and sketches. It is used to improve the standard of support, pricing, and efficiency available to their customers.

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Table 4
Most Useful Software Packages in Building Services Engineering Design

	f	(%)
AutoCAD / AutoCAD MEP	69	46.62
Carrier HAP	33	22.30
CFD	4	2.70
Elite	20	13.51
Revit BIM / BIM	39	26.35
Enscape	1	0.68
Excel Generated Programs	1	0.68
Robot Structural Analysis	1	0.68
Sketchup	1	0.68
STAAD Pro	1	0.68
Trading	1	0.68

Revit BIM / BIM is an information technology-enabled approach that involves applying and maintaining an integral digital representation of all building information for different phases of the complex construction project lifecycle [4]. Revit BIM was the most common BIM software regardless of firm scale, with approximately 90% of users [5]. BIM handles all graphical viewpoints and building records, enabling computer-aided drawing and report creation, concept assessment, project scheduling, and resource organization from facility design to service.

Carrier's Hourly Analysis Program is an improved user-friendly platform built on the Carrier data book and can predict cooling load. Carrier's HAP is a load calculation simulation application. It offers information on building loads as well as machinery operation for both industrial and residential buildings. It is essential to integrate energy-saving functionality into the architecture implementation of the cooling load software to reduce power usage [6]. HAP has a wide range of functionality that can be used to configure HVAC systems for commercial buildings. It also has strong energy analysis capabilities for comparing the energy usage and running costs of different construction alternatives. Huge time saves are realized when integrating all resources into a single tool. Input details and device configuration equations findings may be used explicitly in energy studies. The software is an effective method for modeling and sizing device components. HAP can accommodate ventures involving small to big commercial buildings with ease.

The least useful software tools which obtained the same frequency of 0.68 were Enscape, Excel Generated Programs, Robot Structural Analysis, Sketchup, STAAD Pro, and Trading. These tools were rarely used in the industry, most especially for mechanical services design.

Table 5
Perceived Benefits of Software Packages Application in Engineering Design in terms of Economic Sustainability

Indicators	WM	VI	R
1. It provides cost savings and a positive margin on the business.	3.24	Agree	5
2. It keeps design services more affordable and cheaper.	3.32	Agree	3
3. It promotes the program to recycle solid and liquid wastes.	3.45	Agree	1
4. It provides a smaller footprint for development sites.	3.26	Agree	4
5. It contributes to the growth of economic sustainability while maintaining a healthy balance with our ecosystem.	3.36	Agree	2
Composite Mean	**3.33**	Agree	

Table 5 presents the perceived benefits of software package application in engineering design in terms of economic sustainability. The composite mean of 3.33 indicates that the respondents agreed on the above benefits. Among the items cited, "promotes the program to recycle solid and liquid wastes" got the highest weighted mean score. This result only shows that most of the respondents agreed that the software packages application in engineering design promotes the recycling of solid and liquid wastes. However, material recycling technology is getting more exceptional for companies with larger wealth. The expenditures are unavoidably high, yet it aids more firms in dealing with water issues.

In terms of economic sustainability, software packages will enable design engineers to integrate solid and liquid waste recycling into their designs. Several legislative and environmental requirements and recommendations have been adopted and applied worldwide, which will allow all players of the building sector to follow sustainability criteria and policies in their projects. For example, in the development of Lusail City, the Gulf Organization for Research and Development (GORD) is tasked with regulating and promoting best practices on sustainability through the

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development and implementation of standards and guidelines through their Global Sustainability Assessment System (GSAS) – a performance-based sustainability rating scheme for the construction industry in the Middle East region. The primary objectives of GSAS involve developing a safer living climate, reducing resource use, and reducing environmental destruction as a result of the rapid rate of urbanization that is occurring in this period. In GSAS, the following requirements are included: urban connectivity (UC), site (S), electricity (E), water (W), materials (M), indoor atmosphere (IE), cultural & economic principles (CE), management & activities (MO). Each category includes a variety of requirements and sub-criteria, some of which are allocated a number of credits while others are called prerequisites. Water consumption falls under the water category, which covers the reuse of rainwater and greywater services. The developers must meet these requirements for their project to be approved. As we all know, rapid economic development and urbanization are exposing the world to excessive consumerism, lifestyle changes, and environmental degradation. Various ecological concerns are posing a threat to our survival as well as the survival of future generations. As the global human population increases, so are the water demands. Water is one of the few resources needed for nearly all transition processes that promote production activities. It is required to grow and develop raw materials, transform raw goods into consumable items, and deliver products to the consumer. As a result, conserving water use is a top priority for many businesses, especially in the construction industry.

In terms of water recycling, this practice has many benefits. Recycling rainwater and wastewater boosts and saves the ecosystem. It eliminates soil runoff and, as a result, discourages flash flooding. It replenishes freshwater. Recycling reduces the number of raw materials that need to be extracted, refined, and processed. It contributes significantly to air and water pollution. Recycling conserves electricity while still reducing greenhouse gas pollution, thus aiding in the battle against climate change.

However, these strategies are effective but inefficient from an economic standpoint since the goals are not met at the lowest possible cost. It was followed by contributes to the growth of economic sustainability while maintaining a healthy balance with our ecosystem. Contractors, architects, and builders are changing their priorities to create economically and biologically friendly structures. These structures have proven to be functional in actual life. Sustainable buildings will generate tremendous income due to their declines in carbon dioxide (CO2), modern technologies, environmental methods, and cost savings [7]. BIM, for example, has been used to strengthen the applications of sustainable buildings to increase the high efficiency of design and meet the targets of cost-saving in the construction sector [8]. In a nutshell, sustainable buildings have a positive effect on environmental sustainability and green design growth.

On the other hand, two items, such as "provides a smaller footprint for development sites" and "provides cost-saving and positive margin on the business" got the lowest weighted mean value, though rated positively. Although these two items were rated the least, it still shows that the software package application in engineering design promotes the sustainability or green building design that is economically viable. Sustainability is comprised of three fundamental components: social, economic, and environmental sustainability. However, recent research has shown that software technology improves the life-cycle cost savings of a built facility by a 6.92% cost reduction [9]. To be sustainable, development in the built environment should consider social, fiscal, and environmental factors at the same time. The unified approach of these aspects allows for the treatment of sustainability issues as a dynamic framework rather than relying on the "cause and effect" separately [10].

Table 6

Perceived Benefits of Software Package Application in Engineering Design in terms of Social Sustainability

Indicators	WM	VI	R
1. It educates staff about the efficient use of energy.	3.16	Agree	4
2. It encourages people to assume responsibility for creating and enjoying a sustainable future.	3.24	Agree	3
3. It contributes to sustainable development through contributing safety, health, and social harmony for the stakeholders in the engineering business.	3.03	Agree	5
4. It improves the education about the sustainability of the public, stakeholders, and potentially affected groups.	3.26	Agree	2
5. It empowers employees to make the workplace/environment healthier, safer, and secure, which provides opportunities and community activities.	3.28	Agree	1
Composite Mean	**3.19**	Agree	

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Table 6 shows the perceived benefits of software package application in engineering design in terms of social sustainability. The composite mean of 3.19 indicates that the respondents agreed on the above indicators. Among the items, "empowers employees to make the workplace/environment healthier, safer, and secure that provides opportunities and community activities" got the highest weighted mean.

The result reveals these packages in engineering design in terms of social sustainability have some benefits to the organizations and the communities. Organizations are urged to accept accountability for the consequences of their actions on society and the community. They must therefore integrate sustainability principles into their business strategies. The use of software technology has the potential to improve social sustainability in two areas. First, it provides a more robust facility design for a cleaner, safer, and more sustainable society's ease of living. Second, it turns traditional practice, which is frequently deeply fragmented, into a more cohesive initiative that reinforces the working relationships between project stakeholders. This study is vital for social sustainability because it can identify any negative relationships that emerge during the process and disrupt the project team's harmonious collaboration. Social sustainability ensures a stable, conducive, and secure atmosphere for all parties participating in the process, whether managers, builders, contractors, subcontractors, or end consumers [11].

Meanwhile, the lowest rated items include "educates staff about efficient use of energy" and "contributes to sustainable development through contributing safety, health, and social harmony for the stakeholders in the engineering business," with mean scores of 3.16 and 3.03, respectively. Although the software package promotes the efficient use of energy and contributes to sustainable development, the company still needs to initiate training and education for its employees to ensure that they are committed to the firm's sustainable design goals and contribute to its success. As technologies and society begin to shift both individually and in response to one another, more pressing issues will emerge. As the world's natural oil supplies start to dwindle, a growing number of citizens are urging that major reforms be made to move society away from fossil fuels and other nonrenewable energy sources. The construction industry must overcome this issue by educating its employees on energy efficiency to improve social sustainability by safety, health, and social harmony for all stakeholders involved in the construction industry. Social sustainability ensures a stable, conducive, and healthy environment for all parties participating in the process, whether managers, builders, contractors, subcontractors, or end consumers [11]. The use of software packages in engineering design allows for the development of a sustainable design that can assess the effect of green building, specifically in building output, material use, and energy usage. To ensure client compliance, the firms must ensure that the specification meets the owner's criteria for sustainability, codes, operations, technical elements, constructability, cost, and timetable. To do this, they must integrate energy efficiency and recycling policy into our plan, as defined in the project specifications, solar energy usage, energy-efficient equipment, LED energy-saving light bulbs, etc. Energy efficiency entails consuming less energy to produce the same results. Being energy-efficient reduces your carbon emissions, lowers your energy costs, and helps to make the planet a safer environment for future generations.

Table 7
Perceived Benefits of Software Packages Application in Engineering Design in terms of Environmental Sustainability

Indicators	WM	VI	R
1. It promotes water conservation practices.	3.17	Agree	2
2. It promotes green building design using resources to create high-quality and more energy-efficient buildings.	3.05	Agree	4
3. It protects the environment by reducing the greenhouse gas effect, energy and water consumption, and waste.	3.18	Agree	1
4. It promotes the implementation of renewable energy systems.	3.12	Agree	3
5. It promotes energy conservation practices (i.e., heating, cooling, ventilation, etc.).	3.01	Agree	5
Composite Mean	**3.11**	Agree	

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As seen from table 7, the respondents positively assessed the benefits of software packages application in engineering design in terms of environmental sustainability. On a similar note, "protects the environment by reducing greenhouse gas effect, energy and water consumption, and waste" was the observed top benefit. If implemented well within the company system, the software package can supplement the design process to help the organization meet its sustainable design goals, such as reducing the greenhouse gas effect, energy and water consumption, and waste.

Most developing countries, such as China and the United States, have seen rapid industrialization. Since industrialization and manufacturing have substantial social and economic benefits [12], they consume both renewable and non-renewable resources, as well as significant quantities of energy [13], and they pollute the soil, water, and air. Customers, states, and non-governmental organizations (NGOs) are putting pressure on business to behave actively in the face of multiple global environmental problems, such as global warming and ozone depletion, and to understand the ecological effects of their operations [14]. Furthermore, stakeholder demands and material prices and shortages force producers to adopt sustainable manufacturing methods, such as reducing material and energy use and waste generation[15].

Qatar incorporated sustainable development into its Qatar National Vision (QNV) 2030, which was ratified in 2008 as a roadmap for medium-term national development plans focused on social, human, fiscal, and environmental development. Qatar aspires to be an industrialized nation capable of achieving sustainable growth and maintaining a fair standard of life for future generations by 2030. QNV 2030 guarantees universal access to and safe use of water and sanitation in terms of the environmental sustainability foundation. The need to preserve and conserve the climate includes air, soil, water, and wildlife. Qatar has also put a high priority on climate change. Doha hosted the 18th Climate Change Conference, which culminated in many resolutions, the most notable of which was amending the Kyoto Protocol to establish a second commitment cycle between 2013 and 2020 and working to reduce greenhouse gas emissions in developing countries by at least 18%. However, based on the Paris Agreement, the baseline target for reducing GHGs will be by a whopping 75%. Of the 75%, 2.71% is unconditional, meaning the local sectors will fund this. The remaining 72.29% is conditioned on the financial support coming from other countries. Without external support, this component will not succeed and will only die in the water.

A software package with an energy-simulation framework may provide more detailed knowledge for optimum design selection to perform an energy consumption study. BIM software, for example, may enhance spatial architecture, especially in terms of airflow assessment and a building's overall ecosystem [16]. It may also be used to improve energy modeling and quantify potential adverse environmental effects in the sense of green assessment [17]. With proper planning and development, the software tool will help create a more favorable atmosphere for sustainability. The project's materials and components have a strong connection with environmental protection.

But items like "promotes green building design using resources to create high quality and more energy-efficient buildings" (3.05) and "promote energy conservation practices (i.e., heating, cooling, ventilation, etc.)" (3.01) obtained the lowest mean score. The application of software packages in engineering design enables the creation of a sustainable design that can analyze the impact of green building, particularly in building performance, adoption of materials, energy efficiency. It also promotes energy conservation practices. Previous research has found that legislative constraints are the most important motivator for companies to enact sustainable practices and accept responsibility for the environmental consequences of their operations [18]. According to Testa et al. [19], legislative standards push businesses to reduce their ecological footprint and increase their energy quality. Environmental laws are likely to grow increasingly strict in the light of climate change, and companies may experience increased pressure to conform with environmental best practices (e.g., reduce material consumption, implement an energy conservation program, optimize resource usage, and have specific objectives for waste management). This will assist them in meeting regulatory standards and provide them with a competitive advantage.

Table 8
Perceived Benefits of Software Packages Application in Engineering Design

Indicators	WM	VI	R
1. Economic	3.33	A	1
2. Social Sustainability	3.19	A	2
3. Environmental Sustainability	3.11	A	3
Composite Mean	**3.21**	A	

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Based on the summary table 8, it was found out that among the benefits of software packages application in engineering design focused on economic since the obtained highest weighted mean. To be sustainable, sustainability growth in the built environment should incorporate economic, social, and environmental aspects at the same time. The combined solution of these aspects allows ecological problems to be addressed as a complex framework rather than focusing on cause and effect separately [10].

However, in terms of economic sustainability, the software package will promote business optimization and provide strategic advantages to the company, particularly during the pandemic crisis, allowing the company to become more successful in the emerging market and accelerate business development. Many perceived benefits of the software package include workforce reduction, lower production costs, shorter lead times, increased efficiency, higher quality of work, improved coordination and teamwork among design teams, and so on. It further supports green construction practices such as treating solid and liquid waste. It also helps to increase economic sustainability while keeping a healthy balance with our ecosystem. It has been shown that software packages such as BIM boost a designed environment's life cycle cost savings. According to Lu et al. [20], a cost-benefit study performed in one sample program resulted in a 6.92 percent cost savings. The software package will help eliminate the time-consuming task of engineering design and the sharing of design knowledge among an organization's project team members.

Social sustainability was also observed as a significant benefit, while environmental sustainability was the least. The use of software packages has the potential to improve social sustainability in two respects. First, it creates a better environment for a society's ease of living by making it healthier, cleaner, and more stable. Second, it turns traditional practice, which is often highly fragmented, into a more cohesive effort that reinforces working relationships among project partners. Addressing the stakeholders' interests is the only approach to accomplishing social sustainability results in a built environment [21].

According to Zou and Zhao [11], social sustainability creates a safe, conducive, and healthy environment for all parties participating in the project, regardless of whether they are owners, designers, contractors, subcontractors, or end-users. Based on the results of the study, software package implementation, in terms of social sustainability, has a lot of perceived benefits such as empowers employees to make the workplace/environment healthier, safer, and more secure that provides opportunities and communities activities; improves the education about the sustainability of the public, stakeholders, and potentially affected groups; encourages people to assume responsibility for creating and enjoying a sustainable future, educates staff about the efficient use of energy, and contributes to sustainable development through contributing safety, health, and social harmony for the stakeholders in the business.

Table 9
Impact of the Software Packages Application in the Business in terms of Operations

Indicators	WM	VI	R
1. It improves customer service.	3.16	To a Great Extent	3
2. It reduces cycle time to perform a design process.	2.90	To a Great Extent	5
3. It increases the productivity of the Designer and Draftsman.	3.32	To a Great Extent	1
4. It reduces the operational cost of the business	3.24	To a Great Extent	2
5. It improves efficiency and quality of works.	3.03	To a Great Extent	4
Composite Mean	**3.13**	To a Great Extent	

Table 9 presents the impact of the software packages application in the business in terms of operations. The impact of the software packages on the business makes a competitive advantage in business operations. This can be done by integrating the right technologies into the business. Based on the result, "increases the productivity of the Designer and Draftsman" was the topmost impact with a mean score of 3.32. In general, most respondents feel that the implementation of the software packages in business operations will increase the productivity of the designer and draftsman. Business operations are regarded as the heart of every company. Essentially, companies work to provide value for their customers, and operations are the aspect of the company that does so. Software applications increase efficiency, provide technological

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advantages to the production phase, and provide a creative and interconnected operating platform for business sustainability [22]

"Improves efficiency and quality of works" and "reduces cycle time to perform a design process" also brought an impact. However, these items obtained the lowest mean score of 3.03 and 2.90, respectively, but were rated positively. This demonstrates that the application of software packages can encourage greater productivity and unity among players who were previously seen as adversaries [23]. The idea of integrated project delivery, which is a novel project delivery method that integrates individuals, processes, and business mechanisms and procedures into a collaborative tool to mitigate waste and maximize productivity in all phases of the project life cycle, is supported by software technology (Glick & Guggemos, 2009). Companies will gain the top three advantages with introducing the correct technologies: shorter project completion times, improved efficiency, and increased output [24].

Table 10
Impact of the Software Packages Application on Business in terms of Service Quality

Indicators	WM	VI	R
1. It provides reliability such as minimal downtime, good data integrity, and no errors that directly affect users.	3.28	To a Great Extent	3
2. It contributes to performance efficiency	3.18	To a Great Extent	5
3. It provides a high-security level to protect information against the risk of software breaches.	3.29	To a Great Extent	2
4. It provides accurate information/data.	3.32	To a Great Extent	1
5. It improves the level of satisfaction with resolution.	3.22	To a Great Extent	4
Composite Mean	**3.26**	To a Great Extent	

It can be seen from Table 10 that there is a great extent to the impact in terms of service quality, as revealed by the composite mean of 3.26. All items were assessed as "to a great extent" and "provides accurate information/data" ranked first with a mean value of 3.32. Based on previous research, software technology like BIM increases the consistency and accuracy of information used during the whole project [5]. It increases the level of service, quality, and performance that they are able to provide to their clients. Providing consistent and accurate information and data to the customers is the kind of service quality that a company offers. Service quality is described as a service that meets the customer's standards and meets their needs and requirements. This does not mean that a service company can automatically conform to consumers' implicit wishes. Implementing software packages in the market is one way to meet the demands and desires of customers. The usage of a software package improves the quality and accuracy of details used in the project. It enhances the standard of support, pricing, and efficiency they can provide their customers. According to CRA Construction Innovation, a software package such as BIM has many advantages in project execution, including precise geometrical representation of building components, increased design accuracy, and more robust budget management. It should not be used only to make drawings but as part of a holistic approach to knowledge processing and coordination [25].

On the other hand, the least rated items were "improves the level of satisfaction with resolution" (3.22) and "contributes to performance efficiency (such as the use of resources and how that affects its scalability, customer satisfaction, and response times)" (3.18). Although these two items were rated positively and suggested by some literature, most respondents do not show very great support. Environmental performance for sustainable building design can be determined using software packages such as BIM, Elite, and Carrier HAP. Software technology offers enormous potential for increased performance efficiency in the overall design and construction process.

According to Chiu and Lai [26], software tools contribute significantly to competitive advantages such as enhanced workforce efficiency, productivity, and performance, improved design quality, increased customer satisfaction, proper documentation, broader coordination, enhanced environmental performance, and improved resource utilization management. Effective software package implementation may result in a more productive design, construction, operation, and support process [27].

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Table 11
Impact of the Software Packages Application in the Business in terms of Management Responsiveness

Indicators	WM	VI	R
1. It provides business sustainability and continuity.	3.32	To a Great Extent	1
2. It advocates social responsibility through safety and quality.	3.14	To a Great Extent	3
3. It promotes sustainable business competitiveness.	3.04	To a Great Extent	5
4. It increases business income and company profit.	3.05	To a Great Extent	4
5. It promotes social responsibility.	3.20	To a Great Extent	2
Composite Mean	**3.15**	To a Great Extent	

Table 11 shows the impact of the software packages application in the business in terms of management responsiveness. All were rated to a great extent, which means that the respondents experienced a positive impact. Among the items cited, "provides business sustainability and continuity" obtained the highest weighted mean score of 3.32. Management responsiveness is the ability to react deliberately and within a reasonable timeframe to consumer demand or marketplace changes to gain or retain a competitive advantage and ensure business sustainability. According to Holweg [28], most market strategists agreed that capturing consumer interest and provided the best product or service within a proper context is a critical pillar of long-term success. According to this argument, software technology is needed to be implemented in the industry to ensure business sustainability and continuity.

Many researchers have argued that companies must integrate environmental concerns into their corporate strategies to remain competitive [29]. There has been an uptick in research into the competitive implications of integrating sustainable business practices into company strategy in recent years. A constructive corporate environmental policy may result in critical operational skills that can boost a company's competitiveness [30]. The principle of sustainability must be embedded in the company's core principles, which include concepts such as minimizing the environmental footprint of the company's products, collaborating with partners to conserve the atmosphere, emphasizing work-life balance, and encouraging personal growth. It was followed by promoting social responsibility and advocating social responsibility through safety and quality.

On the other hand, the least two items were "increases business income and company profit" and "promotes sustainable business competitiveness," which obtained a mean value of 3.05 and 3.04, respectively. Though rated the least, this only reveals that the respondents still support these two items. Software tech increases company income and profit promote sustainable business competitiveness. Software applications improve productivity, get technical benefits to the development process, and deliver an innovative and integrated working platform to business sustainability [22]. Sustainable business refers to environmentally and socially conscious business strategies and activities that lead to a safer and healthier planet while still providing a roadmap to increased profitability [31]. Business sustainability aims to assist a company in developing a holistic and cohesive strategy to fulfilling its stakeholders' economic, environmental, and social commitments. As a result, a more stable organization evolves, one that can be maintained over time. The firm's sustainable development plan would include collaboration among public and private entities to bring about significant technological change. Scholars also concluded that it is essential to create a win-win situation in which an organization will increase profits while still making strides toward implementing sustainable corporate practices [32]. Several studies have concluded that a favorable corporate environmental policy will create critical operational skills that can improve firm productivity [30].

Table 12
Impact of the Software Packages Application in the Business in terms of Cost-Effectiveness

Indicators	WM	VI	R
1. It promotes reasonable costs in engineering services.	3.13	To a Great Extent	3
2. It increases the engineering services fee.	3.09	To a Great Extent	5
3. It is practical to implement this in large-scale and high-end projects.	3.12	To a Great Extent	4
4. It provides a rewarding investment in the engineering design business.	3.16	To a Great Extent	1
5. It is cheaper to implement in the engineering design.	3.14	To a Great Extent	2
Composite Mean	**3.13**	To a Great Extent	

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Table 12 presents the impact of software packages application in the business in terms of cost-effectiveness. The composite mean of 3.13 reveals that there is a great impact on the business. "Provides rewarding investment in engineering design business" ranked first. It has been proven that a software package increases the life-cycle cost savings of a constructed facility by 6.92 percent cost savings [9]. This is a very reasonable cost-benefit in the building sector. BIM software implementation in the early stage of the project, such as during procurement and the early design stage, will cost-effectively minimize the variation costs and make projects more compliant [33]. The principle of cost-effectiveness has long been one of the first demands made by mechanical engineers in the design, planning, and construction of buildings. This need has been expanded to incorporate the relatively common social expectation of sustainability. While the cost-effectiveness aspect is solely associated with economical optimization, the primary consideration of sustainability encompasses both ecological and social concerns. Cost-effectiveness and resilience are not mutually incompatible concepts.

Nevertheless, the least two items were "practical to implement this in large-scale and high-end projects" and "increases engineering services fee." These two items also brought impact, though rated the least. The respondents still support these two items, though rated the least. These were backed up by previous literature. Software packages, such as BIM, can be used vary greatly based on the actor. The actor's profession and the company's scale are essential considerations in this disparity in opinion about what software technology is and how it can be used. Large companies, who are more likely to be interested in large initiatives, may favor tools with greater versatility in customizing project settings. At the same time, smaller businesses will prefer more intuitive project environments [34]-[35].

Table 13
Impact of the Software Packages Application in the Business in terms of Marketability

Indicators	WM	VI	R
1. It provides a competitive advantage.	3.07	To a Great Extent	5
2. It generates product/service differentiation.	3.28	To a Great Extent	1
3. It elevates customer satisfaction.	3.18	To a Great Extent	3
4. It builds business innovation.	3.12	To a Great Extent	4
5. It promotes company branding and advertisements.	3.20	To a Great Extent	2
Composite Mean	**3.17**	To a Great Extent	

Table 13 displays that there is a positive impact on using software packages application in the business. There is a great extent of impact on marketability. All were rated to a great extent but "generates products/services differentiation" was on the top with a mean value of 3.28. The use of software tech in the industry has been a key factor in the market growth in product/service differentiation. Product/service distinction allows a business to gain a comparative edge over other firms with identical product/service alternatives. It is a critical marketing process that is critical to a country's economy.

In this modern age, software packages in the engineering industry have been a critical factor of market growth in terms of product/service differentiation. Successful software package implementation may result in a more productive design, construction, service, and support mechanism [27]. The software package will lower construction and development costs by making better use of time and visualization. It has a significant effect on the industry by enhancing teamwork, improving design work, encouraging sustainable design, minimizing lead time, increasing design measurement precision, drawing clarity, and making routine activities more straightforward. BIM and Revit software not only bring technical value to the implementation phase, but they also offer an innovative and integrated operating platform that increases efficiency and profitability over the project life cycle [22]. Software packages provide a profound effect on building practice when they incorporate innovative processes and methods of providing plans, manufacturing, and facilities management services.

Nonetheless, "builds business innovation" and "provides competitive advantage" were rated the least and got the lowest mean scores. The use of emerging technology and its application to the philosophy of sustainability in the building sector has been deemed successful in managing environmental conservation and construction schedules [36]. According to Chiu and Lai [26], innovation through software tech

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contributes significantly to providing competitive advantages such as enhanced workforce effectiveness, productivity, and results, improved design quality, broader cooperation, improved environmental performance, improved resource management, and many more. While innovation brings opportunities in today's competitive environment, it also creates uncertainties and risks if resisted [37]. Sustainable growth is beneficial in all aspects of a building project through incorporating ecological technologies. Sustainable building schemes, as an innovative building form, are gaining worldwide interest.

Table 14
Summary Table on the Impact of the Software Packages Application in the Business

Indicators	WM	VI	R
1. Operations	3.07	GE	5
2. Service Quality	3.28	GE	1
3. Management Responsiveness	3.18	GE	3
4. Cost-Effectiveness	3.12	GE	4
5. Marketability	3.20	GE	2
Composite Mean	**3.17**	GE	

Table 14 shows the summary result on the impact of software packages application in the business. Among the subdomains, service quality got the highest mean value of 3.28. This only demonstrates how the software package implementation will affect the company and build a profitable business and strategic edge over other rivals in terms of service quality. This can be accomplished by incorporating the appropriate technology into the business. Technology developments are critical for any business enterprise because they affect how your clients will reach you and influence development by providing innovative products/services. If well integrated within the company structure, software technologies will complement the process. To build a profitable business, corporations must understand the environmental and social aspects of the business, including its strategies and operational practices that guide enterprises to a cleaner and healthier future while also offering a route to improved profitability [31].

Even though "cost-effectiveness" and "operations" were assessed to a great extent, these two items obtained the lowest rank. The respondents still believe that software packages application promotes cost-effectiveness and enhances business operations. Software tech makes a competitive advantage in business operations. The effective implementation of software packages can result in an efficient change in design, construction, operation, and support process [27]. Software package increases the life-cycle cost savings of a constructed facility.

Table 15
Relationship Between Perceived Benefits of Software Packages Application in Engineering Design and the Impact of the Software Packages Application on the Business

Economic Sustainability	rho-value	p-value	I
Operation	0.589**	0.000	HS
Service Quality	0.600**	0.000	HS
Management Responsiveness	0.407**	0.000	HS
Cost Effectiveness	0.307**	0.000	HS
Marketability	0.329**	0.000	HS
Social Sustainability			
Operation	0.578**	0.000	HS
Service Quality	0.621**	0.000	HS
Management Responsiveness	0.498**	0.000	HS
Cost Effectiveness	0.411**	0.000	HS
Marketability	0.414**	0.000	HS
Environmental Sustainability			
Operation	0.629**	0.000	HS
Service Quality	0.714**	0.000	HS
Management Responsiveness	0.476**	0.000	HS
Cost Effectiveness	0.418**	0.000	HS
Marketability	0.367**	0.000	HS

Legend: Significant at p-value < 0.05

Table 15 reveals the relationship between the perceived benefits of software packages application in engineering design and the impact of the software packages application on the business. It was observed that the obtained rho-values indicate a moderate direct correlation, and the computed p-values were all less than 0.01 alpha level. Thus, the null hypothesis is rejected showing that there a significant relationship exists. This means that the better the benefits of software packages application, the greater is its impact on the business. This is because software package applications' perceived advantages are linked to economic, social, and environmental factors to build a sustainable business. According to Larson, et al. [31], sustainable business is associated with environmentally and socially responsible business practices and operating strategies that guide companies to a cleaner and healthier future while offering a roadmap to improved profitability. This also enhances the impacts of software packages on business operations, service quality, management responsiveness, cost competitiveness, and marketability, as revealed from

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the findings that all indicators were interpreted as highly significant. This shows how the software package implementation will affect the organization and help establish a profitable business and a strategic advantage over competitors. This may be achieved by implementing the necessary technologies within the company.

Designing for sustainability is more crucial than ever. Software technologies such as BIM and AutoCAD facilitate sustainable design practices by allowing architects and engineers to visualize, simulate, and assess building performance early in the design process. BIM technologies are employed throughout the lifespan of a building and have a significant influence on its performance. BIM technologies are focused on manipulating project data and information, which aids in the development and gathering of building information made through the lifespan of the building by various teams with various goals and kept in separate systems. BIM may be utilized for project design and construction through the design, construction, and operation stages of a building's lifetime.

Software technology makes a competitive edge in business operations. It provides a creative and interactive working platform for company sustainability [22]. It also influences productivity improvements in design, construction, operation, and support processes [27].

Meanwhile, cost-effectiveness is a fundamental component of the sustainability concept. The software tool also promotes cost-effectiveness. The cost-effectiveness concept has long been one of the key demands made by mechanical engineers in building design, planning, and construction. This need has been broadened to include the relatively widespread societal expectation of sustainability. While cost-effectiveness is only concerned with the economic aspect, the central issue of sustainability consists of both ecological and social problems. The principles of cost-effectiveness and resilience are not mutually exclusive. The efficient implementation of software packages may change the design, construction, operation, cost-effectiveness, and support processes [27]. A software program improves the life-cycle cost reductions of a built structure. Among the ecological aims targeted at more significant development are the reduction of nonrenewable resource usage, the guarantee of long-term resource recovery, and environmental impact from waste management and residues [38].

TABLE 16
Proposed Action Plan to Enhance Business Operations Sustainability

KRA/ Objectives	Proposed Strategies	Person(s) Involved	Expected Outcomes
Economic sustainability To develop sustainable design goals to improve the economic performance of the company.	❖ Implement software packages in the early stage of the project, such as during procurement and the early design stage, to cost-effectively minimize the variation cost, shorten project time resulting in cost savings, and improve the company's income. ❖ Design projects to recycle rainwater to be used for the irrigation system. ❖ Design projects to recycle greywater to be used for flushing water closets. ❖ Design projects to reduce the amount of potable water used for all projects. Projects shall be designed to achieve between 20-30% water savings over typical buildings ❖ Incorporate recycled material and reuse plans in projects. ❖ Maximize the percentage of construction expenditures for goods and services originating from the national economy.	Management, design teams, logistics, regulators, clients, and other stakeholders involved	The company will maintain financial stability, provide healthy and reasonable economic returns, and mitigate the effects of drought and water shortages, resulting in high costs, food shortages, health risks, and political conflict.
Social sustainability Develop sustainable design goals to enhance the company's social performance.	❖ Design projects to improve indoor air quality (IAQ) and protect building occupants from potentially hazardous airborne contaminants. ❖ Develop projects that stimulate/ contribute to their local community using local building materials and local building techniques. ❖ Design projects that speak to the culture of their place. ❖ Encourage the use of regionally extracted and manufactured building elements and materials. ❖ Encourage the use of responsibly sourced materials for primary building elements to minimize the depletion of non-renewable materials.	Management, design teams, logistics, regulators, clients, and other stakeholders involved	The company will be able to enhance social sustainability and, at the same time, contribute to safety, health, and social harmony for the stakeholders.

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	❖ Encourage the reuse of existing building structures that previously occupied the site to reduce the need for virgin materials. ❖ Encourage the use of building elements and materials made from recycled content to reduce the need for virgin materials. ❖ Design projects to provide a thermally comfortable environment to ensure the comfort and health of building occupants. ❖ Provide adequate mechanical ventilation to ensure occupant comfort and health.		
Environmental sustainability Develop sustainable design goals to increase the company's environmental performance.	❖ Design projects to reduce the amount of fossil-fuel-based energy. ❖ Design projects to maximize passive sustainable design opportunities such as wind, sun, and water. ❖ Include the use of low environmental impact refrigerants in the project specification. ❖ Design buildings to lower their energy demand. ❖ Design projects to lower the demand for non-renewable sources, thereby reducing harmful emissions and depletion of fossil fuels. ❖ Establish energy demand performance levels for the building to reduce environmental and economic impacts associated with excessive energy use. ❖ Establish fossil energy conservation performance of the building with its delivery systems and energy supply network. ❖ Establish CO2 emission reduction performance of the building with its delivery systems and energy supply network. ❖ Encourage the use of materials and products which have the lowest life cycle environmental impact and embodied energy.	Management, design teams, logistics, regulators, clients, and other stakeholders involved	The company will reduce greenhouse gas emissions, energy consumption, promote renewable energy and other energy conservation practices.
Service quality Develop a business strategy to improve service quality	❖ Integrate the appropriate technology or software package into the business strategies to improve the company's performance efficiency and level of satisfaction, and provide accurate information and data to the customers.	Management, QA/QC, clients, and other stakeholders involved.	The company will improve service quality through the latest technology, such as increasing the consistency and accuracy of information used during the whole project.
Marketability Develop a business strategy to improve the marketability of products/ services.	❖ Create marketing materials that emphasize the firm's sustainable design components, such as its design philosophy, a list of accredited employees, and benefits of sustainable design, among other things. ❖ Update the website's sustainability section to reflect the company's current practices. ❖ Empower employees to be "active marketers" to promote the company's sustainable approach to potential clients. ❖ Create a presence on other social networking sites like Facebook, Twitter, LinkedIn, MySpace, etc.	The marketing department, staff	The company will be able to improve the marketability of the products/ services through marketing strategies.
Management responsiveness To develop a business strategy to enhance management strategy.	❖ Implement software package in business to ensure business sustainability and continuity. ❖ Make sustainability a strong office department, not an add-on to another one. ❖ Make the action plan available by providing it to the IT department for posting and commit to annual progress reports. ❖ Put together information that supports the value of the firm's sustainable design services (include information on project costs, operating costs, and occupant satisfaction). ❖ Encourage staff to participate in community outreach programs. ❖ Post annual reports on the website every year to discuss achieving the goals set out in each of the plans. ❖ Have an officewide report after the sustainability forum every year to discuss the progress towards achieving the plans' goals. ❖ Provide advisories through online channels, employee news, webinars/ forums/ meetings. ❖ Conduct public consultations, community briefings, customer satisfaction surveys, hotline numbers, etc.	Management, staff, community, customers, and other stakeholders involved.	The company will be able to enhance business operations and continuity.

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Proposed Action Plan

The company should create a long-term design sustainability action plan that aligns with the 2030 climate target plan by the UN Intergovernmental Panel on Climate Change concerning the three sustainability foundations (economic, social, and environmental). Although action plans vary by firm, a practical, sustainable action plan should address the following objectives, as described in table 16 below:

CONCLUSION AND RECOMMENDATION

The most useful software tools selected by the respondents in building services engineering design are the AutoCAD / AutoCAD MEP, Revit BIM / BIM, Carrier HAP, and Elite. The respondents agreed on all the perceived benefits of software package application in engineering design in terms of economic, social, and environmental sustainability. Among the benefits of software packages, most are focused on economic, which obtained the highest score

. The impact of software package application on the business in terms of operations, service quality, management responsiveness, cost-effectiveness, and marketability were all rated "to a great extent." Among the subdomains, service quality got the highest mean score. There was a significant relationship between the perceived benefits of software package application in engineering design and the impact on the business. This means that the better the benefits of software package application, the greater is its impact on the business. The study proposed an "action plan" to enhance sustainable business operations.

Other researchers may specify or utilize other software tools (other than those selected by the respondents) which they think will be appropriate for their works/projects. Other researchers may evaluate the benefits of different software tools since their benefits may vary from those of the software tools selected for the study. Other researchers may assess the impact of different software tools, which may vary from the impact of the software tools used for the study. The company may maximize the benefits of software package application in engineering design to significantly impact the business. The proposed action plan may be submitted for discussion and implementation.

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