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A review of relationship between sustainability and capital budgeting

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ABSTRACT
The integration of sustainability considerations into capital budgeting decisions is increasingly recognized as crucial for organizations striving to align financial investments with long-term environmental, social, and economic goals. This comprehensive literature review examines the intersection of sustainability and capital budgeting, encompassing key concepts, methodologies, challenges, and opportunities. Drawing upon a wide range of scholarly articles, case studies, and industry reports, this review provides insights into current practices, emerging trends, and future directions in sustainable capital budgeting. The review has been divided into multiple sections. In one section, all the reviews which identify current lacunae in sustainability incorporation in capital budgeting has been provided. In another section, logical reasons to incorporate sustainability have been discussed and emphasized upon. The third section discusses aspects of sustainability which have already been considered in the capital budgeting process. The fourth section discusses aspects of sustainability incorporated indirectly into cost of capital which is related to capital budgeting. Finally, the paper discusses research gaps and scope of future research.

Keywords
Sustainability, capital, budgeting, review, environmental, social, governance

Introduction
Capital budgeting is the process by which organizations evaluate and select long-term investment projects that involve significant capital expenditures. Traditionally, capital budgeting decisions have been based primarily on financial metrics such as net present value (NPV), internal rate of return (IRR), and payback period. However, in recent years, there has been a growing recognition of the need to integrate sustainability considerations into capital budgeting processes to ensure that investment decisions are aligned with broader environmental, social, and governance or ESG goals. The current study is an attempt to unravel the already conducted literature reviews of the sustainability aspects covered as part of capital budgeting and go deep into it to find the current lacunae in those studies and any scope for future studies. The study progresses by studying all literature reviews which identify a current aspect of sustainability being ignored in contemporary practices of capital budgeting. In other types of studies, logical reasons to incorporate aspects of sustainability have been provided. They have been studied to collect various aspects of sustainability which should be incorporated in the capital budgeting practice. In addition, those types of studies have been included which discusses few aspects of sustainability already integrated in to the capital budgeting process. Yet another distinct types of research papers have been studied which provides information of sustainability aspects integrated into cost of capital dterminations. The research gaps revealed from all of these literature reviews have been discussed as part of a separate section along with possible scope for future research.

Research Methodology

A literature review, by definition, is a thoroughly comprehensive critical analysis and careful synthesis of present literature or studies on a selected topic. The research problem being studied here is the probe of the relationship between sustainability and capital budgeting practices which have already been exploited before. The research papers have been collected through online databases of journals namely ABI/INFORM, EBSCO, Elsevier's online journal collection, EMERALD Insight, JSTOR, Taylor and Francis online journals and Wiley online journals. The entire list of research papers in these databases were sifted to look for words and phrases in the tile of the research paper such as "Capital Budgeting", "Budgeting", "Long term financial planning", "Purchase of fixed assets", "Acquisition of plant" and a play of words where "fixed assets" were replaced by "machinery" or "plant" or "small business" or just "business" or "investments". The application of these words or phrases shortened the list of research papers to few thousands. Thereafter, the list was further shortened by further looking for the words or phrases such as "sustainable", "sustainability", "maintainable" "tenable", "green" and the words opposite in meaning to "sustainable" like "erosion", "depletion" in the titles of the shortened list. "+" operator was often used to search for both the sets of phrases together to achieve the task. The shortened manageable list of few hundreds was roughly scanned inside to remove the totally unrelated or irrelevant ones to arrive at the present number of research papers. In later stages, the shortlisted research papers were segregated according to the several themes they catered to. A total of seven themes have been worked out to segregate the literature review as detailed in the literature review section. The time period selected for the study is from 1990 to the present date. Moreover, focus is given to research papers post 2000 and only those papers in the 1990s era have been selected which are relevant to the study and cater to the basic information. The research papers were segregated into different sections based on the theme which they catered to.

Literature Review

Sustainability has been defined by United Nations Brundtland Commission as "fulfilling the demands of the present times without unnecessarily compromising the capability of the generations to come to achieve their own demands. Sustainability has multiple aspects which primarily include economic, environmental and social. Economic sustainability is concerned about the philosophy of supporting long term economic growth while making it sure that the social, environmental, and cultural aspects of a community are duly taken care of and they are enhanced rather than being harmed upon. Environmental sustainability is concerned about the philosophy of appropriately managing natural resources in a responsible manner to support the demands of the present and future worlds. Social sustainability is the philosophy which supports fair distribution of natural and other resources amongst all and promotes a good quality of life for all of humanity. The current study focuses on all three aspects of sustainability especially with regards to incorporation in capital budgeting. It is worthwhile to note that the present study focuses only on microeconomic aspects of capital budgeting at the corporate level which only focuses on investment projects.

Literature Review 1.1: Literature Review highlighting lack of proper incorporation of sustainability in capital budgeting practices

The following section discusses those research papers which highlighted complete or partial ignorance of sustainability aspects of capital budgeting. Gordon, Salmi, Chinnasamy and Soundarajan (2023) [6] identified that real options and sustainability aspects are yet to be successfully accepted in capital budgeting practices in Oman. Schoenmaker and Schramade (2023) [55] discussed basics of capital budgeting and behavioural aspects associated with them. They also elaborated how traditional capital budgeting calculates financial value only while totally ignoring social and environmental value or at the best considering them at a secondary

value. The authors emphasized that social and environmental value needs to be calculated and detailed an effective method to calculate the same. Calculation of social and environmental values independently and their present value calculation has been elaborated. Moreover, three different methods to incorporate social and environmental values in investment decisions have been elaborated. This theory found support in study by Gleibner, Gunther and Walkshasl (2022) [22] according to which financial sustainability is not adequately operational as on the date of the research. Yet, it was emphasized by the authors that financial sustainability is an important hidden construct without which it is almost impossible to study risk and sustainability management. Risk and sustainability ignored while undertaking capital budgeting makes it an incomplete exercise as indirectly implied by the authors. Jha and Arora (2019) [26] supported the idea by emphasizing that sophisticated tools of risk assessment and capital budgeting are still not assertively utilized in capital budgeting. This indirectly points to sustainability aspects being usually ignored.

Jha and Arora (2019) [27] also provided a simulation solution to better account for risk assessment including risks of losing all types of sustainability in a paper thereby highlighting the usual ignorance of sustainability incorporation via risk assessment. The implication is that if an organization chooses to ignore any economic, environmental or social sustainability, the consequent scenario would increase the risk of the project by increasing expenses. This was supported by Siddikee (2018) [53] who identified that the traditional methods of capital budgeting do not incorporate sustainable practices into account. De Lange (2017) [13] revealed similar information by claiming that investors were found to be rather choosing to avoid business risk than to accommodate sustainable solutions. The investors are mostly clueless about the value which is being captured by incorporating sustainable model of business or accomplishing other sustainable ventures. Similar views were shared by Kimbro and Wehrly (2017) [34] where they prominently shared that most of the managers do not take environmental savings, costs and external factors into account thereby indicating at the ignorance of sustainability factors. Moreover, it was revealed that academically recommended analytical methods like Net Present Value and Internal Rate of Return are thought of as not favouring or somewhat biased against sustainable projects. It is also revealed in the study that the current batch of managers are fully aware that managing risks related to sustainability is necessary for survival in current age of information. Vesty (2011) [64] supported this viewpoint by identifying that most of the companies do not consider environmental impacts of their capital investments while making a decision. This was further supported by Meyer and Kiymaz (2015) [41] where it was highlighted that sustainability is not taken into consideration while considering most capital investment decisions. Similar views are shared by Bocken (2015) [9] where he revealed that sustainability focussed investments or projects which cater to long term sustainability are still very less in number. It was also highlighted by the author that start ups focussing on sustainability may look beyond environmentally conscious customers and may employ technology and special skills to deliver returns.

Literature Review 1.2: Literature Review indicating financial behavioural aspects leading to ignorance of incorporation of sustainability into the capital budgeting process

Curmei, Tilixa and Curmei (2021) [11] have identified that the rational behaviour of investors have a limiting factor especially when the capital budgeting decision is immediately followed on by a financial crisis. The sustainability aspects are often ignored in such cases as the focus is more on reducing losses rather than enhancing sustainability. The study is supported by Frost, Rooney and Lee (2012) [19] who have identified the trade off between financial viabilities and considerations for sustainability. This is so because sustainability concerns pay after a long time while financial viabilities are immediately rewarded. The concept is further indirectly supported by Krahe (2021) [36] where it has been argued that investors would never be in a

perfect position to accurately distinguish between sustainable projects and non-sustainable projects due to non complete disclosure. Hence, the financial behavioural aspects of non insistence on complete disclosure lead to ignorance of true sustainability. It has been further emphasized by the author that it is the duty of the state to make it sure that there is a classifying criteria to differentiate between sustainable and unsustainable projects. Martin (2021) [37] had a slightly different take on the subject. It was revealed by the author that managers indeed prefer corporate social responsibility oriented projects even when the financial incentives are slightly stacked against them. It was also revealed by the author that most of the companies are negatively affected by the preference of the manager for corporate social responsibility oriented projects. The final negative effects and not the financial behavioural aspects were seen as the deterrent. The findings were previously somewhat indirectly supported by a study by Martin and Moser (2015) [38] in which it was revealed that potential investors react more positively to information of environmental friendly investments than to no information. However, those investors also react positively to a report which presents claims that no green investments were made. Probable unprofitable green investments are also seen as a deterrent by the investors which are again duly considered by the managers.

Literature Review 1.3: Literature Review pointing towards a multidisciplinary approach towards the incorporation of sustainability and capital budgeting

The preliminary research pointing to a study which identified the fact that important multidisciplinary parameters may be missing from capital budgeting started in 1994 itself. Zinkhan and Zinkhan (1994) [67] have revealed that there are diverse disciplines related to finance, marketing and strategy which are interrelated. There might be aspects in strategy or marketing which might be utilized in financial decisions including capital budgeting but they are often not taken into consideration. The authors have argued emphatically for gathering useful data from multiples disciplines before making any decision including financial ones. The authors have reasoned that such information from diverse disciplines have a financial value. The study moved on to incorporate sustainability in minor ways. It was then revealed by Greyson (2007) [23] that sustainability would not be fruitful the way it is practised in that era and there needs to be a change in mindset for the same. A very broad approach was discussed by the author encompassing entire economy. The view was supported by Sookram and Kistow (2012) [59] who identified the importance of incorporating holistic sustainability considerations into the capital budgeting process. It was suggested by him that environmental, economic and social factors should be considered in a holistic manner for business decision making. A broader view was taken by Heikkurinen and Bonnedahl (2013) [48] who emphasized that market orientation and stakeholder orientation as competing strategies for sustainability is incomplete, external as well as weak and it would be beneficial to include internal and inherent business practice for sustainable development. Capital budgeting, by default, would be part of this internal and inherent business practice. This was indirectly supported by Amini and Bienstock (2014) [4] who identified the linkages between business strategy and sustainability. Although not talking directly about capital budgeting, it was emphasized by the authors that business strategy has to be modified for incorporating sustainability. Capital budgeting is an integral part of business strategic decisions. Hence, it was implied that capital budgeting cannot be kept separate from sustainability as and when the organization is incorporating sustainability on a holistic level.

Park and Ravenel (2013) [47] discusses the incorporation of environmental, social and governance factors into financial framework and decision making process especially where risk is incorporated into the consideration. Generally, positive expectations have been shared about the future when environmental, social and governance factors would be incorporated into the framework. The indication is to utilize a broader set of information also encompassing

sustainability considerations. Barbier (2016) [8] went a step further and emphasized that sustainability is not only important for a company but for the entire economy. Sustainability was defined as welfare that does not diminish over any time period. This definition of sustainability was thought to maintain or enhance assets or portfolio over time which not only includes humans but also natural capital. Hence, the implication is that companies should make every business decision including sustainability and the larger economy into consideration thereby increasing the scope of business decision making. Kim, Shin, Ahn and Lee (2017) [32] supported the idea of looking at broadening the scope of capital budgeting by incorporating a sophisticated approach which considers risk factors of projects and also the long term sustainability aspects while linking them together. It was identified that the volatilities in the present value of project cash flows are factors that can change decision criteria and hence need to be effectively considered. The research applied real option valuation to the two colour rainbow options. It was emphasized that volatility of present value of cash outflows are more significant than cash inflows as is usually thought.

Literature Review 1.4: Literature Review which indirectly implicates incorporating sustainability incorporation into capital budgeting while talking about related factors

Although not talking directly about the capital budgeting process, Xu, Shen, Zhang and Chen (2020) [63] talk about incorporating financial sustainability in energy enterprises. The authors talk about providing salary incentives and equity incentives so as to bring about financial sustainability in energy companies. Provision of equity incentive is slated to sort out principal agent problems. Moreover, technological innovation is also sought to bring about a positive change in sustainability. Hence, a refined approach to capital budgeting is indirectly implied by the authors which should take sustainability into consideration. This was supported and modified by Frost and Rooney (2021) [18] where they identified that it is necessary to include non-financial knowledge and criteria of evaluation into the capital budgeting process to incorporate sustainability in the process. The concept was indirectly supported by Alfredsson and Malmaeus (2019) [1] where it was identified that by current rate of economic growth and the need to curb harmful emissions quickly, the need for incorporating sustainability in capital investments is paramount. The relationship between capital budgeting and sustainability was emphasized by Mondal, Singh, Gupta (2022) [42] albeit without any reference to causality when they highlighted the importance of carefully studying strategic factors before implementing all aspects of sustainable development. The idea of linking sustainability with capital budgeting and improving capital budgeting approach was presented by Situmorang (2024) [56]. Situmorang (2024) [56] undertook a deeper analysis of a food processing machine and the various aspects of capital budgeting related to it. The study took three different scenarios of standard, optimistic and pessimistic to arrive at three different values of all relevant values of capital budgeting methods. Although the study for undertaken for a particular case study, the analysis was presented as a better approach to the real option approach of capital budgeting. Moreover, the approach was indirectly emphasized to contribute to a better planning of sustainability.

Solow (1993) [58] discusses the role of innovation in social accounting so that more and more renewable resources are being considered for use enhancing the overall economy and make it sustainable. Pezzey and Withagen (1998) [51] further built up on that approach and studied the aspects of sustainability with respect to present value maximization model. It was revealed by them that technological progress is the most likely and realistic assumption which dismantles various conflicts. The study implies that renewable resources would most likely rise and sustainability would be achieved early. Capital depreciation is also thought of as a more likely event. Although not directly discussing capital budgeting, the study talks about present value maximization which is an integral element of capital budgeting. Other aspects of sustainability

were duly taken care of by Kimbro (2013) [33] who emphasized on including assessment and costing aspects of life cycle along with economic efficiency and full accounting appraisal for integration of sustainability affects into capital budgeting. The author included environmental costs and gains as well as environmental risks into account for a new model of capital budgeting.

The concept of social accounting was further supported by O'Dwyer and Unerman (2016) [46] who emphasized the importance of incorporating social sustainability accounting. They also advocated for the increased merging of knowledge from other fields to enhance the concept of social sustainability accounting. The idea was indirectly favoured by Warren and Jack (2018) [65] where they emphasized the idea of a deeper research exploration of capital budgeting methods used both by the government and industry to better understand the structuration process in accounting practice. In a very interesting case study, the generators carefully restricted their capital expenditures because of their prior knowledge of capital budgeting. The generators forced the government to identify that there was a problem of environmental sustainability, long term supply and price for the consumers in case of generators. Hence, capital budgeting knowledge has been shown to be linked to environmental sustainability in this case.

Jha and Pande (2024) [28] acknowledged the fact that recent research has shown that there is an inconclusive or mixed result for the relationship between sustainable business and development which is sustainable. However, it was emphasized by the authors that whenever the share of sustainable businesses and investments rise in a country, the nature of development which is sustainable also rises. Hence, it was implied by the authors that when sustainability is incorporated in the capital budgeting process, presence of multiplier effect would eventually add more value to the investment. Similar views were expressed by study of Han and Cai (2024) [24] where it was emphasized that harnessing more of energy technologies which are sustainable leads to protection of vulnerable natural resources as well as ultimate increase in the value of human capital as humans become aware of ways to preserve natural environment which in turn only benefits them. Hence, indirectly the study is encouraging the implementation of sustainable practices in capital budgeting so that the entire environment and ultimately human capital is at an advantage. Siqueira, Fischer, Bin and Kickul (2023) [57] have identified that there is considerable overlap between traditional investments in business and carefully considered sustainable investments in business. The presence of a considerable overlap identifies the fact that there should be considerable incentives for businesses to invest in sustainable ventures.

Chituru, Shiyanbola and Gbolahan (2022) [3] identified that a properly done capital budgeting has had a positive effect on sustainability of small and medium enterprises in Lagos, Nigeria. This brings up a new understanding where sustainability is presented as a dependent variable of capital budgeting process. The view is supported by Baig, Khalidi, Mubarak and Sarwat (2020) [7] where they have suggested to fully incorporate sustainability aspects in the capital expenditure appraisal process. The view is further supported by Peterson and Fabozzi (2002) [50] who emphasized on the importance of both firm's performance and sustainable growth while engaging in the activity of capital expenditure appraisal process. Kakiya and Bosire (2019) [29] also supported the theory by suggesting that capital investment is a strategic decision and needs special considerations. Factors such as past experiences, peculiar conditions of the market and special economic situation were considered important by the authors for this strategic decision. It was emphasized by them that while making capital budgeting decisions, companies should take active steps deemed necessary for sustainable growth as well as competitive advantage.

Literature Review 1.5: Literature Review which talks about taking a holistic approach towards sustainability and capital budgeting while talking about several distantly related factors

Gordon, Salmi, Chinnasamy and Soundarajan (2022) [6] have revealed that real options approach to capital budgeting has promising ability to enhance sustainability aspects in capital budgeting practices but it is yet to gain attention of companies. The author has highlighted an increased need for global companies to adopt the process. Although not directly advocating for a real options approach incorporation in capital budgeting to enhance sustainability, a holistic model was earlier emphasized by Mundalamo (2015) [43]. They conducted a study on SCOPE-1 greenhouse gas companies in South Africa and found out that they indeed practice sustainable capital budgeting practices. The companies still find difficulties in analysing the accurate impact of sustainability. The author has identified a need of a holistic model to cater to sustainability in capital budgeting. The requirement to incorporate several real life aspects have also been earlier identified by Gannoshyna and Volkivskyy (2010) [21]. They studied and analyzed the controversy regarding economic viability of algae based fuel production. They have argued that although traditional capital budgeting methods work well but they do not provide the whole story. Usually uncovered aspects like market observations and analysis should not be completely ignored. It was further emphasized by the authors that utilization of more complicated capital budgeting methods does not always provide the straight answer but is useful in providing suitable indications and strategic thinking guidance. It was indirectly indicated by the authors that sustainability aspects are usually only covered when complicated capital budgeting methods are incorporated while taking inputs from several different fields.

The role of real options in enhancing the value of sustainability was also indirectly identified by the study of Schachter and Mancarella (2016) [54] where it was revealed that using simple mathematical approach of financial option model for real option valuation may not work in most cases. It was emphasized that probabilistic real option models would work better in these cases. Moreover, there is a growing interest amongst regulators to incorporate these probabilistic real option models into the system. The wait and observe strategies would make it possible for the best approach to be taken for every possibility and make the project more sustainable.

Spitzer, Pojasek, Robertaccio and Nelson (1993) [60] identified the need to incorporate pollution prevention aspects into the accounting and capital budgeting practices of companies. This was further continued by Kearney (1995) [31] where he identified the importance of environmental accounting along with few bottlenecks to be taken care of. The idea of green accounting was supported by Stern (1997) [61] in his study of sustainability with respect to capital theory approach. The study identified two different approaches. However, in both these approaches, interactions between economy and environment and individual states of both economy and environment are considered. Although not discussing capital budgeting, it is implied by the author that sustainability cannot be ignored in financial decisions when economy and environment are interacting with each other. This view was supported by Gale and Stockoe (2001) [20] who emphasized the use of taking environmental accounting into consideration as it is directly involved with management accounting. Although focussing on a rather different aspect of capital investment appraisal, McDermott, Stainer and Sainer (2002) [39] implied taking environmental sustainability into account. Moreover, they have emphasized that by third generation partnering; more than half of cost reduction and almost four fifth of time reduction can be achieved. These factors have indirect implications for environmental sustainability. The idea was supported by Al-Tuwaijri, Christensen and Hughes (2004) [2] where they claimed that environmental performance has a direct bearing on economic performance of the

companies. They identified quality of management with both economic and environmental performance. Without directly discussing capital budgeting, the authors imply paying more attention to this aspect also as it is directly linked with economic performance and quality of management.

Similarly, though not directly talking about accounting or capital budgeting, Pearce (2008) [49] revealed learning curve, economies of scale, resource scarcity and stringent legislation as the reasons for pursuing sustainable capital projects or taking sustainability into consideration in capital budgeting. This was further supported by Marynina (2014) [40] who identified environmental cost accounting as an intrinsic part of sustainable management. Although being very limited in their scope of study, this is also supported by Kistow and Sukram [35] where have conducted a study in Trinidad and Tobago and concluded that if they plan to become sustainable businesses then they should pay attention to both internal and external costs and incorporate sustainability aspects in capital budgeting practices.

Badia, Serrats and Rodon (2020) [10] have conducted a study on capital budgeting aspects of corporate social responsibility projects. The objective was to be able to determine the different outcomes of such projects so as to be able to control external effects of such activities. This is another approach where sustainability-oriented activity is further looked upon for any adverse effect. Similar approach was shown by Ziolo, Bak, Cheba, Spoz and Niedzielski (2021) [68] where they conducted a study in financial institutions to analyze the state of progress and level of thinking in accommodating sustainability in financial systems. The study focussed on four different groups of financial institutions. Banks were revealed to be the group with the most advanced with respect to the accommodation of sustainability while capital markets and stock exchanges were found to be the least accommodating. Climate risk is duly considered in banks leading to its high ranking in accommodating sustainability.

A more direct approach of comparing sustainable projects with unsustainable ones was taken by Nishihara (2023) [45]. Nishihara (2023) [45] undertook a study where a sustainable project with high initial investment with guaranteed cash flows in the future is compared with an unsustainable project with low initial investment with risk of abrupt closure of future cash flows. It was emphasized by the author that with a higher risk of environment, social and growth factors along with lower required rate of return and higher growth rate, any rational organization would choose a sustainable project over an unsustainable one. Moreover, it was identified that the higher the volatility of the cash flows in a project, the greater should be the inclination for a rational organization to invest in sustainable projects. However, it was also identified that a higher rate of leverage would undo the advantages of sustainable projects over unsustainable ones. A higher corporate tax rate as a policy factor was discouraged because it might encourage higher leverage thereby discouraging sustainable project investments. The idea of incorporating sustainability in capital budgeting practices was further supported by Kalkan (2023) [30]. It was highlighted by the author that larger investments are scrutinized carefully as compared to smaller ones as they have more impact on company's value and sustainability. Larger investments also are of usually longer term and naturally involve larger financial involvements. The author reiterated the idea that capital budgeting along with other investment appraisal activities should be logical, fully systematic and thoroughly comprehensive. Lastly, it was also identified by the author that capital budgeting also helps companies in developing sustainable growth strategies by being forced to choose a careful and analytical approach. Hence, the author has presented sustainability as a necessary after effect of a careful capital budgeting and not something which can be detached from capital budgeting.

Literature Review 1.6: Literature Review that views capital budgeting from the point of view of cost of sustainable capital or reduced value of cost of capital

The concept of cost of sustainable capital earlier came into picture when Fayers (1999) [16] conducted a study on personal investment choice. It was reported by the author that earlier investors paid close attention to only financial returns and sustainability and financial returns were considered mutually exclusive. It was socially changing values which forced investors to think on lines of leading a change towards developments which are environmentally, socially and governance wise sustainable. The idea gained somewhat support by Steven (2005) [62] where it was argued by the author that sustainability should be developed by combining knowledge of various disciplines including business and finance. Cost of sustainable capital concept was intrinsic to the study and encouraged by it. It was implied by the author that incorporating sustainability into decision making has the potential of increasing long term returns. Figge and Hahn (2005) [17] developed a method to determine the cost of sustainability capital just as an analogy to the determination of cost of economic capital. Moreover, cost of sustainability capital is presented as a value rather than a burden. The concept is supported by De, Anthony and Levy (2008) [12] who emphasized the idea that a growing number of investors want the companies to adopt sustainability practices as part of the corporate policy. It was also acknowledged by the authors that these investors are fully aware of the fact that adopting sustainability practices would enhance the financial prospects of these companies in the long term. It was also highlighted that there are several roadblocks in the process. Accurate valuations of sustainable investments as well as managing associated risks are challenges which need to be taken to task.

The idea was supported by Dhaliwal, Li, Tsang and Yang (2011) [14] where they claimed that companies engaging in a comparatively better corporate social responsibility were able to see a reduced value of cost of capital after they published all their reports highlighting their corporate social responsibility efforts. It was also revealed by the authors that these companies find more institutional investors and analysts who are specifically attracted to these companies further emphasizing that it becomes easy for the companies to raise equity capital. The concept finds support from the study by Anthony and Rezaee (2015) [44] where it was reported by the authors that companies with better performance on the economic sustainability front were duly able to report lower values of cost of equity capital. However, it was also reported by the authors that this lower cost of equity is due to abundance of growth opportunities in the sector and also due to intense research efforts undertaken by the companies. The idea is fully supported by study by Efimova (2018) [15]. Efimova (2018) [15] supported the idea that incorporating environmental, social and governance factors in capital appraisal process may have huge positive financial impacts. It was also emphasized by the author that institutional investors should invent a technique to incorporate environmental, social and governance factors into the valuation process. The valuation process focuses more on the cost of capital aspects. The approach and thought process is further supported by Pinney, Lawrence and Lau (2019) [52] who have emphasized that millennials and female investors are more interested in companies which are oriented towards sustainability thereby implicating that it reduces cost of capital. The thought process is closely supported by Zerbib (2022) [66] who conducted a study on sustainable investors and found out that the affect of these investors on company's cost of capital is substantial in many cases. Although not directly focussing on capital budgeting, the study focuses on an important parameter of capital budgeting which is cost of capital.

Literature Review 1.7: Literature Review that emphasizes considerations for qualitative aspects for sustainability incorporation into the capital budgeting process

The idea of qualitative aspects of sustainability with respect to capital budgeting was supported by Aro-Gordon and Al-Sakiti (2021) [5] who emphasized the role of capital budgeting in

promoting a sustainable business and future economic development. Their study was based on a non-oil sector which was hitherto uncovered in studies in the region. Qualitative aspects and their utility in capital budgeting were beautifully presented in the study. However, it was identified that measurement of non-financial factors was still challenging in the process of capital budgeting. These non-financial factors are mostly related to environmental, social and governance factors which require a global compliance. Lima, Silveira, Matos and Xavier (2017) studied cotton ginning plants and observed that application of qualitative aspects in capital budgeting improve both the net operating results as well as long term sustainability of project especially in those cases where too much quantitative information add to the complexity.

Discussion

The knowledge gained from literature review has been classified in these several categories as displayed under:-

Discussion 1.1: Discussion focussing on lack of proper incorporation of sustainability in capital budgeting practices

Studies by Gordon, Salmi, Chinnasamy and Soundarajan (2023), Schoenmaker and Schramade (2023), Gleibner, Gunther and Walkshasl (2022), Siddikee (2018), De Lange (2017), Kimbro and Wehrly (2017), Meyer and Kiymaz (2015), Bocken (2015) and Vesty (2011) [6,9,13,22,34,41,53,55,64] have clearly indicated that several aspects of sustainability which include environmental, social and governance factors are not adequately considered while making capital budgeting decisions. It was identified that although some effort is taken to acknowledge sustainability aspects but the complete quantifiable value is often ignored and an incomplete value at best is taken for consideration. Hence, a research gap has been fairly identified where sustainability aspects have not been properly analyzed and adequately quantified to be taken into consideration for capital budgeting purpose. Future researchers can pick up all such missed aspects of sustainability and try to develop a model which adequately and quantitatively incorporates aspects of sustainability into the capital budgeting process.

Discussion 1.2: Discussion focussing on interference of financial behavioural factors leading to incorrect incorporation of sustainability in capital budgeting practices

Few studies by Curmei, Tilixa and Curmei (2021), Krahe (2021), Frost, Rooney and Lee (2012) [11,19,36] have highlighted the fact that investors are somewhat immune to sustainability aspects of prospective projects which affects the relevant companies to ignore sustainability aspects. However, studies by Martin (2021) as well as Martin and Moser (2015) [37, 38] presented a slightly different impression of managers and investors in which they appear slightly positively affected by sustainable projects and reports on these projects respectively. However, the final negative effects due to incorporation of sustainability factors in most cases lead to deterrence of such incorporation. Moreover, it was also revealed that the investors also react positively to non incorporation of sustainability aspects. Thus, a research gap is identified where behavioural finance aspects of managers and investors have not been properly analyzed so as to identify adequate and quantifiable inclinations towards sustainability which can be properly exploited and the negative factors neutralized. Future researchers can think of analyzing such behavioural finance aspects of managers and investors and try to quantify it and prepare a model.

Discussion 1.3: Discussion pointing towards a broad, holistic and multidisciplinary approach towards the incorporation of sustainability and capital budgeting including looking at distantly related aspects

A separate section of studies by Zinkhan and Zinkhan (1994), Heikkurinen and Bonnedahl (2013), Greyson (2007), Amini and Bienstock (2014), Kim, Shin, Ahn and Lee (2017), O'Dwyer and Unerman (2016), Warren and Jack (2018) and Frost and Rooney (2021) [4,18,23,32,46,48,65,67] have supported the idea of taking a holistic and broader approach towards incorporation of sustainability into the capital budgeting process. The studies indicated at looking beyond environmental, social and governance factors of sustainability and involving business strategy factors and non financial qualitative aspects also. Therefore, a research gap has been identified where there is a need to properly define relationship of sustainability with several distantly related factors. Future research may cater to this idea so that a model is created to adequately define and quantify sustainability and establishes its relationship with several other distantly related parameters.

Discussion 1.4: Literature Review which looks at sustainability and capital budgeting from the point of view of cost of sustainable capital or reduced value of cost of capital

In another section of review, studies by Figge and Hahn (2005), Fayers (1999), Steven (2005), De, Anthony and Levy (2008), Dhaliwal, Li, Tsang and Yang (2011), Anthony and Rezaee (2015), Pinney, Lawrence and Lau (2019) and Zerbib (2022) [12,14,16,17,44,52,62,66] have indicated that sustainability aspects can be incorporated while looking at the effect on reduced cost of capital of companies in several ways. However, it was also identified that the process of effect of sustainability on reduced cost of capital is not a simple but a rather complex one where multiple factors are involved. There is an indication in these studies that such complex interplay has not been completely researched. Hence, a research gap has been identified where there is a need to adequately incorporate aspects of sustainability in the cost of capital determination process while taking multiple factors and their interplay into consideration. This would eventually lead to application of correct values of discount rate or hurdle rate consequently improving the capital budgeting process. A reduced cost of capital also helps to enhance the value of investment by reducing the discount rate thereby improving the wealth of the shareholders. This happens by having a lesser probability of rejecting profitable investments courtesy a lower discount rate.

Discussion 1.5: Literature Review which looks at the application of qualitative aspects into the interplay of sustainability and capital budgeting.

Aro-Gordon and Al-Sakiti (2021) and Lima, Silveira, Matos and Xavier (2017) [5,37] have indicated that application of qualitative aspects have increased utility in looking at the interplay between sustainability and capital budgeting. Lima, Silveira, Matos and Xavier (2017) [37] further stressed the significance of qualitative aspects in the capital budgeting process especially when too much quantitative information makes the capital budgeting process complex. Moreover, qualitative aspects were indirectly revealed as having more significance as compared to quantitative aspects especially with regards to sustainability.

Limitations

The study is not immune to limitations as is the case with any study. The literature review may be suffering from bias as only the top tier journals have been targeted for study. Study of both sustainability and capital budgeting together has made the study too narrow thereby probably leading to problems of validity and may have missed important relationships. Moreover, it is very difficult to ensure that all literature on a topic has been covered.

Conclusion

Sustainability is an important factor in taking capital budgeting decisions. Studies have revealed that sustainability has not been adequately applied into the capital budgeting process. It was revealed that although sustainability is considered by companies, a rigorous model is not

applied by them so as to correctly and adequately incorporate it into the capital budgeting process. Studies have also indicated at a considerable interference of financial behavioural factors into the application of sustainability into the capital budgeting process. Behavioural finance is a complex parameter which is always difficult to quantify. Hence, the concept can become a popular subject of future studies. Review of literature has also highlighted inclusion of a slightly diverse and complex set of factors of sustainability which includes aspects of behavioural finance, business strategy and non financial qualitative aspects as well. It is pretty difficult to incorporate such diverse sets of distantly related factors unless a suitable model is developed. Most importantly, it was indicated by research that organizations are not adequately incorporating sustainability in their capital budgeting process still as late as the present time. Companies may start adequately incorporating aspects of sustainability into their capital budgeting process so that cash returns are earned for a longer tenure thereby increasing wealth of the shareholders. It was also indicated that investors may not be thoroughly informed about the benefits of incorporating sustainability. Organizations may take a conscious effort in this regard to adequately educate investors about the same. Informed investors adequately aware of sustainability have shown to reduce cost of capital also. A reduced discount rate because of a lower cost of capital goes a long way in wealth maximization of shareholders. Hence, the benefits of educating investors would be recovered financially from the investment itself.

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The manuscript does not involve any software application or custom codes.

Author's Contributions
The author confirms sole responsibility for the following: study conception and design, collection of research papers, review of literature, analysis and interpretation of literature review as part of discussion, and manuscript preparation.

Research involving Human participants or Animals
There is no research or study involving human participants or animals in this manuscript.

Informed Consent
Yes, wherever required legally