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Sustainability and Firm Performance: A Review and Analysis Using Algorithmic Pathways in the Throughput Model

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Abstract: This paper reviews the prior research on the relationship between sustainability and a firm's performance and proposes algorithmic pathways in the throughput model that could be used to improve the research findings for such research. Results of our literature search were mixed. Some studies reported a positive relationship between a firm's sustainability efforts and profitability while others found a negative to no relationship. Studies found reasons for implementing sustainability even though it is a loss-bearing activity; other studies found reasons for not practising sustainability. Reasons for not practising sustainability ranged from absence of external pressure; not viewing the sustainability report as a business obligation; deeming it too expensive for small firms; to a lack of resources. Our evaluation of the prior research also found that the prior studies excluded an important class of assets—non-financial intangible assets—in their evaluation of the relationship between sustainability efforts and profitability. The contribution of this study is that the throughput model along with its six dominant algorithms depicts the significance of triple bottom line concepts of economic, social, and environmental variables influencing performance.

Keywords: sustainability; financial performance; intangible non-financial performance; throughput model; investors' decisions

1. Introduction

It has been believed that corporations have an obligation to stockholders to maximize profits, which will lead to an increase in their wealth. The only social responsibility a corporation has is to increase profits and make the owners/shareholders wealthy [1]. Consequently, managers should not exercise social responsibility in their role as corporate executives. Pioneering research conducted by the Stanford Research Institute (SRI) in the early 1960s caused a paradigm shift by recognizing other groups to whom the corporation is responsible in addition to stockholders. The other groups are referred to as stakeholders. The original list of stakeholders mentioned by SRI in its research report included shareowners, employees, customers, suppliers, lenders, and society. Thus, there was a paradigm shift from considering the interest of only stockholders (a shareholders' theory) to a broader position called stakeholders (stakeholders' theory). The goal of this paper is to review the previous research on the connection between sustainability and a firm's performance. In addition, a major contribution of this paper denotes algorithmic pathways in a model described as the throughput model. This model enhances the research findings for prior research in the area of sustainability on firm performance and the triple bottom line of economic, social and environmental issues. Therefore, a pertinent research

question is: Can algorithmic pathways assist our understanding of the significance of triple bottom line concepts of economic, social, and environmental influencing performance?

Further, the sustainability movement has brought about an interesting question: can firms adopt a sustainability posture and remain profitable? A substantial amount of research has been conducted on the relationship between sustainability and firm performance. The results of these studies have been mixed, ranging from positive, insignificant, to negative. This paper is motivated by the need to synthesize the literature in the following manner. (1) Introduce a research model (i.e., throughput model) that imports six dominant algorithmic pathways in order to organize sustainability studies. (2) Report the reasons for the contradictory results. (3) Report the reasons why firms continue to implement sustainability activities even though they see them to be loss-bearing activities. (4) Discuss the research model that could improve the interpretation/findings of the sustainability studies.

An algorithm is a procedure that is a sequence of steps typically dealing with by a computer and or statistical program that assures to find the appropriate resolution to a problem in a finite time or indicate that no resolution exists [2]. Although algorithms have manually been around for thousands of years to solve problems, the computerized statistical programs have made it easier and swifter to solve problems. In addition, algorithms have become the centerpiece in artificial intelligence apparatus, which includes biometrics, machine learning, deep learning, big data, etc. [3]. Therefore, algorithms are a part of artificial intelligence, which can be defined as a set of instructions—a preset, rigid, coded steps or pathways that gets executed when it encounters a trigger [4].

Many concepts have given management approaches to decision-making that allow them to consider the interest of multiple stakeholders—for example, the triple bottom line concept. This concept promotes the idea that when making decisions, management should consider not only the interest of financial stakeholders, but social and environmental issues as well [5,6]. Thus, this concept focuses on economic, social and environmental issues relating to a firm's performance. Social and environmental issues are inseparable from the sustainability movement [6–10]. Further, as stated by Elkinjton [11] (p. 37) “to achieve outstanding triple bottom line performance, new types of economic, social, and environmental partnerships are needed.” Corporate social responsibility promotes engagement in activities that are good for society and encourages firms not to spend resources solely to increase profitability. Those other activities could include preventing environmental pollution, human rights, diversity, product/customer relation, employee relations, donations, charity, and supporting education programs. Firms have to have enough resources in order to engage in those activities. Neither the shareholder theory nor the stakeholder theory takes into account resource allocation decisions that must be made by management. Slack resource theory states that for a firm to engage in activities that are not a core business, it should have a resource allocation plan in place to allocate scarce resources to selected activities. Therefore, the decision to consider shareholders only or all stakeholders depends largely on a firm's available resources.

The triple bottom line concept encompasses sustainability. Sustainability has been defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” WCED [11] (p. 43). Further, it encourages the adoption of “business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future” (Deloitte and Touche in Labuschagne, et.al. [12]. Sustainability consists of three important pillars—economic, social, and environmental.

Next, a section, which provides a review of the literature followed by a more detailed analysis of the research findings that includes a discussion regarding the reasons for the contradictory findings. This is followed by a proposed research model that could provide additional insight into the relationship between sustainability, triple bottom line, and the firm performance approach.

Finally, summary and conclusions are presented.

2. Literature Review

The literature review shows two aspects: positive and negative influence from sustainability on firm performance and the triple bottom line. Perhaps the biggest challenge firms face in engaging in sustainability programs is to simultaneously integrate all three pillars—economic, social and environmental [13,14]. Because of sometimes conflicting objectives of the pillars, it can be difficult to balance them [15]. For example, White [16] found that it is not easy to balance the pillars because they are not always treated equally. Lehtonen [15] reports that the social aspect has been the least addressed. Brent and Labuschagne [17] and Hummel and Schlick [18] research indicated that more attention is given to the economic and the environmental pillars of sustainability. However, in addition to environmental information, more firms are now disclosing social, ethical and financial information [19]. In 2013, KPMG surveyed 4100 firms from 41 countries, and 71% of the surveyed firms reported that they disclose sustainability information [20] (p. 82).

The next section will present studies that have found a positive relationship between sustainability and firm performance, followed by a discussion of those which have found a negative relationship between sustainability and firm performance; reasons why firms invest in sustainability even though it is a loss-bearing activity are also presented. Studies that find no relationship between sustainability and firm performance will be presented. Following this section, a discussion pursues how the throughput model can be used to implement both financial and non-financial intangible assets in evaluating the relationship between sustainability and firm performance as well as the triple bottom line (as captured in perception (P) and information (I)).

2.1. Positive Relationship between Sustainability and Firm Performance

In a research study concerning the factors that influence firms to invest in sustainability for DJSI (Dow Jones Sustainability Index) and non-DJSI firms, it reported that profitability was positively related to sustainability performance. That is, firms with high profit are the ones that invest more in sustainability activities than firms that have low profitability. They also found that large firms invest more in sustainability than do smaller sized firms [21]. Another study also found a positive relationship between sustainability and firm economic performance, moderated by advertising. Sustainability effects are higher on Tobin's Q (ratio of market value to the replacement cost) for firms with high advertising intensity, followed by medium advertising intensity and then low advertising intensity. Firms that have better sustainability practices have higher profits, and there is reciprocal relationship: the better the profitability, the higher the sustainability practiced by the company [22]. A causal relationship exists between economic performance and sustainability in both the short term and long term for all low and high firms [23].

Several other studies reported that environmental efforts such as controlling pollution, saving energy and decreasing waste by-products, reducing soil contamination, reducing toxic input, reducing landscape damage, and reducing severe accidents have a positive impact on firms' economic performance [24–26]. Wagner and Schaltegger [26] surveyed 135 UK and 166 German firms and found that the firms that pursue shareholder value-oriented corporate environmental strategies have significant positive impacts on the relationship between environmental and economic performance.

Firms engaged in corporate social responsibility (CSR) also have good financial performance, and there is a positive relationship between the two [18,27–29]. García-Benau et al. [30] found that economic crisis impacts a firms' corporate social responsibility and there was an increase in the reporting of corporate social responsibility during the financial crisis. Furthermore, they found that changes made by companies on their corporate social responsibility reporting have a positive effect on their profitability. Firms that discontinued issuing the reports during the financial crisis experienced a decrease in profitability. They also found there are no differences on those assured reports and those not assured on the firm profitability and market value.

Corporate social activities and business activities complement each other and are compatible and, thus, should be embedded in business strategy [31]. As stated by O'Dwyer [32] "An organization's

social and business role should not be seen as being conflict. They are complementary rather than incompatible". Further, O'Dwyer [32] found that CSR complemented economic self-interest, rather than reducing it. Ballou et al. [33] surveyed 178 corporate social responsibility officers and found that the majority of their initiatives are focused on the environment, and less on human resources devoted to sustainability. However, the respondents argue that as long as sustainability is embedded in business strategy, then there is no need to assign human resources to sustainability. However, they found that only 11.2% of the businesses had embedded sustainability to firm strategy. Most of the respondents (72%) are of the opinion that sustainability initiatives should come from the board of directors if the board views CSR as being important. Therefore, firms should embed corporate social responsibility in their business strategy. Porter and Kramer [34] emphasize that existing sustainability approaches are not connected to business strategy where a firm can get many opportunities from interacting with the community. They argue that if businesses consider it as part of the core business activities then they will see it as not just a cost or charity but as a way of obtaining a competitive advantage, an opportunity for innovation, and many other benefits.

Sustainability efforts also have been reported to improve a firm's market value because investors value sustainability reports [35]. High quality reporting—reporting that includes sustainability information—is valued more than reports lacking such information [36]. Berthelot, et al. [37] found that, in Canada, investors positively valued companies that issued sustainability reports. They also found that the adjusted R-square for market capitalisation increased for the firms that issue sustainability reports, which led them to conclude that investors were willing to pay more for the firms that issued sustainability reports. Investors believed it helped the firms' reputations and increased revenues while reducing costs. Investors rated firms that pursued sustainability and reported on it more highly, increasing that firm's market value [38,39]. Shane and Spicer [40] found that when a large firm pollutes more, its market value lowers; this adds to the evidence that large firms with better pollution control have greater profitability, greater market value, and lower perceived risk [41]. When Dowell et al. [42] investigated the impact of strict environmental standards on MNEs market value, they found that those companies following stringent environmental standards have higher market value than those that do not. Firms have recently begun providing better environmental information because investors demand it and because of ethical concerns for social responsibility with regard to the environment. Firms that want to gain long-term advantage are considering sustainability as part of their core strategy [43,44].

Sustainability also was found to have a positive correlation with firm performance because it helps to enhance a firm's reputation and brand image. Some authors have emphasized the public relations benefits associated with sustainability [45,46]. One such benefit is the ability to offset damage to a firm's reputation that might occur subsequent to adverse environmental impacts from its operating activities [47]. Most large firms consider environmental issues because they gain economically by enhancing their reputations, increasing their sales volumes and reducing their risk [48]. Irish firms disclose social responsibility issues in order to build brand image and as a symbolic act to show citizens that companies care for society as a whole [32]. Velde et al. [49] found that organizations with high performance in corporate governance, including CSR, have better human resources policies and good relationships with customers and suppliers. The results of these studies demonstrated that attending to sustainability helps to build corporate image and reputation.

Studies also have reported that sustainability helps to reduce information asymmetry. As argued by Greenwald and Stiglitz [50], information asymmetry between firms' internal managers and outside stakeholders (such as investors) has changed how firms spend capital acquired from investors. Moreover, they argue that information asymmetry between firms and employees has changed the firms' traditional view of employing people at constant wages, reducing risk. O'Dwyer [32] observed that issuing sustainability reports educates citizens about business efforts to improve sustainability, reduces information asymmetry, mitigates fear from media and pressure groups and promotes the image of caring for the environment. Including environmental information in reports helps investors' judge

firm performance and reduces their risk. In UK and German firms, Wagner and Schaltegger [26] found a significant relationship between offering environmental information and competitive dimensions (market, internal, profitability and risk). In their research on Canadian firms, Cormier et al. [51] found that social and environmental information disclosed by firms reduces information asymmetry and facilitates investment decisions. Orlitzky and Benjamin [52] found that firms' financial risks and CSR performance are negatively related, that is, companies that engage more in CSR issues have low financial risks compared to those companies that do not employ CSR practices. The literature indicates that most companies that disclose environmental issues reduce information asymmetry and investment costs, promoting future returns [53,54].

In a meta-analysis of 52 studies from 1975 to 2011, Albertini [55] found that there was a positive relationship between environmental performance and financial performance. However, the relation is stronger for the accounting-based measures than for the market-based measures. The author also found that non-longitudinal studies reported a stronger relationship between environment performance and financial performance than did longitudinal data.

Studies also have reported that firms that invest in sustainable operations experience a reduction in long-term production costs [32,46,56]. Perrini and Vurro [57] found that Novartis had 70 units of waste for each production of 30 units in 1979. However, in 2000, the company was able to produce 70 units with only 25 units of waste. This was due to the company's effort to reduce environmental pollution. In addition, sustainability contributes to the reduction of energy costs, reduces compliance costs, and absorbs costs related to complying with or pre-empting legislation [58]. In addition, corporate social responsibility helps to reduce the cost of capital. Dhaliwal et al. [59] surveyed 213 US companies and reported that the prior year cost of equity capital is associated with the initiation of firm corporate social responsibilities disclosure in the current period. Firms that have a large cost of equity capital in last period are more likely to start disclosing a corporate social responsibilities report in the current period. Furthermore, the firms that have high social performance tend to have a lower cost of equity capital, and more institutional investors and financial analysts. The authors found that firms are experiencing a reduction in cost of equity capital, which leads to an increase in equity capital and in large amount, have seasonal equity offering when they start to disclose corporate social responsibilities than those who did not and do not have a high level of performance in social responsibilities. They conclude that firms that publish separate reports on corporate social responsibility or have a better than expected social performance will experience a higher reduction in cost of equity capital than those who do not.

Finally, studies have reported that the benefit of investing in sustainability activities exceeds the cost incurred. Barnett [60] is of the opinion that CSR improves firm trust and enhances stakeholder relationships and, thus, helps to reduce costs and increase firm financial performance. Porter and Van der Linde [61] are of the opinion that environmental issues might help firms to lower their costs and improve their economic performance.

In addition to the positive relationship between sustainability and firm performance, some research has shown a causal relationship between sustainability and firm performance as well as from firm performance to sustainability. Some research argues that there should be slack resources so that a firm can use them in sustainability activities [62–64]; (as previously stated, slack resources theory states that a firm should have surplus resources so that it will be able to invest in activities apart from core business activities). Furthermore, the previous period firm financial performance will lead to the next period involvement in sustainability activities. If the previous financial performance was good it means that there will be surplus funds that a firm can use in implementing sustainability issues, otherwise if the financial performance was not good the firm will not consider implementing sustainability issues. Some researchers have found that a firm's financial performance will lead to higher sustainability performance. For example, research by Rodgers et al. [28] reported that the lag market value of a firm performance has a significant positive impact on current corporate social responsibility. Chang and Kuo [23] surveyed 311 firms and found there is a positive reciprocal relationship between financial performance and sustainability, the higher the firm performance the

better the sustainability practices and vice versa. Also, Orlitzky et al. [27] in their meta-analysis study found that corporate social responsibility performance and financial performance have a positive, bidirectional relationship. Moreover, they found a higher correlation with accounting measures than with market value. Clarkson et al. [65] in their research on those firms that pollute more than most firms (Pulp and Paper, Oil and Gas, Chemical, Metals and Mining industries), found that there is positive relationship between financial performance and environmental performance. They also found that an increase in a firm's financial performance in the previous period leads to an increase in its environmental performance the next period. Finally, they found that improved environmental performance in the previous period leads to an increase in financial performance in later periods.

2.2. Negative Relationship between Sustainability and Firm Performance

Some researchers [32,60,66–71] have argued that there is a negative relationship between sustainability (social and environmental) and firm performance. Negative impacts occur because sustainability activities incur additional costs not directly conducive to profitability [66,72]. Activities like charitable donations, sponsorship of local community institutions and development, improving the workforce (by sponsoring further study or training, bettering working conditions, and improving employee benefits, for example) all incur additional costs that are deemed unnecessary and which redistribute profits outside the company [60]. "Devoting corporate resources to social welfare is tantamount to an involuntary redistribution of wealth, from shareholders, as rightful owners of the corporation, to others in society who have no rightful claim" [60]. Moreover, from a cost-benefit point of view, the costs of investing in environmental activities are unnecessarily high, as environmental issues incur more costs than benefits [67]. O'Dwyer [32] found that company managers argued that engaging in environmental issues helped to some extent to save money initially, but beyond the initial savings there was zero payback. One respondent said: "At one level environmental issues are very positive, there is money to be saved... beyond that it gets quite difficult where there are nil pay backs if you want to call them that" [73]. Reporting environmental information reduces earnings and market value while increasing costs, and those costs are believed to be a result of actions by the markets, government rules, and other external pressures that do not entail future improvements [74]. For example, Moneva and Cuellar [71] sampled 44 firms in Spain from 1996–2004 and found that environmental information is not valued by investors in their investment decision and is considered to be irrelevant information in decision making—"environmental costs are seen by the market as end-of-pipe actions and not for future improvements". Finally, sustainability affects a firm's competitive position as social and environmental activities increase costs [60].

Other researchers have argued that using company resources to control pollution and including environmental information in reports are non-income-generating activities that intrinsically undermine financial performance [68]. Jensen [69] found that by focusing on stakeholders rather than shareholders, managers become confused as to the clear objective of the firm. Companies embracing stakeholder theory will experience managerial confusion, conflict, inefficiency and perhaps even competitive failure. Moreover, some researchers have concluded that investing in social activities is detrimental to the fundamental precept of increasing firm value [69]. If the objectives of shareholders and stakeholders are opposed, prior research has found that this will result in a negative relationship between firm performance and social responsibility [75,76].

Finally, researchers also have found that investors and other stakeholders do not take into account sustainability issues in making investment decisions. Some have argued that investors, being preoccupied with financial information, do not consider sustainability in making investment decisions; they regard non-financial information as irrelevant and insignificant in investment decisions [71]. Stockbrokers, auditors and financial analysts are not interested in CSR reporting. Auditors disregard environmental information in making decisions, focusing only on traditional accounting information such as financial statements [70]. Rodgers and Housel also find that auditors can be aware of environmental risk information but not use it in the final decision. They argue that auditors don't

have the training to use environmental information in making decisions. “Auditors’ perception of environmental risk information is downplayed compare to the traditional accounting information during their judgment and decision choice phase... auditors tend to place more reliance on the financial rather than environmental risk information” [70]. Additionally, a large volume of environmental information about companies can cloud investment decisions and make it more difficult to make a decision about a firm [77]. O’Dwyer [32] found that in Irish companies, managers see investments in sustainability as irrelevant and confusing to disclose in CSR reports, as managers do not see the need to practice CSR and do not see it as the firm’s objective. Moreover, no truly significant differences exist between firms that “invest” in social responsibility and those that operate in traditional ways in terms of financial performance [78,79].

2.3. Reasons for Continuing to Implement Sustainability as a Loss Bearing Activity

We now turn our attention to those studies that have found reasons why firms may continue to implement sustainability even if it is a loss-bearing activity. First, pressure from stakeholders, regulations, and ethical considerations can drive firms to continue these efforts [32,80]. Manetti [81] and McWilliams and Siegel [82] argue that stakeholders *expect* companies to issue sustainability reports or social responsibility reports. For example, Artiach et al. [21] reported that firms invest in sustainability because stakeholders pressure them to do so. As argued by O’Dwyer [32], in Ireland there is extreme pressure from media, community and society to issue sustainability reports, and those managers were pressured to report mainly because of these groups. The author also found that companies disclose sustainability reports to protect their business from harmful criticism on environmental damage that resulted from their operating activities. The respondents said that due to extreme pressure they did not have the option to think about social responsibility broadly; they did whatever analysts and other pressure groups wanted. Moreover, participants clarified that they did what they were asked to do in fear of losing their jobs, as their employers were watching. The focus on environmental activities is also a result of increased pressure from investors to disclose environmental information [83,84].

Second, political and governmental (i.e., legislative) factors have an impact. Increasing regulation has required compulsory reporting on firms’ environmental performance [85]. In Britain, where any restriction of corporate freedom is generally avoided by the political class, the then-Prime Minister Tony Blair said: “I am issuing a challenge today to all of the top 350 companies to publish annual environmental reports by the end of 2001” [86]. In addition to government encouragement to report on sustainability (especially regarding environmental issues), reporting is sometimes mandated due to difficulties investors face in comparing firms in making investment decisions [87]. Voluntary disclosure is usually of a qualitative manner [88,89] and includes only positive performance [90,91]. The main advantage associated with compulsory reporting are: (1) it promotes uniformity across companies in disclosing environmental information [84], (2) it decreases information asymmetry which reduces information costs [20], and (3) it improves sustainability [87]. O’Dwyer [32] found that the nature of a business may force companies to be involved in social responsibility. For example, exploration/extractive industries have well-known harmful effects on the environment, public opposition to which can sometimes be ameliorated by CSR and sustainability information.

Third, sustainability initiatives are sometimes perceived as a business obligation to their local communities O’Dwyer [32]. Pre-emptive reporting initiatives by firms allow them to control information and relieve legislators of any need to intervene in such areas. This results in long-term cost efficiencies when there is a push for CSR reporting. Solomon and Lewis [86] added that external pressure, market drivers, societal, political and regulatory drivers, ethics and accountability are all reasons to issue sustainability reports. Organization size and profitability level also play a role in increasing sustainability reports [92].

2.4. No Relationship between Sustainability and Firm Performance

While some authors found a positive relationship others a negative one between sustainability and firm performance, some research suggested that there is no relationship [93], while others say there is insufficient evidence to support any direct relationship [66,82]. Cormier and Magnan [39], found an insignificant relationship between environment information disclosure and firm market value for firms in Canada and France. Ullmann [62] argues that no clear picture can be identified in the relationship between social disclosure, social performance and economic performance. The author found that the studies that focus on the relationship show inconclusive results no clear image they are confusing as same sample different findings by different authors.

2.5. Reasons for Not Practicing Sustainability

Companies that do not practice sustainability can have several reasons. Firstly, companies fail to report in the absence of external pressure. For example, Stubbs et al. [94] found that in Australia, companies do not practice sustainability because they lack external stakeholder pressure, and because of the prevailing, traditional belief that the primary objective of firms is to increase shareholders' wealth. They also found that large firms practice sustainability only to meet the provisos for being listed in the Dow Jones Sustainability Index.

Second, Stubbs et al. [94] found that it is expensive for small firms to engage in sustainability practices. Small firms view it as costly window dressing beyond their resources. The authors also found that many respondents believed that the costs of sustainability outweigh its benefits; they believe it increases risks as an inefficient use of firm resources. Although many managers expressed that it was essentially good to issue sustainability reports, it was unnecessary due to the lack of external pressure. So, they say, it is up to the senior management and directors to decide whether to implement or not, in view of organizational culture and structure. The authors concluded that serious sustainability practices were undertaken by companies only when compelled to do so by legal requirement. Even when there is a political agenda (for example when the UK Prime Minister Blair said that all top 350 companies have to issue environment reports each year starting 2001) related to reporting, procedures and processes are often vague [95].

Third, some managers and executives do not view sustainability as a business obligation. O'Dwyer [32] found that in Irish companies, some managers stressed that it is not the responsibility of the companies to help the community. The respondents said that they focus on only the activities that help them increase shareholder wealth and claimed as well that the CSR concept is complicated and difficult to implement. Stubbs et al. [94] found that managers still hold the traditional view that business and management should prioritize the interests of shareholders and not focus on corporate social responsibilities. Sustainability information can increase risks as markets become informed on the issues. Moreover, the costs are more than benefits of sustainability. When sustainability reporting is not a mandatory, it is seen having no benefit; as it's not an obligation, resources are not considered slack enough to promote sustainability. Finally, firms' cultures do not support sustainability, and changing the cultures requires yet more resources. Some respondents argue that large firms issue sustainability reports just to be listed in DJSI.

2.6. Summary for Sustainability Research

Finally, as most previous studies have suggested (e.g., Cupertino et al. [96]; Masocha [97]; Xue et al. [98]) the sustainability issues such as environmental, social, and governance standards, may enhance an organization's innovation and long-term growth with a positive effect on its long-term value. The next section adds to this literature by incorporating a model (i.e., throughput model) that examines sustainability issues via a process apparatus as opposed to a black box. That is, much can be learnt from previous studies when capturing sustainability issues from an embodying process model,

which can undergird individuals and organizations' perceptual stage, information uses, judgmental stage, and decision choice. The next section presents this model.

3. The Throughput Model

Individuals' and organizations' daily decision-making processes that shape activities involve different algorithmic pathways among four different factors: "perception (P)", "information (I)", "judgment (J)" and "decision choice (D)" (Figure 1). In addition, a major contribution in Figure 1 depicts a coherence between perception and information (i.e., $I \leftrightarrow P$), which denotes triple bottom line components of economic, social, and environmental concepts. In other words, the interplay between perception and information can influence the six algorithm pathways as they pertain to corporate social responsibility features that are good for society and organisations. The Throughput Model (TM) encapsulates six distinctive algorithmic strategies that construct and formulate individuals/organizations' assessments in making a decision (Rodgers [99,100]). TM was previously used to investigate the different lending issues assessed by commercial loan officers (Rodgers [101]). Moreover, other studies have implemented the TM in business ethics (Rodgers and Gago [102]) and auditing (Rodgers et al. [103]; Rodgers and Al Fayi [2]), organizational behavior (Foss and Rodgers [104]), sexual harassment (Culbertson and Rodgers [105]) and tax compliance (O'Shaughnessy [106]). Moreover, Ishaque [107] indicated how the Throughput Model is useful when integrated with social cognitive theory. That is, the Throughput Model provides a novel perspective for investigating decision-making behaviour in situations involving the conflict of interests. In addition, Rodgers and Al Fayi [2] utilized the Throughput Model in order to provide an explanation of complex situations of internal audit reporting line in reality. The findings highlight that individuals' different perceptions and judgments, as well as information signals can lead to different reporting lines (decision choices).

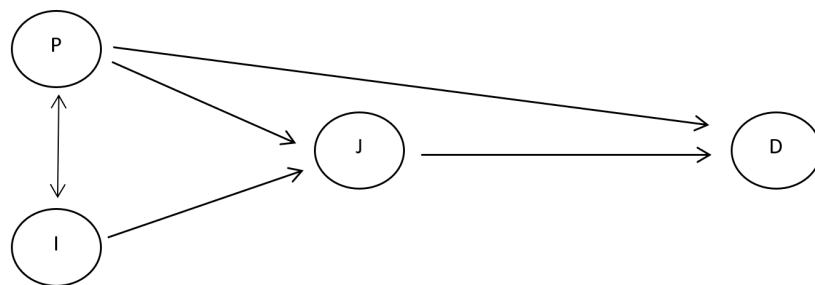


Figure 1. The Throughput Model.

The advantages of the TM are that it provides a structure of different factors impacting individuals' decision-making (Rodgers [99]; Rodgers et al. [103]). Further, TM encapsulates algorithms "deep learning", which is a technology that strives to imitate the human brain. Moreover, the importance of this model is that it conceptualizes how individuals/organizations implement different algorithmic pathways, which represent the interactions among the aforementioned four factors, and then ultimately reaches a final decision choice [108]). The four factors that control the individual's cognitive processes are linked by six conceptual algorithmic pathways, which are used in the decision-making process and based on individuals' reasoning mode. Taking into account the differences among individuals' backgrounds and experiences, some of these algorithmic pathways may be habitually used in decision-making. The usage of the TM in a sustainability context may advance our understanding of the impact of different algorithmic pathways that, in turn, may improve overall decision-making [103]. In order to appreciate the different algorithmic pathways among the four factors of the TM, it is central to introduce those four factors and then the supporting algorithmic pathways. Possible weaknesses are that the model needs more testing in the future.

The TM has different algorithmic pathways that emphasize different factors such as time pressure, availability of information and level of knowledge. In each decision-making situation, individuals have all four factors available to choose from. Individuals will evaluate the different factors and implement a suitable pathway. As a result, six different algorithmic pathways are linked to the four factors of the TM (Figure 2).

These algorithmic pathways are the following (Rodgers [100]; Rodgers and McFarlin [109]), where “perception (P)”, “information (I)”, “judgment (J)” and “decision choice (D)”:

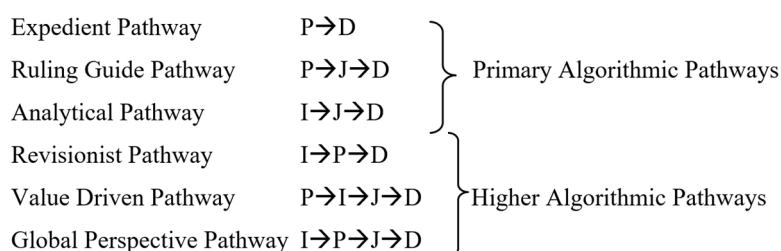


Figure 2. Algorithmic Pathways for Throughput Model.

The model supporting the six algorithmic pathways emerge with individuals’ perception regarding issues engaged in decision-making. Perception represents the categorization and classification of information, which involves framing. This frame explains how individuals view the issues based on their previous experience, training and education. Moreover, this also includes interpretation of the problem by which the process is influence and the decision made. This type of framing requires a level of knowledge in order to give guidance in viewing, rejecting, or accepting the information available [107].

The information factor of the TM includes the available information for individuals to use in making a decision. Such information is collected via individuals’ different modes of processing (e.g., senses), which will assist in the formulation of their judgment process, as well as selection between the different algorithmic pathways within the TM [3]. Additionally, information can be evaluated for its reliability and relevance to the current situation. The reliability of information is based on the source it is coming from as a known and a dependable source. Information relevance indicates that it is available at the right time and is sufficient for its intended purpose. After estimation, the decision maker can consider relevant and reliable information. This information may influence the previously framed perception, especially when it conflicts with perception, or when no perception is available [110]. Moreover, the information and the perception may be interdependent. That is, information available for the decision maker influences the framing made by perception. In the same light, the pre-established perception (frame) affects the type of information collected [31].

Judgment refers to the action of the analyzing and weighting of factors, based on the available information and perception, in order for a decision maker to compare and select among alternatives (Rodgers [101]). Normally, the process of judgment is a compensatory method, a technique used to handle conflict of interest by supporting one prospect over others during the process of selection. A non-compensatory method is a conflict-avoiding technique, which may save time in order to reach a decision while evaluating one’s perception and the information (if available).

The last aspect in the TM is decision choice. In this mode, the decision makers select the best alternative. That is, the decision makers seek to ensure that the decision made is the most satisfactory decision available. The decision makers would evaluate the divergent or distinct relationship connections before making a decision choice [103].

The first algorithmic pathway is the “expedient” pathway, $P \rightarrow D$ (perception \rightarrow decision choice). This pathway relies heavily on the level of individuals’ knowledge and experience in making a decision choice. Decision makers rely on their years of experience within an organization and/or their level of education and qualifications achieved. Moreover, decision makers might be under time pressure

to consider other options available, or the information may not be complete, or is irrelevant to a decision choice.

The second algorithmic pathway is the “ruling” guide, $P \rightarrow J \rightarrow D$ (perception \rightarrow judgment \rightarrow decision choice). This pathway is used when information is absent or insignificant to the current situation. Further, this pathway implies that procedure or rule takes precedence over information sources. Therefore, an individual is guided by rules (perception) that shape his/her decision (Rodgers et al. [111]).

The third pathway is the “analytical” pathway, $I \rightarrow J \rightarrow D$ (information \rightarrow judgment \rightarrow decision choice). This pathway does not consider the individuals’ perception during the process of decision-making. Instead, in this particular pathway, the decision maker weighs all factors and identifies all the alternatives available [112]. In this pathway, the goal influences the types and weights of information to be implemented in an inquiry or investigation. Hence, the objective of what is to be achieved drives the selection and weighting of the information. For example, when a trusted member of an organization advises on new areas, a decision maker may perceive the advice—influenced by source reliability—as fact. In this situation, decision makers have no previous knowledge or experience regarding the existing situation and may judge the information as a reliable source without any impact on their perception, thereby implementing the $I \rightarrow J \rightarrow D$ pathway to make a decision.

The fourth pathway is the “revisionist” pathway, $I \rightarrow P \rightarrow D$ (information \rightarrow perception \rightarrow decision choice), whereby a decision maker has some time to review the available information but may not have enough time to make a further assessment. Nevertheless, in some situations, available information and perception may be sufficient to draw a conclusion for the current situation, if the decision maker has a level of expertise within the firm, or has a high educational level (Rodgers [100]).

The fifth pathway is the “value-driven” pathway, $P \rightarrow I \rightarrow J \rightarrow D$ (perception \rightarrow information \rightarrow judgment \rightarrow decision choice). In this pathway, a person’s perception influences the information and its type. That is, framing (perception) of the situation influences their analytical processes ($I \rightarrow J \rightarrow D$). Therefore, decision makers’ refinement of their experiences, education, and training may override or influence their analytical processes. In other words, the decision maker may search for information that is in accordance with the perception developed that, in turn, would impact both the judgment and final decision process.

The sixth and final pathway is the “global perspective” pathway, $I \rightarrow P \rightarrow J \rightarrow D$ (information \rightarrow perception \rightarrow judgment \rightarrow decision choice), in which the decision maker’s perception is subjective by the information available before an evaluation analysis in route to making a decision choice. In this pathway, informational sources influence a non-consequential ruling guide process ($P \rightarrow J \rightarrow D$). In other words, decision makers may replace a standard procedure or rule base process, if information sources are very compelling for changing a “ruling guide process.” In this situation, the information available to the decision maker either would positively or negatively influence the frame (perception) about the current situation [109].

The throughput model provides six foremost elements that are essential for capital market stability, efficiency and growth [110]:

1. Invest need for information (financial and intangible assets).
2. The roles of the various stakeholders are associated and supported with an effective communication link [103].
3. The assessing sustainability role can provide a constructive link to stakeholders [2].
4. The model is formatted in stages to deliver relevant and reliable information for sustainability related intangible assets [113].
5. Sustainability information is reported separately pursuant to reporting requirements [28,70].

Finally, the throughput model allows for a platform for sustainability reporting that rests on six dominant algorithmic pathways that underlie decision-making processes, which are consistent with the aforementioned six foremost elements. Moreover, sustainability reporting frameworks can

provide a wider context for joining priorities rather than viewing them as competing objectives. In sum, the Throughput Model enables individuals and organizations to view the sustainability issue from the perspective of a more holistic conceptual paradigm by analyzing six dominant algorithmic pathways [110].

4. Discussion of Findings

As can be seen from the preceding, contradictory findings have demonstrated why firms' management decision making about whether to implement sustainability generally remains problematic. Contradictory results could be due to methodological issues (the indicators used to measure the sustainability and financial performance of the firms), as each researcher may believe a certain indicator is more reliable than another. As argued by Barnett [60] and Pava and Krausz [114], methodology plays a crucial role, as different methods can result in totally different findings regarding the same research phenomena. Ullmann [62] argue that the inconsistent results on the relationship in US companies are due to incongruent theories, wrong or inappropriate definitions, or a lack of data. Results might also be due to differing methods, indicators used to measure, models used in the studies and the period of study undertaken.

The relationship between sustainability and firm performance might be explained by a firms' ability to differentiate their products and services from their competitors'. As argued by Hull and Rothenberg [115], such differentiation might depend on innovation and advertising. Precisely how a firm understands corporate social activities also affects the relationship. Porter and Kramer [34] emphasize that the strategy used by the business might influence the results of the relationship. They argue that existing sustainability approaches are not connected to business strategy, through which firm can get many opportunities from the community. They argue that if businesses consider it as part of the core business activities, they will see it is not just a cost; CSR is a way of gaining competitive advantage, opportunity innovation that will enhance firm economic performance. They argue that a business that considers CSR only as a means to lessen public pressure will implement only short-term measures that will ultimately be without benefit to the business. However, if a business considers CSR in its strategic plan, it will bring a lot of benefits to the firm.

The size of the firm and its growth rate are another factor [21]. Larger firms can generally afford to invest more in sustainability, having inherently more resources and ability to achieve more in economies of scale. Investment in sustainability represents a risky, relatively new and substantial allocation of resources for small firms. Furthermore, high-growth companies implement more sustainability practices, as they have already incurred the sunk costs in their production activities compared to low-growth firms. Several others argue that firm size [88], sector [116,117], and degree of internationalization [87,95] have positive relationships with sustainability practices, while Vormeda & Ruud [95] disagree with size and sector, due to their opposite findings.

The fundamental shortcoming of the existing body of literature on sustainability for firms is their failure to consider non-financial performance (i.e., intangible assets). According to IAS 38, *intangible assets* are non-monetary assets with no physical substance and can be identified (either being separable or arising from contractual or legal rights). Most previous research, however, has not considered the impact of a firm's development of intangible assets and their relationship to sustainability. For example, Goyal et al. [118], found that research conducted from 1992–2011 on the relationship between sustainability and firm performance considered only financial performance as firm performance. They concluded that future research should also consider non-financial intangible assets performance in assessing sustainability and firm performance. Also, as suggested for future research by Poolthong and Mandhachitara [119], firms that invest in CSR issues need to know the financial and non-financial intangible assets return on those investments. This exclusive focus on traditional financial information reflects a shortcoming in academic business literature, which in this regard lags behind practice. As explained at the outset of this paper, sustainability represents a sea change in business operations away from the raw financial performance considerations of the 1970s and 1980s, yet most academic

literature concerning sustainability in business has continued to consider sustainability only in terms of its impacts on financial performance.

The intangible assets not captured by the traditional method are sometimes called “the knowledge base” or “intellectual capital.” Many authors tried to define intellectual capital but could not reach consensus on a specific definition. Edvinsson and Sullivan [120] defined intellectual capital as “knowledge that can be converted to value.” Edvinsson [121] considered it to be “the possession of knowledge, applied experience, organizational technology, customer relationship and professional skills that provides competitive edge in the market”. Brooking [122] considered it “the combination of all intangible assets which enable the company to function”. The literature shows that firms’ market value is the summation of both financial and non-financial intangible assets; however the researchers on sustainability did not consider companies’ non-financial intangible aspects.

Previous studies have implemented many ways to measure intangible assets, for example: balanced scorecard [123]; Scandia Navigator [124]; and intangible assets monitor [125]. Balanced scorecard [123] is a framework that tries to link tangible and intangible assets in creating business value. It does not value the intangible assets in terms of currency, but in units. It comprises four perspectives: financial, customer, internal business processes, and learning and growth.

Scandia Navigator [124] views intellectual capital as the summation of human capital and structural capital. Structural capital consists of customer capital, organization capital, innovation capital and process capital.

Sveiby [125] developed an Intangible Assets Monitor. Intangible assets are classified into individual competence, internal structure and external structure. Individual competence is the ability of people including education, skills, experience and knowledge. People are the most important part of intellectual capital as all other parts of business (either tangible or intangible) depend on people’s actions. Internal structure is the organization’s systems, culture, models, administration, databases, etc. owned and controlled by the firms. External structure is the relationship between organization and its customers and suppliers.

However, the above-mentioned frameworks have a major limitation: they cannot specify metrics to measure intangible assets. Fortunately, the EU CSR Alliance Laboratory Model was developed to measure the non-financial performance/intangibles by indicating the ESG (Environmental, Social and Governance) factors that impact those non-financial drivers [126].

5. Suggested Research Methodology Improvement

Traditionally, tangible assets comprised the major determinants of firm value; non-financial intangible assets carried slight value, and were difficult to measure and assay [127]. However, as the world shifts from the industrial age to the information age, the value of firms’ tangible assets have *decreased* and that of their non-financial intangible assets correspondingly *increased*. Thus, traditional financial statement information is no longer the sole determinant of firm value as there can be a big difference between book value and market value as well as focusing on financial performance alone represents a preoccupation with tangible assets and liabilities [112]. As Lev [128] in Volkov and Garanina [129] (demonstrated, in 2000 the financial, tangible assets of the Microsoft Corporation represented less than 10% of the company’s market value. Ballou et al. [130] also observed that the value of non-financial intangible assets increased from 20% in the 1980s to 45% in the 1990s, rising to 75% by the 2000s. Lev and Daum [131] added that for S&P 500 companies, the value of non-financial intangible assets reversed over the ten-year period from 1982 to 1992 from 38% to 68% of firms’ market value, whereas book value fell from 68% to 38% during the same period. Currently up to 90% of a firms’ value, especially for service firms, is in intangible assets.

As non-financial intangible assets become a more important component of firms, especially for service firms, they should be considered when doing research on sustainability. It seems most researchers failed to consider the non-financial performance that has become a big part of firms’ value, and instead remain enmeshed in a pre-1990s fixation with financial performance. Therefore, in order

to test the impact of investing in sustainability, both financial and non-financial intangible assets performance must be tested at the same time and in the long run as argued by Goyal, et al. [117].

The research concludes that the assertion of Goyal et al. [117] that both financial and non-financial return should be considered when assessing the return of sustainability issues is correct. As the previous literature looked only on the return of firms' financial performance, we'll now look on the return of sustainability on firm performance when both financial and non-financial intangible assets are measured. In order to do this, the throughput model by Rodgers [105] is used.

6. Throughput Model used as a Framework for Sustainability Studies

The throughput model developed by Rodgers [99] can be used to employ both financial and non-financial intangible assets in evaluating the relationship between sustainability and firm performance (see Figure 1). This model includes six pathways, as described in what follows. In the throughput model, "P" stands for *perception*, which means how people view a problem according to their personal knowledge, belief or thinking about a certain issue. "I" stands for *information*, which refers to the existing, available information that can be used in decision-making. "J" stands for *judgment*, which refers to how people rank or order the available options from information provided and their perception. The process culminates in a final decision (D).

The first pathway is the analytical pathway: I→J→D: here decisions are made from information available, then ranked by which is best, and finally a decision made. People use this pathway due to limited knowledge or experience regarding the issue since the information available to them guides them to select the appropriate best decision. One example might be comparing the information available from financial reports for different firms in the same industry. Investors use that information to judge and compare companies, then reach an investment decision.

Artiach et al. [21] have used a similar model to account for decision makers' use of available information from financial statements to judge the DJSI and Non DJSI in reaching the decision for or against investment in sustainability activities. It follows that this is like the analytical pathway in the throughput model because they use available information and then rank it to judge the DJSI and non-DJSI in sustainability investment decisions. Another example is research by Wagner [25]. This study seemed to follow the analytical pathway because the researcher used the information from annual reports and judgments about firms that use pollution control, and those that do not use such systems, to reach the final decision on the relationship between the environmental and economic performance. Furthermore, the research by García-Benau et al. [30] appeared to follow the analytical pathway because their decision makers used the financial information available to judge and compare CSR and assurance strategies during the financial crisis. The study concluded that CSR reports and assurance increased during financial crisis. A study by Clarkson et al. [65] examined a similar approach to the analytical pathway, because they used the financial reports information and judged them, by comparing the proactive environmental strategies to reach a conclusion on the relationship between environmental strategy and financial performance.

A study by Wagner and Schaltegger [26] found, when using an approach similar to the analytical pathway that decision makers used the information available and judged it by comparing the firms with environmental shareholders value strategy to those that did not reach a final conclusion based on the relationship between the economic and environmental performance of the test firms. Also, Moneva and Cuellar [71] found, using an approach similar to the analytical pathway approach, that investors judged and compared financial and non-financial environmental issues to reach a final decision based on non-financial environmental information. A study by Velde et al. [49], used a similar approach and found that decision makers used financial information to judge and compare on both high and low sustainability portfolios and reached a decision based on the positive relation between financial performance and a high sustainability portfolio.

Many others (e.g., Chang and Kuo [23]; Dowell et al. [42]; Richardson and Welker [38]; Vormedal and Ruud [95]) appear to follow the analytical pathway because they used available information to rank, compare and judge investment options before reaching a final decision.

The second pathway is the expedient pathway: $P \rightarrow D$: here decisions are made straight from perception, without considering any other factors. In these cases, people have some knowledge/belief and see that available information is irrelevant or unreliable. This pathway is always used for quick decisions under tight time constraints. For example, a certain investor already knows from his/her experience that social activities help a firm to perform better, therefore these investors will work from their knowledge to make the investment decision.

A study by O'Dwyer [32] seemed to follow the expedient pathway when he found that managers' perceptions led directly to decisions on whether to disclose the CSR reports. The results demonstrated that the decision makers followed the expedient pathway from perception directly to decision. Stubbs et al. [94] found, using a similar approach to the expedient pathway, that managers' perceptions led them directly to reach a decision on whether to issue sustainability reports or not. Also, following a similar approach, Solomon and Lewis [86], discovered that decision makers' perception of corporate environmental disclosure for preparers and users, leading directly to a decision, resulted in different incentives and disincentives for preparers and users.

The third pathway is the ruling guide pathway: $P \rightarrow J \rightarrow D$: here decisions are made from perception, then ranked or ordered, and the final decision is made. In these cases, information is unavailable or believed unnecessary or inadequate, so people judge based on their knowledge, experience or belief. For example, Poolthong and Mandhachitara [118] appeared to follow this pathway when they found that customers' perception on CSR, in judging the quality and brand effects on the banking sectors, reached a decision on the relationship between the two. Here the investors use their experience and what they perceive regarding CSR, then compare the companies on the issue.

The fourth pathway is the revisionist pathway: $I \rightarrow P \rightarrow D$: these decisions are made using available information, but since the information may be deemed inadequate, irrelevant or unreliable, people also use their perception to make their decision. Judgment is not used as people cannot compare or contrast. According to our knowledge no studies were found to follow the same as revisionist pathway. Here investors do not have any background on corporate social responsibilities so they will use all the available information that will enhance perception on the issue, then make a decision.

The fifth pathway is the value-driven pathway: $P \rightarrow I \rightarrow J \rightarrow D$. These decisions are made based first on belief and knowledge. People next assess and choose only from the available information, which they then rank, and finally make a decision. Here people are driven by their perceptions to choose certain types of information to judge and to make decision. No research from previous studies seems to follow value-driven pathway. Here investors have their own perception, then they choose the information that they see as reliable, and then they compare among the companies to make the investment decision.

The sixth pathway is the global perspective pathway: $I \rightarrow P \rightarrow J \rightarrow D$. Decisions are made first by assessing the available information. From that information, perception is influenced, options are ordered, and the decision is made. For example, a study by Wagner [22] appeared to have followed the Global perspective pathway since the information from sample financial reports were used and the perception of about advertising and innovation were used to judge whether there was relationship between CSR and economic performance in reaching the final decision. Berthelot et al. [37] found that investors used CSR reporting to judge, compare, and reach a final decision. In this pathway, investors take all available information to enhance their perception about CSR, then judge and compare the firms, and finally make a decision.

Table 1 provides examples of how pathways similar to those found predicted by the throughput model were used in some of the reviewed studies. Table 1, shows author, sample, topic area, method, main contribution, the study results, and their relation to the throughput model; specifically, the pathways that would have been predicted if the throughput model had been used.

Table 1. The related literature on sustainability with the main contributions and findings.

Author(s)	Sample	Topic Area	Method	Main Contribution	Results	Relation to Throughput Model
García-Benauet et al. [30]	Spanish Stock Market companies (Bolsa de Madrid, Spain), before crisis (2005–2007) and the crisis (2008–2010), companies' websites, 127 companies. DataStream for financial information (Toronto, CA)	Sustainability reporting	Kolmogorov–Smirnov test, descriptive statistics Mann–Whitney test-rank	The impacts of financial crisis on the reporting of corporate social responsibility and assurance strategies	They found that during the financial crisis there were significant increases of CSR reports, with no significant changes on assurance strategies but number of assured reports increases.	The research follows the analytical pathway as it uses the financial information available to judge and compare the corporate social responsibilities and assurance strategies during the financial crisis, and reaches the decision that the CSR reports and assurance increased during financial crisis.
Stubbs et al. [94]	23 top public listed Australian companies (Sydney, Australia)	Sustainability reporting	Semi-structured interviews	Analyzing the reasons why Australian firms were not issuing sustainability reports	They found a lack of external pressure; the traditional view that the aim of any business is to increase the shareholder wealth; no benefit seen by issuing those reports by the companies; costs outweigh benefits; increase risks by issuing those reports; it is not the business obligation; not enough resources; not mandatory; organization culture and structure do not support issuing those reports.	The research seems to follow the expedient pathway in data collection on managers' perceptions on whether to issue sustainability reports or not.
Rodgers et al. [28]	Data from KLD (Philadelphia, US) from 2000 to 2006. 497 sample observation	Firms commitment to social activities	Partial least squares.	Examining the impact of corporate social activities on a firm's financial health and market value.	They found that social responsibility activities impacts financial performance even after controlling for innovation. Customer perceptions have positive impacts on both financial and market value, while employee perception only has an impact on financial health and community only affects high innovation firms' market value.	The research follows the throughput model as they use innovation and CSR (measured only by customers, employees and community) as perception while the current study will use sustainability (environmental, social and economic) to judge investor decisions.
Berthelot et al. [37]	146 companies from Toronto Stock Exchange S&P/TSX Composite Index (Toronto, CA) and Bloomberg database (New York, US)	Sustainability reports	Weighted least square Regression	Impacts of issuing separate sustainability reports on investors' decisions.	They found that investors positively value sustainability reports in Canada.	The research seems to employ the global perspective pathway as the information was used from the financial reports and the perception on investors' reaction to stock market on the sustainability reports issued by companies, then they judged and compare and reach to a final decision as investors react to sustainability report more positively than those who don't issue.

Table 1. Cont.

Author(s)	Sample	Topic Area	Method	Main Contribution	Results	Relation to Throughput Model
Clarkson et al. [65].	Sample from 1990–2003 for Pulp & Paper, Chemical, Oil & Gas, Metal & Mining. Compustat (Philadelphia, US), US Environmental Protection Agency (Washington, US)	Proactive environmental strategies	Econometric Granger for causality.	Analyzing the factors that move firms to implement proactive environmental strategies and the relationship between environmental strategies and financial performance.	They found that a firm's positive (negative) changes in financial resources in prior period lead to positive (negative) changes in environmental performance in the future periods, which lead to positive (negative) financial performance. There is a positive relationship between financial performance and environmental performance.	The research is related to analytical pathway, as they use the information financial reports and judge by comparing the proactive environmental strategies to reach a conclusion on the relationship between environmental strategy and financial performance.
Artiach et al. [21]	US Firms in DJSI (2002–2006) and non DJSI firms (Troy, US)	The determinates of corporate sustainability performance	Regression model	Factors influencing firm's to invest in CSP	In terms of size, growth rate and profitability there is significant different between DJSI firms and non-DJSI firms. No significant differences between the samples in terms of leverage and cash resources.	Their research is related to Analytical pathway of the throughput model as they use the information from financial statements to judge the DJSI and Non DJSI in reaching the decision of investment in sustainability activities.
Wagner [22]	Compustat (Philadelphia, US), Worldscope Disclosure (Toronto, CA), BankerOne (Toronto, CA) and KLD (Philadelphia, US) from 1992 to 2003. US firms	Corporate sustainability performance	Panel estimation technique	It analyzes the link between corporate sustainability performance and economic performance	The relationship between corporate sustainability and economic performance are moderated by advertising intensity, with no moderating effects for R&D.	The research follows the Global perspective pathway as the information from the financial reports have been used and the perception on advertising and innovation were used to judge if there is relationship between CSP and Economic performance in reaching the final decision.
Poolthong and Mandhachitara [118]	Sample from questionnaires of 275 banking customers from Thailand	Corporate social responsibility and customer expectations	PLS	Analyzing how CSR impacts customer perspectives on the service quality and brand moderated by trust in banking sector.	They found that CSR has positive impacts on customers' views on service quality and brand effect, which are moderated by building trust between customer and banks. Also they found there is direct relationship between CSR and brand effect.	Appears to follow the ruling guide pathway as customers' perception on CSR in judging the quality and brand effects on the banking sectors, and reach a decision on the relationship between them.
Vormedal and Ruud [95]	The 100 largest Norwegian firms 2004 Paper-based reports; firm data provided by DN, a Norwegian newspaper (Oslo, Norway)	Sustainability reporting	Content analysis.	Analyzed the influence of social, political, and regulatory characteristics on the quality of sustainability reporting	They found that 94% of the companies do not follow legal requirements for disclosing environmental and gender equality issues, and that most of companies would not disclose the information about environmental social and economic dimensions. They found only 14% issue sustainability reports, with varying contents. Firm size has no association with the reporting requirements while industry and degree of internationalization have association, with no clear picture for the sector.	Appears to follow the analytical pathway as it uses the information available to judge the quality of sustainability reports and reach a decision on whether the content of those reports cover the legal requirements or not.

Table 1. Cont.

Author(s)	Sample	Topic Area	Method	Main Contribution	Results	Relation to Throughput Model
Moneva and Cuellar [71]	44 Spanish companies listed in Madrid Stock Exchange (Bolsa de Madrid, Spain) 1996–2004 Annual reports and Compustat Global Data database (Philadelphia, US)	Environmental disclosure	Valuation model, price model regression	Analyzing the value relevance of financial and non-financial environmental information on the firm value.	They found that <i>non-financial</i> environmental information is treated by the market as irrelevant in decision-making while <i>financial</i> environmental information is relevant. Also they found an increase in market value vis. environmental issues after the introduction of obligatory environmental reports in Spain in 2002.	The research seems to follow the analytical pathway as they use information to judge and compare the financial and non-financial environmental issues to reach the final decision on whether market value non-financial environmental information.
Chang and Kuo [23]	2003–2005 SAM (Sustainable Asset Management) (New York, US) Hoover's Company Record (New Jersey, US)	Sustainable development	Structural equation model (SEM)	The analysis of sustainable development on financial performance	Better sustainability has a positive relationship with profitability in same or later period/sustainable groups. There is reciprocal relationship between them. Profitability has a positive influence on corporate sustainability in lower/higher groups. Sustainability negatively influences lower group profitability.	The research appears to follow the analytical pathway as it use the information available to judge the relationship between sustainability performance and firms' financial performance, and reach to a decision that there is relationship between them.
Velde et al. [49]	Data from Vigeo corporate social scores 2000–2003 (New York, US)	Corporate social responsibility	OLS	Analyzed the interaction between sustainability and financial performance.	They found that high-sustainability portfolios perform better than low-sustainability portfolios. Also they found that investors are willing to pay more for the companies that have good relationship with stakeholders.	The research seems to follow Analytical pathway as it uses financial information to judge and compare on both high and low sustainability portfolios and reaches a decision on a positive relation between financial performance and high sustainability portfolio and negative relation with low sustainability portfolio.
Wagner [25]	European paper industry firms from UK, Germany, Italy and Netherlands. Data from financial reports and ER-I (The Hague, Netherlands), TRI (Washington, US) and UK Pollution Inventory From 1995–1997 (Bristol, England)	Corporate environmental strategies	Ordinary Least Square Regression (OLS)	Analyzes the relationship between environmental and economic performance in the paper industry, and the effects of environmental strategies on the relationship between the two.	The author found a positive relationship between environmental and economic performance for the firms that adopt pollution prevention strategies that lead to enhanced sustainability.	The research appears to follow the analytical pathway as it uses the information from annual reports and judging firms that use pollution control and those that don't to reach the final decision on the relationship between the environmental and economic performance.

Table 1. Cont.

Author(s)	Sample	Topic Area	Method	Main Contribution	Results	Relation to Throughput Model
Rodgers and Housel [70]	84 senior auditors	Environmental risk information	Regression	Analyzing auditors' decision making when provided with environmental risk information.	Auditors are focusing on traditional financial information and ignoring environmental information in making their decision.	The research follows the throughput model as the auditors were given information on financial reports and environmental risk to gather their knowledge, then make judgment about those companies and finally decision. However the study uses only environmental risk information, not the overall sustainability issue. Also it focuses on auditors while the existing paper focusing on investors' decision.
Wagner and Schaltegger [26]	Data from EBEB (Brussels, Belgium) and questionnaires to 135 UK and 166 German firms.	Corporate environmental strategy	OLS regression	Researched whether Environmental Shareholder Value strategy impacts the relationship between economic and environmental performance of a firm.	For the firms that have environmental shareholder- oriented strategy, there are positive and significant effects between environmental impact reduction and the four dimensions of competitiveness (market, internally, profitability and risk related). While for the firms not having Environmental Shareholders Value Strategy, no significant influence was found. Also, the choice of strategy has a positive impact on the relationship between environmental and economic performance.	The research follows the analytical pathway as it has used the information available and judged by comparing the firms with environmental shareholders value strategy to those that don't to reach the final conclusion on relationship between economic and environmental performance of firms.
O'Dwyer [73]	Irish companies from Irish stock Exchange (Dublin, Ireland), 29 senior executives. 1997	Corporate social responsibility	Semi-structured interview	Examining managerial conceptions on the issue of corporate social responsibility.	The author found that managers understand corporate social responsibility as antagonistic to maximizing shareholders' wealth. Also the constraints on the pressure groups make managers not think about social responsibility broadly. Also, the author concludes that managers find the concept of CSR complex and difficult to apply.	Follows the expedient pathway as it uses managers' perceptions on the decision of corporate social issues.
Solomon and Lewis [86]	Questionnaires to 625 UK organizations and individuals in 1995	Corporate environmental disclosure	Wilcoxon, Kruskal–Wallis descriptive statistics	Investigated the incentives and disincentives of corporate environmental disclosure for preparers and users	They found a difference in the incentives and disincentives between users and preparers of that information. The preparers (companies) view environmental disclosure much differently than do the users (interested and normative group).	The research follows the expedient pathway as it searches for the perception of corporate environmental disclosure for preparers and users and reaches a decision that there are different incentives and disincentives for prepares and users.

Table 1. Cont.

Author(s)	Sample	Topic Area	Method	Main Contribution	Results	Relation to Throughput Model
O'Dwyer [32] (2002)	27 Irish public limited companies from major company sectors quoted on the Irish Stock Exchange (Dublin, Ireland)	Corporate social disclosure	Semi structured interview	Analyzes managerial perceptions for the motives to disclose corporate social responsibility reports.	The author found that disclosing CSR raises more doubts about environmental issues that are sensitive to external pressure, and some companies decide to quit issuing such reports. Also found negative perception generates extreme pressure from interested groups and causes confusion for managers. They also find some managers have Positive perception to the corporate social responsibility disclosure like symbolic, protect from ant damage and educate citizens about the company.	The research follows the expedient pathway as it uses the managers' perception to reach a decision on whether to disclose the CSR reports or not.
Richardson and Welker [38]	Canadian firms, 1990-1992. Data from SMAC/UQAM (Toronto, CA), Statscan (Ottawa CA), I/B/E/S (Toronto, CA), Datastream (Toronto, CA), Compustat (Philadelphia, US).	Social and financial disclosure	Regression	Analysis of the relationship of financial and social disclosure on the cost of equity capital.	They found that financial disclosure has negative relationship with cost of equity capital, while social disclosure has a positive relationship with the cost of equity capital.	The research is related to follow the Analytical pathway as it uses information available and judges by comparing financial and social disclosure to reach a decision on whether there is positive or negative relationship with the cost of equity capital.
Dowell et al. [42] (2000)	Sample from U.S. Standard and Poor's 500 from 1994-1997 (New York, US.) Investors Responsibility Research Center (IRRC) (New York, US) Compustat (Philadelphia, US), and Wordscope (Toronto, CA)	Corporate Global environmental.	Multiple Regression	Analyzed the impact of stringent environmental standards on market value for MNEs firms	They found that MNEs that have stringent environmental standard have more market value than those firms that follow poor environmental standards. They found an insignificant relationship for lagged effects between the environmental standards and market value.	The research follows the Analytical pathway as it uses the available information to compare the firms with stringent environmental standards and those that they don't to reach on the decision on whether the investors value those information.

7. Summary and Conclusions

In summary, many studies have reported a positive relationship between implementing sustainability programs and financial performance, market value, firms' competitive advantages. Further, some of these studies have reported positive sustainability relationships with reputation, brand image, reduction of information asymmetry and associated risks, as well as reducing their cost structure.

Nonetheless, studies reporting a negative relationship between sustainability programs and financial performance have indicated that some of the reasons for that negative relationship stem from individuals or organizations' perception. That is, sustainability activities incur additional costs not directly conducive to profitability. That is, their costs exceed their benefit, and devoting corporate resources to social welfare is tantamount to an involuntary redistribution of wealth from shareholders to society. Moreover, environmental costs are depicted by the market as end-of-pipe actions and not for future improvements.

In spite of the numerous concerns regarding the challenges of implementing and reporting on sustainability efforts, firms may continue to implement sustainability. That is, organizations may still follow a "sustainability" pathway even though this could be a loss-bearing activity in reaction to pressure from stakeholders and regulators. On the other hand, firms may continue to avoid investing in sustainability efforts due to a lack of pressure from stakeholders, regulations and ethical considerations. The throughput model along with its six dominant algorithms depicts the significance of triple bottom line concept. That is, the six dominant algorithms promote the notion that when making decision choices, management should consider not only the interest of financial stakeholders, but social and environmental issues as well. In relationship with the Throughput Model, the interaction of perception and information ($P \leftrightarrow I$) provides a clearer understanding of the economic, social and environmental components relating to a firm's performance.

Finally, even if not measured by present accounting research, the fundamentally important quality of non-financial intangible assets performance is an issue for firms and investors. Instead, accounting researchers have focused only on financial performance (Goyal et al. [117], which only accounts for approximately 10% of firm's value. Also, while implementing sustainability efforts may lower financial performance, it can create the impetus for future financial value via the intangible assets of firms.

Therefore, in order to judge whether sustainability has a positive or negative impact on firm performance, both financial and non-financial performance should be measured over the long run (Goyal et al. [117]; Poolthong and Mandhachitara [118]). Existing frameworks available in the literature such as balance scorecard, intangible asset monitor, Scandia Navigator, and the EU CSR Alliance Laboratory Model (2009) have derived some common aspects of non-financial intangible assets such as human capital, customer relations, innovation and corporate governance that can be used in the throughput model to measure the relationship between sustainability and firm performance. Incorporating the performance of these intangible assets within a comprehensive theoretical framework can lead to new insights. Auxiliary, exploiting and highlighting intangible assets role from a process modeling perspective may uncover hidden value in future traditional financial performance. Implications for future research suggest further study on the impact of sustainability on intangible assets. Furthermore, research should examine firms that practice sustainability and those that do not to understand the impact of CSR on firm performance.

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