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A Decision Support System Architecture for the Development and Implementation of ESG Strategies for SMEs

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ABSTRACT

This paper introduces the ESG index, the opportunities that derive from it and the challenges SMEs face to utilize these opportunities. It also highlights the absence of ESG reporting software that can be used by SMEs as supportive tool to record their ESG activity. Furthermore, it presents the core design of a decision support system that drives SMEs to map their operations against the ESG criteria, and execute a proposed action plan that can generate an SME ESG score. The system functions as an assessment tool providing a staged evaluation of the SMEs activities, identifies ESG gaps and proposes actions needed to fulfil the requirements of the ESG criteria. The system does not evaluate the scale of each ESG activity implementation but its existence in the SME operations and the degree of its adaptation. The goal of this research is to indicate that SMEs can, and should, be awarded ESG scores to help them attract investments for their future development and continuous contribution the economy and the society.

Keywords: ESG, SMEs, MNEs, MIS, Decision support systems, Management, Leadership, Technology

INTRODUCTION

Environmental, social and governance (ESG) factors have been recognized by investors as important measures for company valuation, risk management and also regulatory compliance. The number of asset managers that incorporate ESG into their asset allocation process indicate a rapid increase. Furthermore, new thematic investment schemes emerge that become appealing to investors with very specific investment objectives (Refinitiv, 2022a).

The ESG factors form the three new pillars of organizational sustainability helping organizations to better identify their future and financial performance in terms of return and risk (Hicks, 2018). Companies adopting social or environmental standards achieve operational efficiency and reputation that positively reflects on their stock price performance (Markopoulos et al.

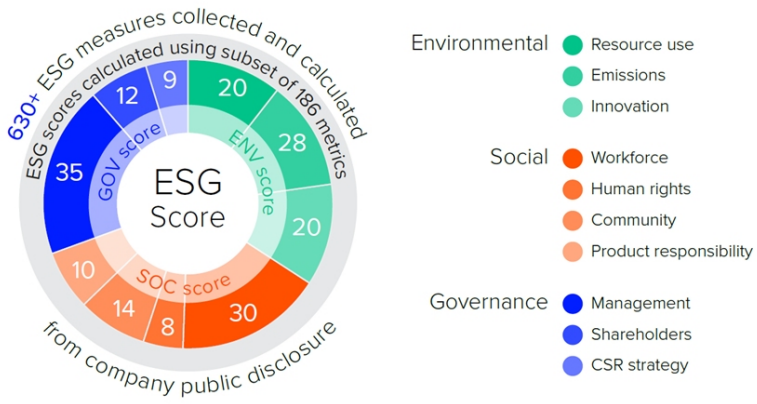

Figure 1: ESG Measures and categories per pillar (Adapted from Refinitiv, 2022a).

2020a). ESG turns out to be a critical organizational valuation index that impacts tremendously investment decisions and actions (Rollenhagen, 2022). In 2018 the sustainable responsible investment (SRI) assets reached 12 trillion dollars from 8.1 trillion in 2016. From those 12 trillion, 11.6 were handled by asset managers considering the ESG criteria (US/SIF, 2018).

On the other hand, and regardless the significant impact ESG ratings have on the financial performance of organizations, the everlasting challenge related with the lack of consensus on the ESG rating methodology remains a big shadow on the credibility of the overall ESG concept. Despite the broad definitions of the criteria, the method of assessing the quality and completeness of each ESG criterion for a specific company varies among the rating organizations.

Moody's, S&P Global, MSCI, and Sustainalytics, are some examples of organizations that rate ESG differently. Therefore, organizations can come up with different ratings, depending on the criticality of each criterion covered and the overall methodology employed to measure the delivered output. This creates serious contradictions on the ESG methodology, the rating process and the overall process ESG index (Financial Times, 2022).

THE REFINITIV ESG CRITERIA

To avoid confusion among the various organizations offering ESG ratings this paper emphasizes on the Refinitiv ESG ranking methodology, categories, and themes (criteria). Refinitiv offers a comprehensive ESG database that covers more than 85% of the global market, with more than 630 ESG metrics, and a long history dating back to 2002 (Refinitiv, 2022b). The Refinitiv ESG Scores measure the ESG performance of companies based on data that publicly and periodically get reported in 10 categories (topics) covering the three ESG pillars (Refinitiv, 2022a). The company selected 186 of its 630 ESG metrics to calculate the ESG score. These 186 metrics are spread over 25 themes forming the 10 categories of the 3 ESG pillars (see Figure 1).

Table 1. Refinitiv ESG structure.

Pillar	Category	Theme
Environmental	Emission	Emission
		Waste
		Biodiversity
		Environmental management systems
	Innovation	Product innovation
		Green revenues, R&D and capital expenditures.
	Resource Use	Water
		Energy
		Sustainable packaging
		Environmental supply chain
Social	Community	Equally important to all industries, hence a median weight of five is assigned to all
	Human rights	Human rights
	Product responsibility	Responsible marketing
		Product quality
		Data privacy
	Workforce	Diversity and inclusion
		Career development and training
		Working conditions
		Health and safety
Governance	CSR Strategy	CSR Strategy
		ESG reporting and transparency
	Management	Structure (independence, diversity, committees)
		Compensation
	Shareholders	Shareholder rights
		Takeover defences

The Refinitiv ESG metrics are based on three considerations which are the materiality, the data availability, and the relevance with the industry. The scoring methodology is based on five (5) key calculations principles: 1) Unique ESG magnitude (materiality) weightings, 2) Transparency stimulation, 3) ESG controversies overlay, 4) Industry and country benchmarks at the data point scoring level, 5) Percentile rank scoring. The total score a company achieves is between 0 and 100 and is represented in four letter categories (A, B, C, and D) with 3 subcategories in each (A+, A, A−, etc). Table 1 demonstrate the range of themes (topics) covered by the Refinitiv ESG categories and pillars (Refinitiv, 2022b).

ESG REPORTING SOFTWARE SYSTEMS

The rapid growth of the ESG index created the need for ESG reporting software, also called ESG software, to automate the collection, aggregation and analysis of ESG data and to support decision-making. The tracking of ESG

Table 2. ESG reposting software systems.

Company	Country	Year	Company Size	Client Size Serve	Regions Served
Datamaran	GB	-	10	5.000+	Europe & Middle East, Americas
Sphera	USA	2016	1,000	5.000+	Europe & Middle East, Americas
Workiva	USA	2008	1,000	5.000+	Europe & Middle East, Americas
Enablon	France	-	1000	5.000+	Europe & Middle East, Americas, Asia-Pacific
Persefoni	USA	2020	250	5.000+	Europe & Middle East, Americas
LogicManager	USA	2005	250	5.000+	Americas
Quentic	Germany	2007	500	5.000+	Europe & Middle East, Americas
Novisto	Canada	2019	50	5.000+	Europe & Middle East, Americas, Asia-Pacific
RioESG	GB	2018	50	5.000+	Europe & Middle East
Emitwise	GB	2019	10	5.000+	Europe & Middle East,
Diginex	Hong Kong	2017	100	5.000+	Europe & Middle East, Asia-Pacific

activities companies run to comply with the ESG criteria can be challenging without the use of specialized software systems to coordinate and monitor this progress. Extensive market research presents indicative software systems that coordinate, propose and support ESG activities. Table 2 indicates several ESG reporting system companies, the regions they support and their clientele size.

From the companies listed in table 2, Novisto (Novisto, 2022), Metrio (Metrio, 2022), and Enablon (Enablon, 2022) stand out with the most functionality related to the ESG criteria (see Table 3).

An analysis of the findings from tables 2 and 3 indicate that most of the companies offering ESG reporting software services are European and American and established the last 15 years when the ESG concept started picking up globally. They are young in terms of maturity and expertise which justifies the lack on addressing many of the ESG requirements. This also indicates room for other companies to emerge and cover this gap, while the existing ones must further develop their functionality to cover more ESG requirements.

Other important findings are related with the size of each company and the regions they operate. Most of the companies are large scale with over 1.000 employees, focused mainly on the United States and European market. Many support the MENA region, a few Asia but no one Africa. A first assumption can be that North America and Europe maintain more social and sustainable personal and professional cultures therefore ESG is part of their DNA and highly considered as an important part of their strategy and operations. On the other hand, this does not favour the rest of the regions, especially the emerging markets that won't become developed markets without companies with high ESG scores.

ESG DISCRIMINATION

Strategic management and business development can be delivered easier in large scale organizations and Multinational Enterprisers (MNEs) due to

Table 3. Most related ESG software companies.

Novisto	Metrio	Enablon
Risk management and oversight	Anti-bribery	Diversity, equity & inclusion (DEI)
Board composition and diversity	Climate risk management	GHG emissions management
Cybersecurity practices	Diversity, equity & inclusion	ESG risk management
GHG emissions	Environmental compliance	Environmental compliance
Energy management	ESG risk management	Materiality assessment
Waste management	Ethical sourcing	Materials management
Employee diversity metrics	Ethics and social metrics	Customer Data
Diversity and inclusion	Financed emissions management	Global Reporting Initiative
Ethics and culture	GHG emissions management	Sustainability accountability standards
Climate-related risks and opportunities	Governance issues management	Task Force Climate Related disclosures
Human rights	Multi-tier supply chain assessment	SDGs
Employee health and safety	Net zero planning	
Supply chain management	Pre-loaded emission factors	
Raw material sourcing	Climate programs management	
Product safety	SDGs	

their excess in human resources, expertise, and time orientation. Small and Medium Size Enterprises (SMEs) on the other hand operate in unpredicted environments, with limited resources aiming first for their survival than their development.

The contrast between the two types of enterprises seems chaotic in numbers but not in plans and intentions. The contribution of the MNEs to national economies and their impact to the society and the environment can be measured with a variety of standards, metrics and practices such as Corporate Social Responsibility (CSR), the Environmental, Social and Governance Index (ESG), the Socially Responsible Investments (SRI) and other. On the other hand, SMEs have the same, if not more, direct impact on the society, the local and regional economy, and the employment, but in a smaller scale. However, due to their limited human resources in terms of skills development and visibility on their efforts, they cannot record and report such actions to receive credit for their responsible management and leadership.

Such a distance between the privileges offered to MNEs against the SMEs creates development dissemination to most of the companies who are considered as SMEs. According to the European Union the Small and medium-sized enterprises (SMEs) represent 99% of all businesses in the EU, and are characterized by factors such as staff headcount (<250), turnover ($\leq$ € 50 m) or balance sheet total ($\leq$ € 43 m) (European Commission, 2022). SMEs employee local personnel, use local resources, contribute to the local economy, but also to the regional and national economy as most of them are active with their country. Therefore, unintentionally they address several

UN SDGs such as SDG8 (Decent Economic Work and Growth), SGD 1 (No poverty), SDG2 (Zero hunger), and others without getting any credit, the opportunity to translate such activities into ESG score, and extend they efforts beyond Corporate Social Responsibility (Markopoulos et al, 2021).

RESEARCH GAP AND PRIMARY RESEARCH RESULTS

Based on secondary research for the ESG index requirements and the organizations that offer ESG reporting systems the following two conclusions identify a research gap. The first one is the need for the simplification of the ESG requirements for SMEs to be able to report their activities on a lighter scale that reflects their size, operations and financial turnover. As of today, there is no indication of any attempt to democratize ESG with a parallel ESG index adjusted to the SMEs abilities. The second conclusion derives from the first one and is related with the lack of ESG reporting software that can be used by SMEs to help them record, report, and benefit from their ESG activities.

Regardless the difference between SMEs and MNEs, SMEs compose 90-99% of the business in any country and such numbers cannot be ignored. Primary research indicates that an ESG reporting systems for the SMEs could he highly beneficial for the democratization of the ESG concept and its adaptation by the SMEs. To better understand the importance and impact of an ESG-SME index and reporting system,16 interviews has been conducted with SME owners and general managers from 6 industries (Finance, Software Development, Retail, Construction, Shipping and Consulting services) and 5 countries (Egypt, Finalnd, Greece, USA, and UK). The key findings are listed in table 3.

An analysis of the interview results in terms of countries and industries involved indicates that the sectors with the most awareness and maturity on the ESG index are the Finance and the Consulting Services. This is due to the fact the financial institutions understand better the financial impact of an ESG score on a company's valuation, while the consulting services organizations indicate ESG maturity as many attempts to provide such services to their clients. On the other hand, the shipping and the construction industries can be considered more conservative when dealing with ESG strategies. Country wise it seems that Finland indicates high maturing and understanding on the ESG index since the environmental concept has been well rooted in the government, the companies and the citizens who live and operate with high environmental and social consciousness.

Analysing the interview results in terms of SMEs challenges to adopt the ESG index, it can be considered that the ESG strategy development, the ESG initiation process and the prioritization of the ESG activities are the ones that should start first. They are also the ones that seem to deliver faster results in terms of visibility and recognition that would motivate the company to continue working on the ESG requirements. Theses three challenges are faced in most of the sectors participated in this research and in most of the countries.

The primary research and the literature review reveals the need for the development of a software technology to help SMEs select the ESG criteria

Table 4. SMEs ESG challenges.

Challenge	Sector	Country
International visibility of ESG actions	Finance, Shipping, Consulting services	Egypt, Greece
Lack of understanding ESG scoring	Software Development, Retail, Construction, Shipping	Egypt, Finalnd, Greece, USA, UK
ESG mentoring	Software Development, Retail, Construction, Shipping	Egypt, Greece, USA, UK
ESG compliance cost	Finance, Software Development, Construction	Egypt, Greece, USA, UK
ESG activities tracking process	Finance, Software Development, Retail	Egypt, Greece, UK
ESG strategy development	Software Development, Retail, Construction, Shipping and Consulting services	Egypt, Finalnd, Greece, USA, and UK
ESG awareness in their market	Software Development, Retail, Construction, Shipping and Consulting services	Egypt, Greece
ESG activities prioritization	Finance, Software Development, Retail, Construction, Shipping and Consulting services	Egypt, Greece, USA,
ESG initiation process	Finance, Software Development, Retail, Construction, Shipping	Egypt, Greece, USA, and UK
Efforts reflection to investors	Software Development, Retail, Construction, Shipping and Consulting services	Egypt, Finalnd, Greece, USA, and UK

to be satisfied first, based on the SMEs abilities and operations strategy. Such a software technology that can help SMEs understand better the ESG process and simulate their performance against the ESG requirements can be educational, informative, and inspirational for the SME to continue their operations while trying to comply with more ESG requirements.

AN ESG-SMES DECISION SUPPORT SYSTEM ARCHITECTURE

The architecture of the proposed ESG-SME decision support system is structured around 8 core components. These are: 1. The assessment tool of the ESG maturity, 2. The alignment of the SMEs activities on the ESG criteria. 3. The ESG strategy formulation with the ESG activities that can be executed 4. The prioritization of the ESG activities based on the SME's ESG maturity. 5. The planning and tracking of the ESG activities. 6. The reporting process of ESG activities executed. 7. The comparison of the results with other SMEs in the results repository. 8. The ESG score received by the SME and the comparison of the SME with other SMEs. Figure 2 presents a high-level architecture of the proposed technology emphasizing on the 8 core components.

The first five components are executed serially while the last three components run in parallel to provide support from the SME's best practices database, the dynamic reporting of the ESG activities and the calculation of

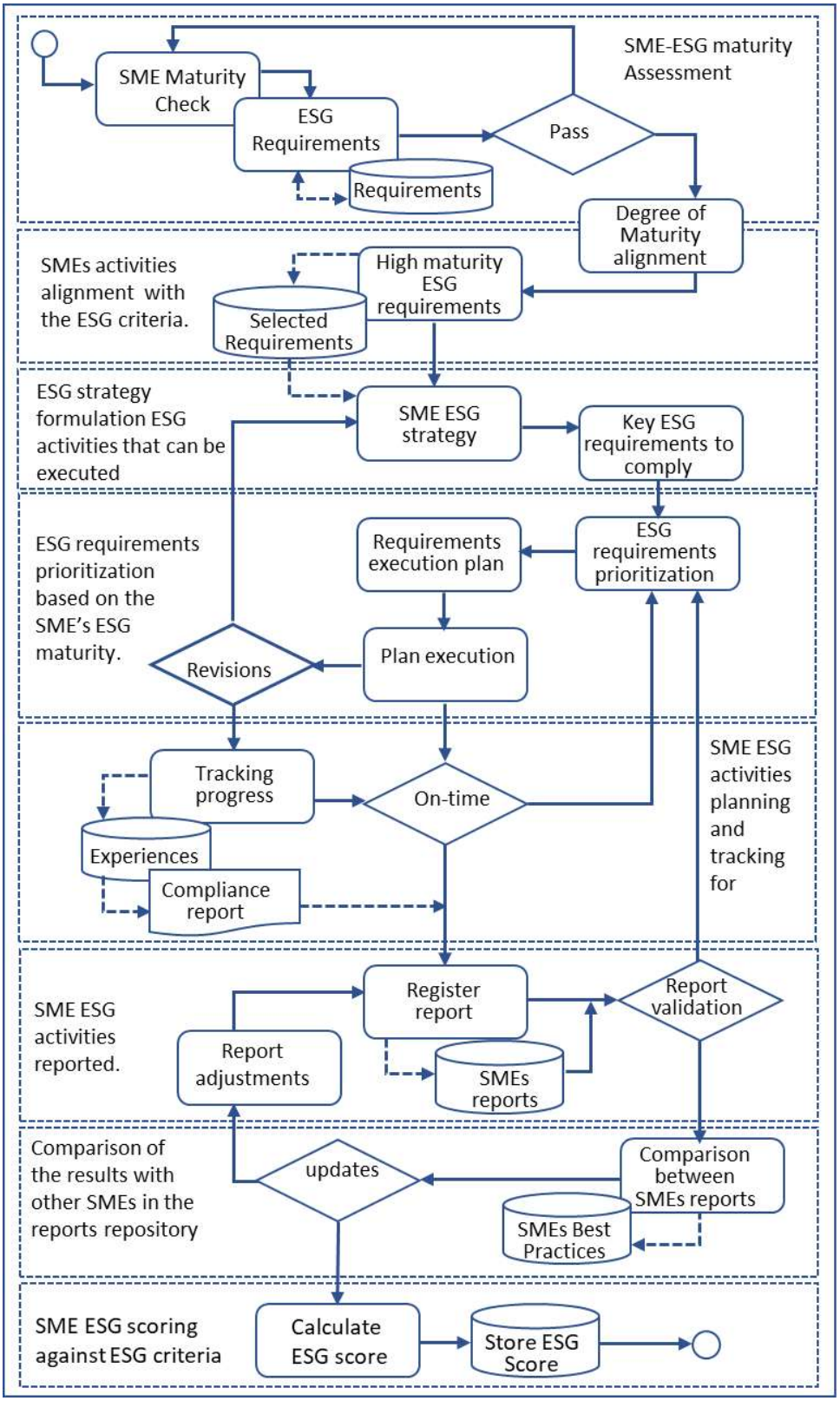

Figure 2: High level architecture of the ESG-SME Decision Support System.

the ESG score. The first two components can be executed independently and per case, as a self-assessment tool, without the need for the SME to execute any other component.

LIMITATIONS AND AREAS OF FURTHER RESEACH

The architecture of the proposed ESG-SME Decision Support System is based on an expert system whose rules need validation with extensive test runs to optimize the inference engine that triggers the execution order of the rules. Furthermore, the knowledge base needs data from SMEs across the world, industries, sizes, and operations models. As the definition of the SMEs covers companies from 5 to 250 employees and revenues from 50.000 to 50 million, the ability for an SME to adopt an ESG strategy varies significantly.

This research intends to further study such limitations, improve the design of the technology to address ESG adaptation challenges, and democratize the ESG concept (Markopoulos et al, 2020b). Such an approach requires running the proposed technology in organizational cultures that can utilize their human intellectual capital (Markopoulos and Vanharanta, 2014), as green fuel (Markopoulos et al, 2020c), for their business transformation efforts to reach Green Oceans strategies (Markopoulos et al, 2020d) with sustainable innovation and Pink Ocean strategies with social innovation (Markopoulos et al., 2020e).

CONCLUSION

While SMEs form the backbone of every economy, they seem to be excluded from the ESG index losing the benefits larger organizations and MNEs enjoy. This paper presented an indicative set of ESG requirements to introduce the effort and depth of activities needed from an organization to score on the index. It also presented a wide range of software technologies supporting organizations adopt the ESG requirements and report the results. However, none of the existing ESG reporting technologies target the SMEs, leaving them with no technological support to report their ESG activities, develop a strategy around them and prioritize their actions that will bring them close to an ESG score. This need has been verified with the results of the primary research in which 16 directors of SMEs participated.

The results of the primary and secondary research on both the ESG requirements and the existing ESG software technology created the need for the introduction of a decision support system design that guides SMEs on the prioritization of the ESG requirements, the formation of the strategy and the mapping their operations against the ESG criteria. Such a system, with the relevant enhancements, presented in this paper can be a useful tool for the SMEs to report their ESG performance.

The goal of this research is to indicate that SMEs can and should be awarded ESG scores as well. The proposed technology can direct SMEs towards ESG compliance, and report their achievements and contributions to help them attract the investments needed to keep on delivering a greater contribution to the local and international economy and society.

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REFERENCES

Enablon (2022). Wolters Kluver, Enblon website: https://www.wolterskluwer.com/en/solutions/enablon

European Commission (2022). Internal Market, Industry, Entrepreneurship and SMEs https://single-market-economy.ec.europa.eu/smes/sme-definition_en

Financial Times (2022). Lies, damned lies and ESG rating methodologies. FT Website: https://www.ft.com/content/2e49171b-a018-3c3b-b66b-81fd7a170ab5

Hicks, C. (June 28, 2018). How ESG Investing Increases Risk-Adjusted Returns. The US News website: https://money.usnews.com/investing/investing-101/articles/2018-06-28/how-esg-investing-increases-risk-adjusted-returns

Markopoulos E, Vanharanta. (2014). 'Democratic Culture Paradigm for Organizational Management and Leadership Strategies - The Company Democracy Model.' In: Charytonowicz J. (ed) Advances in Human Factors and Sustainable Infrastructure. 5th International Conference on Applied Human Factors and Ergonomics. vol 20. pp 190-201

Markopoulos E., Gann E.L., Kirane I.S., Vanharanta H. (2020c) Green Capitalism: Democratizing Sustainable Innovation by Recycling Intellectual Capital Energy. In: Ahram T., Taiar R., Gremeaux-Bader V., Aminian K. (eds) Human Interaction, Emerging Technologies and Future Applications II. IHIET 2020. Advances in Intelligent Systems and Computing, pp. 507–519. vol. 1152. Springer.

Markopoulos E., Kirane I. S., Gann E.L., Vanharanta H. (2020a) A Democratic, Green Ocean Management Framework for Environmental, Social and Governance (ESG) Compliance. In: Ahram T., Taiar R., Gremeaux-Bader V., Aminian K. (eds) Human Interaction, Emerging Technologies and Future Applications II. IHIET 2020. Advances in Intelligent Systems and Computing. pp. 21–33, vol. 1152. Springer.

Markopoulos E., Kirane I.S., Gann E.L., Vanharanta H. (2020b) A Democratic, Green Ocean Management Framework for Environmental, Social and Governance (ESG) Compliance. In: Ahram T., Taiar R., Gremeaux-Bader V., Aminian K. (eds) Human Interaction, Emerging Technologies and Future Applications II. IHIET 2020. Advances in Intelligent Systems and Computing. pp. 21–33, vol 1152. Springer.

Markopoulos E., Kirane I.S., Piper C., Vanharanta H. (2020d) Green Ocean Strategy: Democratizing Business Knowledge for Sustainable Growth. In: Ahram T., Karwowski W., Pickl S., Taiar R. (eds) Human Systems Engineering and Design II. IHSED 2019. Advances in Intelligent Systems and Computing, chapter 20, pp. 115–125. vol. 1026. Springer.

Markopoulos E., Ramonda M.B., Winter L.M.C., Al Katheeri H., Vanharanta H. (2020e) Pink Ocean Strategy: Democratizing Business Knowledge for Social Growth and Innovation. In: Markopoulos E., Goonetilleke R., Ho A., Luximon Y. (eds) Advances in Creativity, Innovation, Entrepreneurship and Communication of Design. AHFE 2020. Advances in Intelligent Systems and Computing, pp. 39-51, vol 1218. Springer.

Markopoulos E., Staggl A., Gann E.L., Vanharanta H. (2021) Beyond Corporate Social Responsibility (CSR): Democratizing CSR Towards Environmental, Social and Governance Compliance. Advances in Creativity, Innovation, Entrepreneurship and Communication of Design. AHFE 2021. Lecture Notes in Networks and Systems, vol 276, pp 94–103. Springer.

Metrio (2022). Metrio Sustainability Software. Metrio website: https://www.metrio.net/

Novisto (2022). Novisto, ESG Management Software. Novisto website https://novisto.com/esg-software/

Refinitiv (2022a). Refinitiv ESG Scores. RE2607801/9-22. https://www.refinitiv.cn/content/dam/marketing/en_us/documents/fact-sheets/esg-scores-fact-sheet.pdf

Refinitiv (2022b). Environmental, social and governance scores from Refinitiv. https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf?elqCampaignId=14314

Rollenhagen. L. (2022). Know about ESG Investing. Wealthsimple website: https://www.wealthsimple.com/en-us/learn/esg-investing#pros_of_esg_investing

US/SIF (2018). Sustainable investing assets reach $12 trillion as reported by the US SIF Foundation's biennial Report on US Sustainable, Responsible and Impact Investing Trends. https://www.ussif.org/files/US%20SIF%20Trends%20Report%202018%20Release.pdf