Diffusion of Material Flow Cost Accounting and its Contribution to Sustainable Development

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Preface and Declaration

The title of the thesis is "*Diffusion of Material Flow Cost Accounting and its Contribution to Sustainable Development*". The thesis includes four chapters in relation to the topic of material flow cost accounting. Chapter one presents a general introduction about the problem statement, aim and structure of the thesis, the key concepts and frameworks used in three scientific papers, background information of three papers, general discussion, and general conclusions. Chapters two, three and four contain three papers in different stages that have been submitted to peer-reviewed journals, all listed in Scopus.

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Summary of the Thesis

Global environmental impacts, such as climate change and resource depletion, have seriously threatened many nations and different industries such as agriculture and food production. These negative impacts are caused by unsustainable economic growth, increased waste and emissions, and inefficiency of resource consumption. It is a fact that nations are challenged to achieve higher economic growth, increase productivity, and reduce environmental impacts. The transition to a sustainable global economy requires the creation and diffusion of new ideas and approaches. Material flow cost accounting (MFCA) has been a contemporary, innovative approach to supporting corporate management and addressing these challenges because of its potential for application in practice and its guideline development and standardization for the last two decades. MFCA, which quantifies the flows and stocks of materials in processes or production lines in both physical and monetary units, has brought environmental and economic benefits, such as material efficiency, waste reduction, emission mitigation, and cost savings, for corporations across various countries and industries.

The diffusion of MFCA plays a vital role in supporting further take-up of its practical application and the achievement of sustainable development. If MFCA is broadly diffused, the targets of green productivity and sustainable production can be accomplished due to its benefits in reducing waste while increasing resource efficiency and profits. Moreover, the diffusion of MFCA can bring out opportunities for transferring knowledge and skills toward sustainability from trainers/experts to a variety of actors such as corporations, consultancies, and educators, which is needed for implementing MFCA in practice, thereby supporting education for sustainable development. However, many corporations remain ill-informed concerning MFCA and there has been a low level of MFCA application at the corporate/micro-level in practice reported in previous research. Moreover, it is unclear whether and how MFCA has been linked with meso-level (e.g., social actors) and macro-level (e.g., national strategies and goals).

Based on the importance of MFCA diffusion and the research gap, this thesis aims to analyze how further take-up of MFCA in practice can be encouraged to support sustainable development. To achieve the aim of the thesis, the central research question is identified: *How is MFCA diffused across micro-, meso-, and macro-levels to support sustainable development?* Answering this question can provide a reflexive way to think about what happened, how it happened, what was done well, and what should be improved or encouraged. Accordingly, it can bring potential benefits for various audiences, such as researchers who are looking for paths to future research on MFCA, policy makers who are looking for institutional policies to address global challenges, and educators who are seeking content regarding teaching and effective ways to improve the quality of education for sustainable development.

To address this question, three studies on MFCA are conducted at multiple levels. The first study reviews existing studies of MFCA application at the micro-level. The second study expands to the national context, exploring MFCA links across three levels (macro-economic strategies, meso-national productivity programs and social actors, and MFCA implementation by micro-business corporations). The third study focuses on MFCA diffusion at the meso-level (e.g., a university in which MFCA is taught). The three studies are connected in relation to the development of MFCA and its links across micro-, meso-, and macro-levels. In addition, these studies show enablers of and barriers to MFCA diffusion across the three levels. Based on the findings of the three studies, we propose different ways to encourage widespread adoption of MFCA to support sustainable development such as green productivity, sustainable production, and education for sustainability.

The thesis consists of four chapters. While Chapter 1 provides an overview of the thesis, the subsequent chapters (Chapters 2, 3, and 4) specifically present three studies.

The first study (presented in Chapter 2) reviews existing studies on MFCA application at the micro-level in developing countries. The findings show that MFCA research has primarily focused on Asian developing countries. Moreover, while the use of MFCA is often associated with improving eco-efficiency, the reviewed studies also indicate a high relevance for strategic decision-making processes within organizations. Finally, one of the key challenges in MFCA application reported in developing country studies lies in existing accounting systems with limited data availability and insufficient cost allocation. Based on our findings and the gaps identified in the MFCA literature, we suggest paths for further research, including the necessity of quantitative research and comparative analysis of MFCA application across countries, the further investigation of MFCA application in small and medium-sized enterprises as well as in various manufacturing and service sectors in developing countries.

The second study (presented in Chapter 3) considers the contextual and transformational links between macro-, meso- and micro-level institutions associated with the progress of MFCA, to improve productivity in Vietnam. Adopting a multi-level framework, the findings reveal four contextual and transformational links (macro-meso, meso-micro, micro-meso, and micro-macro). Six perceived barriers to the development of MFCA across the levels are identified: low environmental awareness and corruption, a high level of compliance with taxation legislation, insufficient data, accounting secrecy, ineffective communication, and a lack of close collaboration among social actors. Given these links and barriers, we make three recommendations for policymakers: meso-level policy guidance on MFCA, potential meso-level reporting pressures, and effective communication between levels.

The third study (presented in Chapter 4) explores how a blended case-based learning approach can enhance students' learning towards accounting for sustainability. The findings provide evidence on learning outcomes, including both knowledge of MFCA and professional skills (critical thinking, teamwork, and communication skills) geared toward sustainable development. Three elements of blended case-based learning—student characteristics, educator roles, and design features—are shown to be crucial for learning in accounting for sustainability. Based on the findings, we offer three practical implications for educators: the necessity of understanding student characteristics, the adoption of various educator roles, and innovation in course design.

Overall, this thesis analyzes how further take-up of MFCA in practice can be encouraged to support sustainable development, thereby making theoretical and managerial contributions. Addressing global challenges requires actions taken by different social actors across multiple levels to promote adoption of MFCA. We hope our contributions and recommendations will draw the attention to researchers, policy makers, and educators, and we look forward to large-scale changes that will help to create a sustainable world.

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List of Abbreviations

AB	Accountancy Bodies (Coding)
APO	Asian Productivity Organization
ASEAN	Association of Southeast Asian Nations
BU	Business Organizations (Coding)
CO	Consultancies (Coding)
EI	Education Institutions (Coding)
EMA	Environmental Management Accounting
EMA-SEA	Environmental Management Accounting for Small and Medium-Sized Enterprises in South-East Asia
GA	Government Agencies (Coding)
GDP	Gross Domestic Product
IFAC	International Federation of Accountants
InWEnt	Capacity Building International
IMT	Institute of Management Technology (Vietnam)
IN	Interview Transcripts (Coding)
ISO	International Organization for Standardization
LJ	Learning Journals (Coding)
MA	Management Accounting
METI	Japanese Ministry of Economy, Trade, and Industry
MFCA	Material Flow Cost Accounting
MOF	Ministry of Finance (Vietnam)
MOIT	Ministry of Industry and Trade (Vietnam)
MONRE	Ministry of Natural Resources and Environment (Vietnam)
MOST	Ministry of Science and Technology (Vietnam)
MPI	Ministry of Planning and Investment (Vietnam)
NG	Non-Government Organizations (Coding)
OECD	Organization for Economic Cooperation and Development
ON	Online Session (Coding)
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SDGs	Sustainable Development Goals
SMEs	Small and Medium-Sized Enterprises
ST	Students (Coding)
STAMEQ	Directorate for Standards, Metrology and Quality (Vietnam)
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
VAA	Vietnam Association of Accountants and Auditors Vietnam
VBCSD	Business Council for Sustainable Development Vietnam
VNCPC	Cleaner Production Centre

Chapter 1

Framework Chapter

1.1 General Introduction

1.1.1 Problem Statement and Aim of the Thesis

Global environmental impacts, such as climate change and resource depletion, have seriously threatened many nations (Schaltegger, 2018; Steffen *et al.*, 2015) and different industries such as agriculture and food production (Beckerman, 1992; FAO, 2017). For example, Vietnamese farmers in the Mekong Delta are severely affected by droughts and saline water intrusion into their rice, fruit, and shrimp farming (The World Bank, 2021). These negative impacts are caused by unsustainable economic growth (Mughal *et al.*, 2022), increased waste and emissions (Kusch *et al.*, 2021), and inefficiency of resource consumption (Hottenroth *et al.*, 2022). As an illustration, the global food system, which accounts for 15–30% of humanity's primary energy consumption (Schramski *et al.*, 2020), creates a vast amount of energy waste (Usubiaga-Liaño *et al.*, 2020). It is a fact that nations are challenged to achieve higher economic growth and reduce environmental impacts. The OECD (2019) highlights that the creation and diffusion of new ideas, products, processes, and methods are fundamental to any transition to a sustainable global economy.

Material flow cost accounting (MFCA) is "a tool for quantifying the flows and stocks of materials in processes or production lines in both physical and monetary units" (ISO, 2011, p. 3). MFCA, which is a key tool of environmental management accounting (EMA), has brought benefits such as material efficiency, waste reduction, emission mitigation, and cost savings for corporations across various countries and industries (Herzig *et al.*, 2012; METI, 2010; Viere *et al.*, 2007), especially the agriculture and food business industries. For example, applying MFCA has helped a brewing company reduce energy consumption and save on related costs in the production process (Schaltegger *et al.*, 2012). Another example is that MFCA has supported a bottled mineral water company to address its wastewater problems while reducing a large number of inputs such as water and plastics losses (Tran and Herzig, 2022). In short, MFCA is helpful in enhancing both environmental and economic performance.

The diffusion of MFCA plays a vital role in supporting further take-up of its practical application (Christ and Burritt, 2016) and the achievement of sustainable development (Burritt *et al.*, 2021; OECD, 2019). If MFCA is broadly diffused, the targets of sustainable production can be accomplished due to its benefits in reducing waste while increasing resource efficiency and profits (ISO, 2021; Okada *et al.*, 2019; United Nations, 2022). Moreover, the diffusion of MFCA can bring out opportunities for building capacity by transferring knowledge and skills toward sustainability from trainers/experts to a variety of actors such as corporations, consultancies, and educators (Viere *et al.*, 2006), which is needed for implementing MFCA in practice, thereby supporting education for sustainable development (OECD, 2016; United Nations, 2018). However, many corporations remain ill-informed concerning MFCA (Christ and Burritt, 2016) and there has been a low level of MFCA application in practice reported in previous research (Christ and Burritt, 2015). Moreover, Schaltegger *et al.* (2022, p. 17) observe that "until now, practically no methods have been proposed as to how to broaden the management accounting scope including linkages to the meso- and macro-level in an effective way." Based on the importance of MFCA diffusion and the research gap, this thesis aims to analyze how further take-up of MFCA in practice can be encouraged to support sustainable development. To achieve the aim of the thesis, the central research question is identified: *How is MFCA diffused across micro-, meso-, and macro-levels to support sustainable development?*

Answering this question can provide a reflexive way to think about what happened, how it happened, what was done well, and what should be improved or encouraged. Accordingly, it can bring potential benefits for various audiences, such as researchers who are looking for paths to future research on MFCA, policy makers who are looking for institutional policies to address global challenges, and educators who are seeking content regarding teaching and effective ways to improve the quality of education for sustainable development.

To address this question, three studies on MFCA are conducted at multiple levels. While the first study starts with a review of existing studies on MFCA application at the corporate/micro-level, the second study expands to the national context, where MFCA links across three levels (macro-economic strategies, meso-national productivity programs and social actors, and MFCA implementation by micro-business corporations) are explored. Then, the third study focuses on MFCA diffusion at the meso-level (e.g., a university in which MFCA is taught). The three studies are connected in relation to the development of MFCA and its links across micro-, meso-, and macro-levels. In addition, these studies show enablers of and barriers to MFCA diffusion across the three levels reflected by different actors such as corporations, government agencies, consultancies, educators, and students. Based on the findings, the three studies propose different ways to further take-up of MFCA in the pursuit of supporting sustainable development.

1.1.2 Structure of the Thesis

The thesis consists of four chapters in relation to the topic of MFCA. While Chapter 1 provides an overview of the thesis, the subsequent chapters (Chapters 2, 3, and 4) specifically present three studies.

Chapter 1 provides a general introduction, including the problem statement, aim, and structure of the thesis. Next, we present the key concepts and frameworks used in the three studies. Then, we provide background information of these studies, including research questions, key findings, and future research and development paths. Based on the findings of these studies, we provide general discussion about the diffusion of MFCA in the global sustainability context and about teaching MFCA in sustainability accounting education. Finally, general conclusions are presented.

Chapter 2 presents the first study, titled "*Material Flow Cost Accounting in Developing Countries: A Systematic Literature Review.*" The study reviews existing studies on MFCA application at the micro-level in developing countries, thereby providing evidence on enablers of and barriers to its application and suggesting paths for future research on MFCA. Despite the debate and difficulty of defining developing countries in terms of various measurable aspects (Hopper *et al.*, 2017), we use the classification of the World Bank, as used in previous studies on accounting (Alawattage *et al.*, 2017; van Helden and Uddin, 2016). This includes four categories: high income, upper-middle income, lower-middle income, and low income. Accordingly, developing countries are not listed among high-income economies. To synthesize and appraise these studies, we conduct a systematic review guided by Tranfield *et al.*'s (2003) approach, including three main stages: planning the review, conducting the review, and reporting the review.

Chapter 3 presents the second study, titled "*Material Flow Cost Accounting in Vietnam - A Multi-level Exploration.*" While papers reviewed in the first study are limited to organizations' boundaries, the second study extends to a national scale in order to explore the links of contextual and transformational processes and barriers involving MFCA across the three levels, thereby making recommendations for policy makers. Vietnam was chosen as the case setting for three reasons. First, it has integrated MFCA into its national productivity program, which has an emphasis on resolving both productivity and environmental problems. Second, it is a member of the Asian Productivity Organization, which focuses on pursuing "green" productivity. Finally, it has very low productivity and environmental performance indexes in

comparison with other Association of Southeast Asian Nations (ASEAN) countries. Primary information is collected from 17 in-depth semi-structured interviews. The evidence is triangulated with public documents.

Chapter 4 presents the third study, titled "*Blended Case-based Learning in a Sustainability Accounting Course: An Analysis of Student Perspectives.*" The study explores students' learning outcomes and enablers of their blended case-based learning in MFCA to support sustainable development, thereby making recommendations for educators. The MFCA course was designed to teach 17 international master's students at the University of Kassel, Germany. For the first time, blending case-based learning was applied. Data are collected from three sources: 51 learning journals, a video recording from the last online session of the course, and six in-depth interviews.

1.2 Key Concepts and Theoretical Frameworks

1.2.1 Material Flow Cost Accounting

Material flow cost accounting (MFCA), which is a key tool of environmental management accounting, has become a contemporary, innovative approach to supporting corporate management and contributing to addressing global challenges because of its application potentials in practice, guideline development, and standardization for the last two decades (Burritt *et al.*, 2021). According to the International Organization for Standardization (ISO), MFCA is "a tool for quantifying the flows and stocks of materials in processes or production lines in both physical and monetary units" (ISO, 2011, p. 3). MFCA originated from the concepts of input-output, mass-balance, or material flows in the early 1920s and 1930s. It then evolved via environmental management projects and was rapidly disseminated in Germany (in the late 1980s and early 1990s) and Japan (in the late 1990s and early 2000s) through eco-efficiency projects. In Japan, the use of MFCA spread with the support of the Japanese Ministry of Economy, Trade, and Industry (Wagner, 2015).

In 2011, based on the initial ideas developed by the Japanese Ministry of Economy, Trade, and Industry and discussions involving 28 national committees worldwide, MFCA was published as a new international standard, ISO 14051, which promised a new era for MFCA implementation and research (Christ and Burritt, 2016). It was later extended to supply chains in ISO 14052 (ISO, 2017) and small and medium-sized enterprises (SMEs) in ISO 14053 (ISO, 2021). The implementation process of MFCA includes five steps: (1) engaging management and determining roles and responsibilities, (2) identifying the scope and boundary of the process and establishing a material flow model, (3) allocating costs (material cost, energy cost, system cost, and waste management cost), (4) interpreting and communicating MFCA results, and (5) improving production practices and reducing material loss through MFCA results (ISO, 2011).

There are two main research streams on MFCA. The first considers conceptual/methodological developments and reviews (Christ and Burritt, 2015; Jasch, 2009; Wagner, 2015), while the second addresses the application of MFCA at the corporate level (Chaiwan *et al.*, 2015; METI, 2010; Schaltegger *et al.*, 2012). Previous MFCA reviews have provided academics, practitioners, and other interested parties with a better understanding of MFCA application and diffusion (Christ and Burritt, 2015; Guenther *et al.*, 2015; Schaltegger and Zvezdov, 2015a). For example, Schaltegger and Zvezdov (2015a) developed a framework for MFCA to support a wide variety of decision-making situations. Another example is that of Christ and Burritt (2015), who raised issues such as a lack of knowledge and application of MFCA in practice. At the time their review was conducted, the evidence on MFCA was limited to a few studies from developing countries. With a small number of such studies, it appears to be helpful to provide a broader understanding of the current state of corporate MFCA application across developing countries and how research into this stream has developed since then.

Developing countries, which are characterized by rapid structural transformation from the agriculture sector to industry and service sectors and are likely to account for nearly 60% of world Gross Domestic Product (GDP) by 2030 (OECD, 2022), have increasingly confronted environmental problems such as the high consumption of natural resources and the creation of massive industrial waste (Mughal *et al.*, 2022). Firms in these countries, which have financial constraints (Bloom *et al.*, 2010), have made efforts to adopt various innovative approaches to resource efficiency improvement and waste reduction (Mughal *et al.*, 2022). A promising tool in this regard is MFCA, as it supports organizations in achieving both economic and environmental performance by analyzing physical material and energy flows as well as related costs (ISO, 2011). However, little is known about existing studies on corporate MFCA application in developing countries.

Moreover, prior research concerning case studies has examined the process of applying MFCA at the micro-level (Herzig *et al.*, 2012; Onishi *et al.*, 2008; Sulong *et al.*, 2015). Through case studies, MFCA applications have played a key role in the transfer of MFCA knowledge to different organizations (Kasemset *et al.*, 2015; Mahmoudi *et al.*, 2017). Furthermore, case studies demonstrate the various environmental and economic benefits of MFCA applications. While MFCA case studies have been demonstrated in prior studies, the main focus has been on solving corporate-level management challenges and assessing the potential for efficiency without explicitly considering the connectedness of corporate MFCA with meso- and macro-level issues (Schaltegger, 2018). With a focus on the micro-level (Fakoya and van der Poll, 2013; Kasemset *et al.*, 2013), it is unclear whether and how MFCA has been supported by government agencies, educators, and other social actors in socio-technical regimes and linked with the meso- and macro-levels. Additionally, prior studies pay limited attention to the role of actors at the meso-level in moving toward broader dissemination of new management techniques and innovations.

MFCA has been diffused through collaborative (pilot) projects in which various seminars, workshops, or E-learning courses were organized to promote its application at the corporate level (Herzig *et al.*, 2012; METI, 2010). Nonetheless, little is known about education on MFCA at universities. So far, there has been significant academic support for implementing sustainability in accounting education (Boyce *et al.*, 2012; Cho and Mäkelä, 2019; Gray and Collison, 2002). Some studies have reflected on *what is taught and integrated* in sustainability accounting courses, such as ethics perspectives (Gray *et al.*, 1994), environmental performance (Wynder *et al.*, 2013), or sociological perspectives (Boyce *et al.*, 2019). Other studies have explored *how material is taught*, which is a pedagogic approach, in sustainability accounting, such as transformative (Saravanamuthu, 2015) and dialogic (Bebbington *et al.*, 2007; Thomson and Bebbington, 2004; Wong *et al.*, 2021). However, there is a lack of knowledge about whether MFCA has been taught at universities and, if so, which teaching methods have been used to educate students in MFCA. Additionally, it is unclear what learning outcomes can be achieved and how student learning can be enhanced through educating on MFCA.

Based on the MFCA literature presented above, three research gaps are identified. First, little is known about existing studies on corporate MFCA application in developing countries. However, understanding MFCA application in these countries is important in the provision of paths for future research on MFCA, which can help contribute to further take-up of MFCA in practice, thereby minimizing or reducing negative environmental effects while strengthening productivity growth and supporting sustainable development. Second, little is known about the connectedness of micro-level MFCA with meso- and macro-level issues—although understanding the links between micro-, meso-, and macro-levels of analysis and barriers to the take-up of MFCA is important in the search for recommendations for policy makers in the pursuit of green productivity for sustainable development, as shown by recent calls for research on the relationship between micro-level applications and higher-level challenges (Bebbington and Unerman, 2020). Third, and finally, little is known about education on MFCA at

universities. However, research on the educational area of sustainability such as MFCA is a vital agenda as it provides potential and long-term views to promoting MFCA for future generations who will be change agents in the future (Hesselbarth and Schaltegger, 2014), thereby contributing to education for sustainable development. With a better understanding of MFCA, students can be harnessed for important competence to further diffuse MFCA and manage corporate sustainability in practice.

To fill these gaps, three research questions are identified and addressed in the three studies of this thesis. In the first study, the research question is: *What is the current knowledge about MFCA application at the micro-level in developing countries?* In the second study, we address the research question: *In what ways are macro-, meso-, and micro-level links related to the development of MFCA?* In the third study, the research question is identified: *How can students' learning be enhanced towards accounting for sustainability through blended case-based learning?* (the study focuses on MFCA diffusion at the university/meso-level). While an analytic framework with guiding questions including bibliographic analysis (year, type, and author), background analysis (methodology, location, size, and industry), and thematic analysis (benefits, process, enablers of, and barriers to MFCA application) is adopted in the first study, two theoretical frameworks (a multi-level framework and a blended case-based framework) are adopted in the second and third studies. These two frameworks are presented next.

1.2.2 Theoretical Frameworks

Christ and Burritt (2015) pointed out that there is a lack of theoretical frameworks used in research on MFCA. The authors suggested some potential theories, such as contingency theory (Gunarathne *et al.*, 2022), institutional theory (Che Ku Kassim *et al.*, 2021), legitimacy theory (Deegan, 2017), stakeholder theory (Marrone *et al.*, 2020), and diffusion of innovation (Rogers, 2003) for research on MFCA and concluded that "while this list is not exhaustive and there are other theoretical approaches and paradigms that may be able to contribute to the further development of this field, it does offer a starting point based on established research on related topics (p.10)."

Recently, the diffusion of innovation theory of Rogers (2003) has been used in some studies on MFCA (Burritt *et al.*, 2019; Sulong *et al.*, 2015). For example, Sulong *et al.* (2015) used this theory to examine MFCA application at a Malaysian company. Another example is that Burritt et al. (2019) used this theory as a major foundation for analyzing five case studies of businesses in Indonesia, the Philippines, and Vietnam to reveal some common characteristics of the diffusion EMA process. The diffusion of innovation theory is regarded as a theoretical framework for analyzing MFCA implementation enablers and barriers in corporations (Sulong *et al.*, 2015). However, this theory is limited to organizational boundaries, without showing the links with macro-level. Recently, Schaltegger *et al.* (2022) suggested using the multi-level framework to show the links of corporate sustainability management accounting across levels.

The multi-level framework has been widely used to understand transitions concerning technological innovations and to explain the social factors in transition pathways (Geels and Schot, 2007; Kanger, 2021). The multi-level framework distinguishes three levels of analysis and their connections: (1) macro-level landscape developments, (2) meso-level socio-technical regimes, and (3) micro-level niche innovations (Geels, 2002). Landscape developments at the macro-level are related to external pressures that develop over long periods of time, set in the epochal environmental crisis (Bebbington *et al.*, 2019). These pressures include global developments and challenges to planetary boundaries (Steffen *et al.*, 2015). Socio-technical regimes refer to sets of rules introduced by various social actors at the meso-level, such as government agencies, consultants, professional associations, and international organizations. Finally, niche innovations occur at the corporate micro-level and include administrative innovations such as MFCA (Geels and Schot, 2007). The multi-level framework is adopted in

the second study because it provides a two-way contextual and transformational analytical bridge across the macro-, meso-, and micro-levels. It also focuses on the analysis of social actors and their interactions with innovations, such as MFCA, at different levels. Finally, it provides a framework for understanding the potential barriers to MFCA transition over time (Geels, 2005).

As presented in Section 1.2.1, the diffusion of MFCA through accounting education at universities has been ignored in the MFCA literature. If this lack of attention continues, students who will be change agents in the future (Hesselbarth and Schaltegger, 2014) may lose opportunities for having access to an innovative tool that can help them address global challenges in practice. Currently, while business schools are embracing sustainable development goals (Weybrecht, 2022), accounting education has faced challenges in enhancing deep learning and developing professional skills toward sustainability (Boyce *et al.*, 2012; Gray *et al.*, 1994; Wong *et al.*, 2021). Sustainability is commonly understood to refer to a triple bottom line, including environmental, social, and economic issues (Byrch *et al.*, 2015) or to meet "the needs of the present without compromising the ability of future generations to meet their own needs" (WECD, 1987, p. 8).

To overcome these challenges, educational pedagogy, such as blended learning and case-based learning, is of vital importance (Gray, 2019). Blended learning is defined as "the thoughtful integration of classroom face-to-face (synchronous) learning experiences with online (asynchronous) learning experiences" (Garrison and Kanuka, 2004, p. 96). A teaching case study is characterized by three fundamental characteristics: a significant business issue or issues, sufficient information on which to base conclusions, and no stated conclusions (Ellet, 2007). Previous studies on accounting education have significantly focused on either case-based (Boyce *et al.*, 2001; Campbell and William, 1991; Raschke and Charron, 2021) or blended learning (Russo *et al.*, 2021; Smith, 2012; Weil *et al.*, 2014). However, there is a lack of evidence on the effectiveness of combining blended learning and case-based learning in accounting courses. No previous studies have explored the use of a blended case-based learning approach in sustainability accounting courses.

Building upon previous research on pedagogies in higher education, a blended case-based framework was integrated in the third study to explore students' learning in MFCA. Three elements of the framework are student characteristics, educator roles, and design features. First, students have different characteristics, such as levels of motivation, attitudes about learning, and responses to specific classroom environments (Felder and Brent, 2005). These individual differences can affect their learning outcomes (Krasodomska and Godawska, 2021; Osgerby, 2013; Paechter *et al.*, 2010). Second, Gerbic (2011) conceptualized four roles of educators concerning the blended approach. These roles are pedagogical, social, technological, and managerial. Third, Kintu *et al.* (2017) found that design features are significant predictors of student learning outcomes in blended courses. These courses need to ensure that both asynchronous and synchronous activities are complementary in a quality learning environment (Garrison and Kanuka, 2004; Smith, 2012; Weil *et al.*, 2014).

1.3 Background Information of the Three Studies

While the first study starts with a review of MFCA application at the micro-level, the second study expands to the national context, where MFCA links across three levels are explored. Then, the third study focuses on MFCA diffusion at the meso-education level. From a multi-level perspective, the three studies of the thesis are connected in relation to the development of MFCA and its links with the micro-, meso-, and macro-levels. In addition, these studies show enablers of and barriers to MFCA diffusion across the three levels. For each study, we provide general information about the research questions, key findings, and future research and development paths.

1.3.1 Material Flow Cost Accounting in Developing Countries: A Systematic Literature Review

The first study addresses the following research question: *What is the current knowledge about MFCA application at the micro-level in developing countries?*

By systematically reviewing the existing literature, our analysis of 28 studies from nine developing countries (China, Indonesia, Iran, Malaysia, South Africa, Sri Lanka, Thailand, the Philippines, and Vietnam) shows that MFCA research has primarily focused on Asian developing countries. Moreover, while the use of MFCA is often associated with improving eco-efficiency, the reviewed studies also indicate high relevance for strategic decision-making processes within organizations. Finally, one of the key challenges in MFCA application reported in developing country studies lies in existing accounting systems with limited data availability and insufficient cost allocation.

Based on our findings and the gaps identified in the MFCA literature, we suggest paths for further research, including the necessity of quantitative research and comparative analysis of MFCA application across countries, the further investigation of MFCA application in SMEs, and the need for further research on MFCA application in various manufacturing and service sectors in developing countries.

1.3.2 Material Flow Cost Accounting in Vietnam - A Multi-level Exploration

The second study seeks to investigate the research question: *In what ways are macro-, meso-, and micro-level links related to the development of MFCA?*

Adopting a multi-level framework, the findings reveal four contextual and transformational links, macro-meso, meso-micro, micro-meso, and micro-macro, in relation to macro-economic strategies, meso-national productivity programs and social actors, and MFCA implementation by micro-business corporations. Six perceived barriers to the development of MFCA across the levels are identified: low environmental awareness and corruption, a high level of compliance with taxation legislation, insufficient data, accounting secrecy, ineffective communication, and a lack of close collaboration among social actors. Given these links and barriers, three recommendations are made for policymakers: meso-level policy guidance on MFCA, potential meso-level reporting pressures, and effective communication between levels.

Based on our findings, future research is needed to extend knowledge about how corporate MFCA can contribute to achieving macro-level sustainable development goals. In addition, because the current case study explores MFCA in Vietnam, to develop generalizations, further research can examine comparison with multi-level settings in other countries, as well as empirical analysis across a larger number of companies. Finally, further research is needed to reveal whether recommendations may be applicable to other countries in which contemporary management accounting tools (including MFCA) are not common but where some institutional and cultural characteristics are similar.

1.3.3 Blended Case-Based Learning in a Sustainability Accounting Course: An Analysis of Student Perspectives

The third paper addresses the research question: *How can students' learning be enhanced towards accounting for sustainability through blended case-based learning?*

Adopting blended case-based learning, our findings show that students enhanced the application of MFCA knowledge with a high level of cognitive objectives, according to Bloom's taxonomy (Gray *et al.*, 1994; Kidwell *et al.*, 2013). Based on recognizing the importance of MFCA in making decisions toward eco-efficiency and sustainable production, over one-third of the students want to apply this tool in their career paths. Along with MFCA

knowledge, our results emphasize that students can enhance their critical thinking, teamwork, and communication skills through blended case-based learning. Three elements—student characteristics, educator roles, and design features—were shown to be crucial for blended case-based learning in accounting for sustainability.

Student characteristics including nationality, background, and learning attitudes affect learning outcomes. In addition, four educator roles—pedagogical, social, technological, and managerial roles—make vital contributions to helping students enhance their learning. Finally, innovations in course design create positive learning feelings for students and enhance their learning outcomes. Specifically, students greatly appreciate the complementation and interactions of learning activities, including both asynchronous and synchronous sessions, and strongly engage with a wide range of learning materials.

Based on our findings, further study on blended case-based learning in various settings, subjects, and programs would be worthwhile. Due to our focus on a course on MFCA for international, non-accounting students at the postgraduate level, the generalizability of the findings is limited. Therefore, future research may explore the learning of accounting students who may have different characteristics when experiencing blended learning with cases. In addition, our study focuses on student perceptions, which play a vital role in demonstrating the effectiveness of blended case-based learning. Building upon our findings, future research could explore educators' perspectives on this educational pedagogy in relation to the design, application, and teaching strategies used in accounting courses. Finally, our study explored the positive effect of innovative learning materials, such as animated and lecture videos, on student learning. Future research should extend knowledge about the primary/supplementary mode of delivery in accounting courses, such as podcasts featuring interviews with experts.

1.4 General Discussion

1.4.1 Diffusion of Material Flow Cost Accounting in the Global Sustainability Context

The first study of the thesis provides a better understanding of MFCA application in developing countries. Our findings show that MFCA research has primarily focused on Asian developing countries. Drawing from our review of papers published between 2009 and 2018, the total number of publications concerning MFCA application in nine developing countries (China, Indonesia, Iran, Malaysia, South Africa, Sri Lanka, Thailand, the Philippines, and Vietnam) is still limited. These findings are consistent with previous findings showing the low level of MFCA application in the global context (Christ and Burritt, 2016; Guenther *et al.*, 2015). In addition, they are complementary with prior reviews, which have not shown sufficient evidence on MFCA application in developing countries (Christ and Burritt, 2015). Based on our findings, we suggest some paths for further research, such as the investigation of MFCA application in extended manufacturing sectors and service industries and an exploration of the process of MFCA application in SMEs in developing countries.

Given these paths, recent studies on MFCA (published 2019–2021) provide a considerable extension to the diffusion of MFCA in various industries, such as wastewater treatment plants (Behnami *et al.*, 2019; Fakoya and Imuezerua, 2020; Ho *et al.*, 2021). Notably, two cases explored the benefits of MFCA in health services (Arieftiara *et al.*, 2021) and agriculture (Dekamin and Barmaki, 2019). These cases make a major contribution to the development of MFCA, as they show potential for the benefits of MFCA in a wide variety of industries (not only in manufacturing sectors) mentioned in ISO (2011). In addition, there is a considerable increase in MFCA publications in SMEs (Nguyen *et al.*, 2020; Sahu *et al.*, 2021) supported by ISO (2021). These academic efforts in collaboration with corporate practices make important contributions to the take-up of MFCA application.

However, it is arguable that the scope of MFCA is still internal to organizations. In other words, these studies have continued to show a strong bias toward action-based corporate case studies. In the context of developed countries, many studies have relied primarily on case studies in Japan (Higashida, 2021; Imai, 2019; Okada *et al.*, 2019; Yagi and Kokubu, 2019) and Germany (May and Guenther, 2020). Regarding developing countries, a number of studies have continuously paid attention to case studies in previously identified contexts, including China (Li *et al.*, 2019), Iran (Behnami *et al.*, 2019; Dekamin and Barmaki, 2019), Malaysia (Ho *et al.*, 2021), South Africa (Fakoya and Imuezerua, 2020), and Vietnam (Nguyen *et al.*, 2020), coupled with a little extension to other emerging countries, such as India (Sahu *et al.*, 2021). Hence, there is a need for future MFCA studies beyond case studies at the corporate level (Christ and Burritt, 2015) and focusing on policymaking in the pursuit of enabling companies' MFCA application toward sustainable targets (Tennojiya *et al.*, 2019).

Given the above calls for extending the scope of MFCA research focusing on internal issues to policymaking research for diffusing the take-up of MFCA, the second study of the thesis explored the links between the macro-, meso-, and micro-levels that have contributed to the development of MFCA in Vietnam, thereby showing how further take-up of MFCA in practice can be encouraged. Considering MFCA application in a national context, the situational and transformational links across the three levels were explored: macro-meso, meso-micro, micro-meso, and micro-macro.

In terms of situational links (macro-meso and meso-micro) affecting MFCA practices, the macro-level for the country to achieve a sustainable economy through increased productivity and meeting its global commitments has largely put pressure on meso-level institutions. At the meso-level, various social actors—international organizations (e.g., the Asian Productivity Organization [APO]), consultancies (e.g., the Vietnam Cleaner Production Centre [VNCPC]), government agencies (e.g., the Ministry of Science and Technology [MOST]), educational institutions (e.g., academic researchers), and other social actors (e.g., industry associations)—have taken an active role in the diffusion of MFCA.

When considering the context of Vietnam, evidence on the involvement of professional accounting associations is restricted to supporting situational meso-mirco links. This finding is different from the study of Zou *et al.* (2019), showing the potential effect of accounting networks such as the International Federation of Accountants on the promotion of EMA. Likewise, this is in contrast with the study of Christ and Burritt (2016), in which ISO 14051 is expected to promote the take-up of MFCA, but this is not the case in Vietnam. However, our findings show the important role of government agencies' support in the development of MFCA, which is consistent with findings from prior cases in the context of developed countries such as Japan (Kokubu and Nakajima, 2004).

It is notable that Vietnamese academic researchers have actively affected corporate MFCA practices in Vietnam through collaborative research projects with international scholars (Nguyen, 2018; Nguyen *et al.*, 2020). Such collaboration is important to exchange knowledge and experience to foster the diffusion of MFCA for the implementation of sustainable development goals (Christ and Burritt, 2019).

Concerning transformational links (micro-meso, micro-macro), successful MFCA application has conversely affected various meso-level actors, such as international organizations (e.g., the APO) and government agencies (e.g., the MOST), after the National Program in relation to increased productivity while reducing environmental impacts actively contributed to the diffusion of MFCA in many Vietnamese enterprises. There is still room for discussing the extended scope of MFCA beyond organizational boundaries, such as the meso-level supply chain encouraged by (ISO, 2017). Recent studies have demonstrated the usefulness of MFCA expansion in other contexts, such as a Japanese company using coordination mechanisms in

supply chain management (Higashida, 2021) and a German company connected with a blackcurrant juice supply chain (May and Guenther, 2020).

Our findings provide a greater understanding of micro-macro transformation. In particular, it shows that MFCA application at the corporate level has the potential for transforming macro-level waste management toward increased national productivity and reduced environmental impacts. Considering MFCA application in other countries such as Japan, it is notable that some Japanese companies, such as Nitto Denko, have promoted and influenced governments to change existing accounting policies and regulations in order to support the take-up of MFCA (Kokubu and Kitada, 2015). Corporate MFCA is linked with macro landscapes such as the circular economy (Nishitani *et al.*, 2022) and sustainable production goals (Okada *et al.*, 2019). These examples have provided valuable evidence of MFCA's potential links with macro sustainability improvement, supporting future MFCA research beyond organizations' boundaries. In this regard, Schaltegger *et al.* (2022, p. 11) emphasized that niche-landscape transformational mechanisms are underdeveloped in extant research on sustainability management accounting due to its limited scope of internal organization:

> With this internal focus, the existing sustainability management accounting literature has not explicitly analyzed how sustainability management accounting could be developed to link situational influences with contributions of the company towards solving sustainable development problems beyond the organization's boundaries […].

Coupled with situational and transformational links, the second study of the thesis has shown six barriers that hampered the broader diffusion of MFCA in Vietnam. These barriers include low environmental awareness and corruption, a high level of compliance with taxation legislation, insufficient data, accounting secrecy, ineffective communication, and a lack of close collaboration among social actors.

Given the 28 papers reviewed in the first paper of the thesis, we found a wide variety of hurdles encountered by various companies during the implementation of MFCA. For example, one of the key challenges in MFCA applications reported in developing country studies is limited data availability. We explained that this barrier exists within various companies due to the limitations of technological capacity and management accounting development. It is arguable that data availability can be facilitated if a company uses enterprise resource planning, where information between departments and processes is integrated and shared (Fakoya and van der Poll, 2013). Other barriers, such as performance appraisal issues and limited experience and knowledge of MFCA, are also found. Recent studies have investigated additional barriers to MFCA application in broader contexts, including in developed countries (Tennojiya *et al.*, 2019; Walz and Günther, 2021). For example, the "developability" of MFCA and the interruption of knowledge by personnel changes are two key challenges that impede the continuous use of MFCA in Japanese companies (Tennojiya *et al.*, 2019).

However, these barriers are only reflected by individual organizations (mostly applied MFCA), with a lack of reflections of related social actors and enterprises (not knowing about or applying MFCA). In the second study of the thesis, we found that insufficient data reflected by different consultancies is a common barrier in Vietnam, hampering the motivations for both companies and consulting institutions to diffuse MFCA. When using the multi-level framework, accounting secrecy is a unique barrier found in the Vietnamese context compared to case findings from other studies. Social actors need to carefully consider such cultural characteristics, thereby making suitable policies and strategies to encourage the take-up of MFCA. Moreover, Sulong *et al.* (2015) revealed the effectiveness of internal communication enabling MFCA implementation at a Malaysian company, while Walz and Günther (2021) showed that no support from authorities is another barrier that impeded MFCA diffusion. In contrast, our findings found that a wide variety of companies have not known about the

existence of MFCA due to ineffective communication between social actors, although a government agency (e.g., the MOST) has largely contributed to further take-up of MFCA. This is an important barrier that must be considered by future implementers and influencers of MFCA.

1.4.2 Teaching Material Flow Cost Accounting in Sustainability Accounting Education

1.4.2.1 The Need for Integrating Sustainability Accounting into the University Curriculum

The faculty and accounting educators need to push for substantial changes in education paths, courses, programs, and curricula in support of advancing sustainability (Cho *et al.*, 2021) for several reasons. First, student demand for learning in sustainability accounting is increasing (Pippin *et al.*, 2021; Sharma and Kelly, 2014) due to their job requirements (Boulianne and Keddie, 2018; Shen *et al.*, 2020), and there is a willingness of students to engage in this contemporary discipline (Ebaid, 2021; Eugenio *et al.*, 2021). In addition, salient stakeholders, such as industry accountants and government representatives, have a strong belief in the necessity of integrating sustainability into the accounting curriculum (Al-Hazaima *et al.*, 2021; Onumah *et al.*, 2021). Finally, the need for this integration is called for and supported by accounting professional associations such as the British Accounting and Finance Association (BAFA, 2022) and universities (University of Birmingham, 2022).

With these emerging needs, we, as accounting educators, should not ignore or postpone our responsibility for creating a sustainable future (Cho and Mäkelä, 2019). Such responsibility needs to be embraced by a wide range of scholars instead of by just a few individuals. Education on sustainability accounting is not just a fashion but also a requisite change. It is believed that integrating sustainability into accounting education is likely to continue to make large-scale changes (Cho *et al.*, 2020) inspired by leading scholars in sustainability accounting (Boyce and Greer, 2013; Gray, 2019; Thomson and Bebbington, 2005).

1.4.2.2 The Inclusion of Sustainability in the Accounting Curriculum

Accounting is long accepted and widely understood as a technical practice undertaken to provide information for internal and external stakeholders (Carnegie *et al.*, 2021). As a result, accountants are perceived as gatekeepers of information rather than as change agents (Schaltegger and Zvezdov, 2015b), and accounting courses have largely emphasized calculative techniques and bookkeeping (Hopper, 2013). It is unsurprising when accounting can be understood to "act autopoietically, regardless of the critical and potentially life-threatening nature of the issues" (Gray, 2019, p. 37). To change such perceptions, sustainability must be "central to the accounting curricula" (Hopper, 2019, p. 95).

However, various themes related to sustainability accounting have been integrated into accounting curricula, depending on teaching preferences (Cho *et al.*, 2020) and experience (Botes *et al.*, 2014), educational strategies of faculty and universities (Boulianne and Keddie, 2018), and institutional commitment (Mburayi and Wall, 2018; Stevenson, 2002). Despite different coverage in teaching accounting for sustainability, three broad themes discussed by Gray (2019) can be embedded in the accounting curriculum: (1) environmental management accounting, (2) capital, and (3) corporate sustainability.

The first theme is potentially valuable for addressing global ecological crises such as planetary boundaries (Cho *et al.*, 2021; Lee *et al.*, 2017; Schaltegger, 2018). It is clear that MFCA as a key tool of EMA may help companies to identify their key problems in existing business models (Álvarez Etxeberria *et al.*, 2017) and support circular economy and sustainable development (Nishitani *et al.*, 2022). Hence, EMA has to be a fundamental topic in the accounting curriculum (Mohammad, 2012; Wynder *et al.*, 2013) because of its links with achieving sustainability goals such as climate change and sustainable production and consumption (ISO, 2021; Okada *et al.*,

2019) and the advantages of updated learning resources (Bebbington *et al.*, 2021; Grimm, 2021; Schaltegger and Burritt, 2017).

The second theme is extended from economic capital to a wider perspective—multi-capital accounting—including social, cultural, and natural capitals such as accounting for biodiversity. Recently, social/ethical issues such as human rights and modern slavery have been emerging topics. These should also be considered for embedding into accounting programs (Boyce *et al.*, 2019; Carnegie, 2021; Gray *et al.*, 1994; Lehman, 2014). Once research on these areas has drawn attention to many scholars who have a strong passion for social change (Christ *et al.*, 2019; Christ *et al.*, 2020), this situation could inspire other scholars, thereby leading to fundamental changes in the structure of accounting courses (Audencia, 2022; Powell and McGuigan, 2022).

The third theme—corporate sustainability, such as corporate social responsibility reporting, non-financial reporting, and ethical reporting—is dominant in many accounting courses (Mangion, 2006) for three reasons. One is that this topic can be taught in support of available instructional resources (e.g., practical reports from corporations) and sustainability frameworks/guidelines (e.g., Global Reporting Initiative, Greenhouse Gas Protocol, International Integrated Reporting Council, and Sustainability Accounting Standards Board). Another is that both firms and stakeholders have been interested in sustainability disclosure (Burke *et al.*, 2020; Michelon and Rodrigue, 2015), which requires the burgeoning integration of this kind of knowledge (Ibrahim *et al.*, 2006; Pippin *et al.*, 2016). Finally, institutional pressures have also affected the integration of corporate reporting into accounting curricula (Senaratne *et al.*, 2022).

Sustainability is commonly understood to refer to a triple bottom line, including environmental, social, and economic issues (Byrch *et al.*, 2015). Hence, three dimensions of sustainability, including the environmental dimension, have to be embedded inclusively (Mathews, 2001) as competitive advantages of universities (Audencia, 2022; Boulianne and Keddie, 2018). Such embeddedness should occur in a systematic manner rather than individual interest (Bebbington, 1997; Lee *et al.*, 2017). We, as accounting educators, need to make changes, thereby moving accounting's capabilities and inherent influence to create a more sustainable world (Carnegie *et al.*, 2021).

1.4.2.3 Approaches to Embedding and Teaching Sustainability in the Accounting Curriculum

The inclusion of sustainability in the accounting curriculum has to be placed in the scrutiny of specific contexts. The question is whether these contexts allow educational freedom to alter course content and program-related decisions (Boyce *et al.*, 2019; Brown and Dillard, 2019; Hazelton and Haigh, 2010). Thus, a number of questions need to be addressed: Who should be taught (accounting and/or non-accounting students)? Should sustainability accounting be a standalone discipline or integrated into existing accounting subjects? Which student levels (undergraduate or postgraduate) are necessary to integrate? Which years should be taught? Should the course be compulsory or selective? Do the faculty and universities have sufficient resources to teach students? How can students' learning be assessed? While these questions may be illustrative (but not exhaustive) to serve as a basis for curriculum decision making, it is important to have considerations for educational needs and curriculum objectives (Apostolou *et al.*, 2013; Howieson, 2003; Onumah *et al.*, 2021).

Thomson and Bebbington (2004) recommend that the process of determining the content of educational programs requires a close connection with the opinions of the students who are the center of dialogic learning. Following this process, the design of the educational process and the action process take place. The design of the educational process refers to various teaching methods that are already in use, such as case-based learning (Boyce *et al.*, 2001; Boyce *et al.*, 2012), problem-based learning (van Mourik and Wilkin, 2019; Wyness and Dalton, 2018), and

transformative learning (Cottafava *et al.*, 2019; Saravanamuthu, 2015), to encourage dialogic education. An action process is related to praxis, which brings more learning opportunities for students to have exposure to dialogic education and create a more first-hand set of experiences through the combination of action and reflection. Overall, dialogic education is regarded as an effective pedagogy for embracing learning in accounting for sustainability (Bebbington *et al.*, 2007; Boyce, 2004; Coulson and Thomson, 2006; Thomson and Bebbington, 2004).

Notably, the use of case studies that facilitate learning in accounting for sustainability (Grimm, 2021) is one of the most common dialogical methods, typically connected with reflective writing and class discussion or presentation (Apostolou *et al.*, 2013). Without a doubt, teaching with cases has brought lifelong benefits, ranging from knowledge to skills (Ellet, 2007). However, case-based learning in accounting for sustainability has been examined in face-to-face environments (Boyce *et al.*, 2019), with a lack of evidence of blended learning. Although educational programs have shifted to blended classrooms, which have become very common during the COVID-19 pandemic, student learning in relation to sustainability accounting courses in such environments has not been reported in the literature. Singh (2021) emphasized that even when learning returns to face-to-face classrooms, the trend toward blended learning post-COVID-19 will continue. The question is whether educators have devoted sufficient time to providing high-quality, blended, and dialogic learning for their students (O'Connell, 2021).

The third study of the thesis provided evidence on the learning outcomes of blended learning in sustainability accounting, including both knowledge and professional skills (critical thinking, teamwork, and communication skills) toward sustainable development. Learning outcomes are achieved through dialogic learning by the enormous efforts of students who have different characteristics and enhanced educator roles (pedagogical, social, technological, and managerial roles). More importantly, the effectiveness of comprehensive innovation in course design (both learning activities and materials) was shown to be crucial for dialogic learning in accounting for sustainability.

Our findings provide successful evidence of blended learning because of the creation of a cohesive community of inquiry in which learners and educators interact effectively through learning activities and materials in relation to social presence and teaching presence to cultivate cognitive knowledge formation and develop professional skills (Garrison and Anderson, 2003). In our blended case-based course, the use of a variety of innovative technologies, such as animated and lecture videos in face-to-face activities combined with games utilized in online sessions, has created a strategic mix that increases student success (Prinsloo and van Rooyen, 2007). In this regard, Cohen (2022) agreed that lecture videos should be used with an insightful purpose instead of personal convenience. Finally, our findings show that both asynchronous and synchronous activities are complementarily designed in a high-quality learning environment. These findings are consistent with recommendations from prior studies (Garrison and Kanuka, 2004; Smith, 2012; Weil *et al.*, 2014) and support the view that systematic and thoughtful integration of the various delivery modes of blended learning is of vital importance to meet students' needs and expectations (Garrison and Anderson, 2003).

Overall, based on the findings, we discussed the diffusion of MFCA in the global sustainability context and the teaching of MFCA in sustainability accounting education. From a multi-level perspective, we emphasize the interconnectedness of various actors across levels to encourage further take-up of MFCA, ranging from micro-level corporations to meso-level actors such as researchers, government agencies, and educational institutions toward macro-level sustainability. While business corporations have been placed under pressure to achieve higher productivity with reduced environmental impacts, the diffusion of MFCA among these corporations is considered to be an effective approach for the achievement of goals in relation to sustainability in production (SDG12) (Kokubu and Tachikawa, 2013; Okada *et al.*, 2019; Pforzheim University, 2022). Moreover, when accounting education has faced challenges in

enhancing deep learning and developing professional skills toward sustainability, integrating MFCA into the accounting curriculum, coupled with utilizing dialogic pedagogies (e.g., blended case-based teaching), may foster learning in the next generation, for example, accountants and managers, who are enabled to support achieving the goal of education for sustainable development (Target 4.7 of SDG 4).

1.5 General Conclusions

Nations are challenged to achieve higher economic growth and reduce environmental impacts. The creation and diffusion of innovative management tools such as MFCA are fundamental to addressing these global challenges and making transitions to greener growth (OECD, 2019). Addressing these challenges requires the close collaboration of different actors, including us as researchers. Hence, this thesis aims to analyze how further take-up of MFCA in practice can be encouraged to support sustainable development. To achieve the aim of the thesis, the central research question is identified: *How is MFCA diffused across micro-, meso-, and macro-levels to support sustainable development?* From a multi-level perspective, three studies of the thesis are connected in relation to the development of MFCA and its links with micro-, meso-, and macro-levels. The first study begins with a review of MFCA application at the micro/corporate level. Then, the second study expands to the national scale, where MFCA links across the three levels are explored. Lastly, the third study focuses on MFCA diffusion at the meso-level (e.g., a university). In addition, these studies show enablers of and barriers to MFCA diffusion across the three levels reflected by different actors such as corporations, government agencies, consultancies, educators, and students. Overall, the three studies propose different ways to further take-up of MFCA application in supporting sustainable development.

The findings of the first study provide a better understanding of research on MFCA application at the corporate level in developing countries, thereby providing evidence of enablers and barriers to its application and suggesting future research paths. The results of the second study reveal the perceived salience of four MFCA links (macro-meso, meso-micro, micro-meso, and micro-macro) and six perceived barriers to the diffusion of MFCA across the levels, thereby making three recommendations for policy makers. The findings of the third study provide evidence of learning outcomes, including both MFCA knowledge and professional skills toward sustainable development. In addition, three elements of blended case-based learning—student characteristics, educator roles, and design features—are shown to be crucial for learning in MFCA. Based on the findings, the thesis makes several theoretical and managerial contributions.

1.5.1 Theoretical Contributions

In the first study, presented in Chapter 2, we reviewed 28 studies on MFCA application in nine developing countries (China, Indonesia, Iran, Malaysia, South Africa, Sri Lanka, Thailand, the Philippines, and Vietnam). Although there has been a considerable increase in the quantity of studies and special issue calls for papers from peer-reviewed journals on accounting in developing countries, MFCA research has been largely neglected so far. In addition, reviews that have addressed MFCA in the literature have mainly focused on MFCA practices in general rather than examining specific regions. Our findings show a strong bias toward Asian regions in the scope of MFCA research. While the application of MFCA is often connected to improving eco-efficiency, the reviewed studies also indicate a high relevance for supporting strategic decision-making processes. Moreover, the current accounting system, including limited data availability and insufficient cost allocation, is the key challenge in MFCA application reported in developing country studies. Overall, our findings contribute to providing a fuller picture of the MFCA literature, thereby providing paths for future research.

The second study (presented in Chapter 3) demonstrates the importance of top-down (context) and bottom-up (transformation) links across three levels of analysis, using the multi-level

perspective framework proposed by Schaltegger *et al.* (2022). Overall, the study illustrates a novel application of the framework used to reveal these linkages and the barriers to linkages in the chosen setting of Vietnam and MFCA. More specifically, the links with MFCA context and transformation were examined, with the results indicating four potential links: macro–meso, meso-micro, micro-meso, and micro-macro. In the context of the chosen developing country, Vietnam, analysis reveals the close connection of corporate MFCA with the meso-level regime through the government agency (the MOST), consultancies (the VNCPC and Institute of Management Technology), international organizations (the APO, Capacity Building International [Germany], and the Association for Overseas Technical Cooperation and Sustainable Partnerships [Japan]), and Vietnamese researchers. Furthermore, the results show how MFCA is linked with the meso-economic national productivity program to encourage transformation toward waste reduction and green productivity, which encourages the development of MFCA through funding, consultancies, workshops, and published MFCA guidelines. Moreover, the findings explore six barriers to MFCA application beyond internal organizational boundaries (low environmental awareness and corruption, a high level of compliance with taxation, insufficient data, accounting secrecy, ineffective communication, and a lack of close collaboration among social actors), which were not discovered in prior studies (Walz and Günther, 2021). Finally, our qualitative findings contribute to MFCA literature in the area of policymaking research called by Tennojiya *et al.* (2019) when making specific recommendations for policy makers to enhance the development of MFCA in Vietnam.

While previous research has shown a lack of evidence on learning outcomes in relation to accounting for sustainability, our third study (presented in Chapter 4) specifically reveals that MFCA knowledge is acquired and professional skills toward sustainability (critical thinking, teamwork, and communication skills) are enhanced. This finding contributes to addressing the knowledge and skill gap raised in accounting education literature (Al-Hazaima *et al.*, 2021; Wolcott and Sargent, 2021). Moreover, our exploratory findings contribute to pedagogical approaches in accounting education when complementing a blended case-based learning approach, which has rarely been mentioned in previous studies (Apostolou *et al.*, 2021; Parsons *et al.*, 2020; Weil *et al.*, 2011). Notably, our study is the first to apply this approach in sustainability accounting education, in addition to other educational pedagogies, such as problem-based learning (Wyness and Dalton, 2018) and transformative learning (Saravanamuthu, 2015). Finally, our study is a unique case that indicates a vital topic of education on MFCA, which has been given little attention by accounting scholars.

1.5.2 Managerial Contributions

This thesis offers managerial implications for two salient groups: policy makers and educators.

First, the findings of our study presented in Chapter 3 demonstrate that corporate MFCA has a close link to waste reduction, which enhances green productivity. In light of better macro-management for enhancing productivity and reducing environmental consequences, three recommendations are made for policy makers: meso-level policy guidance on MFCA, potential meso-level reporting pressures, and effective communication between levels. When our recommendations for the Vietnamese policy makers are taken into practice, a promising future for a circular economy and a sustainable nation can be achieved.

Meso-level policy guidance on MFCA. To date, there are no existing legislative regulations or guidance on MFCA proposed by the Vietnamese Ministry of Finance (MOF). Hence, we recommended that the MOF might be better suited to be the leading/collaborative unit for proposing and diffusing MFCA guidance to accountants, instead of the Ministry of Science Technology alone, since from the interviews it appeared ineffective as accountants were unaware of the MFCA guideline.

Potential meso-level reporting pressures. The MOF could introduce MFCA reporting pressure in the control of taxation and environmental activities. For example, MFCA calculations could be integrated into reports concerning environmental protection taxes and environmental protection fees. Meanwhile, the Vietnamese Ministry of Natural Resources and Environment (MONRE) could promote MFCA as a policy tool to strengthen the effectiveness of existing government regulations. For example, Environmental Impact Assessment Reporting regarding the MONRE could be integrated with MFCA, leading to the provision of transparent corporate MFCA information, which could be aggregated for policymaking at higher levels, such as for industries, regions, and at the national level.

Effective communication between levels. Concerning communication content, MFCA needs to emphasize further environmental aspects, as policy makers have not yet considered MFCA as a powerful tool to solve environmental problems in Vietnam. Indeed, MFCA is overemphasized as an innovative tool to increase productivity and reduce costs, given the 712 National Program implemented by the MOST. We recommend that it is necessary to accumulate typical examples showing the links between MFCA and other emerging concepts in existing legislation and strategies, such as a circular economy or sustainability reporting. Along with mass media channels, government agencies should collaborate closely with private institutions, such as consultancies, the Vietnam Business Council for Sustainable Development, and industry associations, to strengthen face-to-face communication, as these institutions are engaged in the enterprises' business activities.

Second, the findings of our study presented in Chapter 4 show that blended learning with a case study is an enjoyable journey for students when diving into real practice. Using this approach has a wide variety of benefits, ranging from acquiring knowledge to gaining professional skills such as critical thinking, teamwork, and communication skills. Based on our findings, we offer three practical implications for educators: the necessity of understanding student characteristics, the adoption of various educator roles, and innovation in course design.

The necessity of understanding student characteristics. Student diversity is a crucial asset for the success of the classroom, as students have different backgrounds, opinions, and perspectives. Given that blended case-based learning relates to the dialogic approach, educators should not ignore student characteristics such as their nationality and mental health. When educators understand the diversity of students thoroughly, they can engage with students effectively and help them achieve learning objectives (Felder and Brent, 2005).

The adoption of various educator roles. COVID-19 has changed educational challenges and the way students and educators think, interact, and take actions (Tharapos, 2021). In terms of the pedagogical role in blended learning, an educator not only provides lectures but also acts as a facilitator through using questions and probes for student responses during their discussions. Given the lack of student engagement in blended education (Sangster *et al.*, 2020), the social role is of vital importance due to the ability to enable students to engage in interactive learning (Lux *et al.*, 2022). Moreover, given the increasing need to integrate blended learning into higher education (Alammary *et al.*, 2014), educators should develop technological skills to adapt to this type of learning. Finally, educators need to be involved in managerial roles, which require a thorough consideration of the delivery mode and curricula to foster interactive dialogues within students. Although each educator has different teaching styles, specific educator roles such as pedagogical, social, technological, and managerial roles should be identified and adopted inclusively to cultivate student blended learning and unleash their potential.

Innovation in course design. Course design plays a key role in enhancing learning interactions in blended classrooms (Helms, 2014). However, selecting the most appropriate approach for blended case-based learning design is challenging for educators, especially those who have a lack of theoretical preparation and experimental experience with blended learning (Alammary

et al., 2014). In this regard, blended course design should be based on knowledge categories or learning objectives (Huang and Zhou, 2005), thereby utilizing asynchronous and synchronous learning activities and materials such as videos, quizzes, podcasts, and real cases/experiential learning (see **Appendix**) in an appropriate manner (Garrison and Kanuka, 2004). When it comes to blended teaching with cases, there have been daunting challenges such as workload and technological problems (Case Centre, 2021). However, if educators want to continue to make significant changes in sustainability (accounting) education (Cho *et al.*, 2020), they need to rethink and redesign how they teach as much as what they teach (Gray, 2019).

To conclude, this thesis analyzes how further take-up of MFCA in practice can be encouraged to support sustainable development. Addressing the global challenges requires actions taken by different social actors across multiple levels, ranging from researchers to policy makers and educators, in line with the promotion of MFCA. Researchers play a vital role in diffusing MFCA through further (action-driven) studies in relation to supporting sustainable production (Kokubu and Tachikawa, 2013; Okada *et al.*, 2019; Pforzheim University, 2022). Paths for future studies in relation to MFCA application and its links with meso- and macro-levels are suggested in this thesis, such as the quantitative research and comparative analysis of MFCA application across countries, MFCA application in SMEs, MFCA application in various manufacturing and service sectors in developing countries, and the contribution of corporate MFCA to achieving macro-level sustainable development goals in different settings. Moreover, it is crucial to have the close engagement of policy makers in diffusing MFCA toward sustainable development through providing meso-level policy guidance on MFCA, making potential meso-level reporting pressures, and conducting effective communication between levels. Last but not least, educators could contribute to diffusing MFCA by embedding this tool into sustainability (accounting) curricula and programs, coupled with utilizing dialogic pedagogies (e.g., blended case-based teaching). This may foster learning in the next generation, for example, accountants and managers, who are enabled to support achieving the goal of education for sustainability.

Inspired by researchers and educators in sustainability accounting (Bebbington and Unerman, 2020; Burritt *et al.*, 2021; Gray, 2019; Schaltegger *et al.*, 2022; Thomson and Bebbington, 2005), the thesis was written with the motivation of addressing practical problems and contributing to pushing for ongoing changes in research and teaching paths in order to make significant impacts (Cho and Mäkelä, 2019; Rinaldi, 2022). As Cho *et al.* (2020, p. 1000) accentuated, "We can do more. Let's make it a collective goal." We hope our contributions and recommendations will draw attention to researchers, policy makers, and educators and look forward to large-scale changes to create a sustainable world.

1.6 Appendix

Appendix 1.1 Using podcasts featuring interviews with experts in accounting education

Tran, T.T., Herzig, C. (Under Review, Date of submission: 20 March 2022): Engaging students through using podcasts: experience from a blended accounting course, *The British Accounting Review* (Scopus Q1, ABS 3*).

Abstract: The COVID-19 pandemic has created not only challenges concerning student engagement but also enormous opportunities to innovate learning approaches and materials. The design and use of podcasts for accounting education have various benefits, including increased learning performance. While lecture podcasts have been widely used in higher education, the use of podcasts featuring interviews with experts is still limited. This study aims to explore how students interact with interview-based podcasts to enhance their knowledge and professional skills. The case study method was used; data were collected through 36 learning journals that students kept while taking a blended accounting course. The results showed that, through these interview-based podcasts, students enhanced their knowledge of material flow cost accounting and environmental management accounting, and critical thinking skills. This effective learning is achieved by the convergence of three aspects: student learning styles (auditory or visual); the richness of information provided by the experts, leading to students' high level of attention; and students' opportunities to interact with the information provided by the experts and connect it to other course learning materials. The findings are useful for educators as they provide insights into students' effective learning with interview-based podcasts and 'good practices' for using these podcasts.

Appendix 1.2 Experiential learning in accounting education

Tran, T.T., Herzig, C. (Accepted for presentation): Learning processes and barriers to experiential learning in accounting education: an exploratory case study, *44th Annual Congress of the European Accounting Association*, NHH Norwegian School of Economics, 11-13 May 2022 (https://eaa2022.eaacongress.org/r/default.asp?iId=JGLMEJ).

Abstract: The paper aims to explore students' experiential learning processes and barriers to their learning within these processes. An exploratory case study was used in relation to a course on material flow cost accounting. Data were collected in form of in-depth interviews with students and learning journals developed for the course. Using experiential learning theory, the paper demonstrates that the learning cycle can vary among non-accounting students with diverse learning styles: diverger, assimilator, converger, and accommodator. Through the exploration of their learning cycles, the study reveals five barriers to students' experiential learning, including the selection of relevant information from the case, the lack of previous experience in learning with cases, the increasingly complex level of the tasks, time management, and writing learning journals. Despite these barriers, students have shown to be very active in experiential learning and to appreciate working in teams. The paper makes several contributions. This study is the first one to describe the learning cycle of non-accounting students that has given little attention in accounting education literature so far. Moreover, while experiential education research is limited to traditional accounting, the paper provides evidence on sustainability in accounting education and explores challenges students face in the learning process based on a real case study on material flow cost accounting. Overall, the findings are relevant for accounting educators as they provide a foundation for designing and implementing accounting programs that promote active learning opportunities and enhance professional skills.

1.7 References

Alammary, A., Sheard, J. and Carbone, A. (2014), "Blended learning in higher education: three different design approaches", *Australasian Journal of Educational Technology*, Vol. 30 No. 4, pp. 440–454.

Alawattage, C., Wickramasinghe, D., Tsamenyi, M. and Uddin, S. (2017), "Doing critical management accounting research in emerging economies", *Advances in Scientific and Applied Accounting*, Vol. 10 No. 2, pp. 177–188.

Al-Hazaima, H., Low, M. and Sharma, U. (2021), "Perceptions of salient stakeholders on the integration of sustainability education into the accounting curriculum: a Jordanian study", *Meditari Accountancy Research*, Vol. 29 No. 2, pp. 371–402.

Álvarez Etxeberria, I., Ortas, E. and Schaltegger, S. (2017), "Innovative measurement for corporate sustainability", *Sustainable Development*, Vol. 25 No. 2, pp. 111–112.

Apostolou, B., Dorminey, J.W. and Hassell, J.M. (2021), "Accounting education literature review (2020)", *Journal of Accounting Education*, Vol. 55, p. 100725.

Apostolou, B., Dull, R.B. and Schleifer, L.L.F. (2013), "A framework for the pedagogy of accounting ethics", *Accounting Education*, Vol. 22 No. 1, pp. 1–17.

Arieftiara, D., Theresa, R.M. and Sari, R. (2021), "Sustainability in health service industry: the implementation of Material Flow Cost Accounting (MFCA) as an eco-efficient analysis", *Journal of Southeast Asian Research*, Vol. 2021 No. 747009, pp. 1–15.

Audencia (2022), "Executive MBA Chief Value Officer: The first worldwide Chief Value Officer MBA !", available at: https://executive.audencia.com/en/programmes-in-english/mba-chief-value-officer/ (accessed 7 January 2022).

BAFA (2022), "Building Sustainability into the Accounting and Finance Curriculum", available at: https://bafa.ac.uk/subgroups/cdaf/events/events-upcoming/cdaf-workshop-4-march-2022.html (accessed 6 January 2022).

Bebbington, J. (1997), "Engagement, education and sustainability", *Accounting Auditing & Accountability Journal*, Vol. 10 No. 3, pp. 365–381.

Bebbington, J., Brown, J., Frame, B. and Thomson, I. (2007), "Theorizing engagement: the potential of a critical dialogic approach", *Accounting Auditing & Accountability Journal*, Vol. 20 No. 3, pp. 356–381.

Bebbington, J., Larrinaga, C., O'Dwyer, B., Thomson, I. and O'Dwyer, B. (Eds.) (2021), *Routledge Handbook of Environmental Accounting*, Routledge, New York, NY.

Bebbington, J., Österblom, H., Crona, B., Jouffray, J.-B., Larrinaga, C., Russell, S. and Scholtens, B. (2019), "Accounting and accountability in the Anthropocene", *Accounting, Auditing & Accountability Journal*, Vol. 33 No. 1, pp. 152–177.

Bebbington, J. and Unerman, J. (2020), "Advancing research into accounting and the UN sustainable development goals", Vol. 33 No. 7, pp. 1657–1670.

Beckerman, W. (1992), "Economic growth and the environment: Whose growth? Whose environment?", *World Development*, Vol. 20 No. 4, pp. 481–496.

Behnami, A., Zoroufchi Benis, K., Shakerkhatibi, M., Fatehifar, E., Derafshi, S. and Chavoshbashi, M.M. (2019), "Integrating data reconciliation into material flow cost accounting: the case of a petrochemical wastewater treatment plant", *Journal of Cleaner Production*, Vol. 218, pp. 616–628.

Bloom, N., Mahajan, A., McKenzie, D. and Roberts, J. (2010), "Why do firms in developing countries have low productivity?", *American Economic Review*, Vol. 100 No. 2, pp. 619–623.

Botes, V., Low, M. and Chapman, J. (2014), "Is accounting education sufficiently sustainable?", *Sustainability Accounting, Management and Policy Journal*, Vol. 5 No. 1, pp. 95–124.

Boulianne, E. and Keddie, S.L. (2018), "Where is sustainability within the Canadian CPA education program?", in Belal, A. and Cooper, S. (Eds.), *Sustainability Accounting, Advances in Environmental Accounting & Management*, Vol. 7, Emerald Publishing Limited, pp. 71–112.

Boyce, G. (2004), "Critical accounting education: teaching and learning outside the circle", *Critical Perspectives on Accounting*, Vol. 15 No. 4-5, pp. 565–586.

Boyce, G. and Greer, S. (2013), "More than imagination: making social and critical accounting real", *Critical Perspectives on Accounting*, Vol. 24 No. 2, pp. 105–112.

Boyce, G., Greer, S., Blair, B. and Davids, C. (2012), "Expanding the horizons of accounting education: incorporating social and critical perspectives", *Accounting Education*, Vol. 21 No. 1, pp. 47–74.

Boyce, G., Narayanan, V., Greer, S. and Blair, B. (2019), "Taking the pulse of accounting education reform: liberal education, sociological perspectives, and exploring ways forward", *Accounting Education*, Vol. 28 No. 3, pp. 274–303.

Boyce, G., Williams, S., Kelly, A. and Yee, H. (2001), "Fostering deep and elaborative learning and generic (soft) skill development: the strategic use of case studies in accounting education", *Accounting Education*, Vol. 10 No. 1, pp. 37–60.

Brown, J. and Dillard, J. (2019), "Accounting education, democracy and sustainability: taking divergent perspectives seriously", *International Journal of Pluralism and Economics Education*, Vol. 10 No. 1, pp. 24–45.

Burke, Q.L., Chen, P.-C. and Lobo, G.J. (2020), "Is corporate social responsibility performance related to conditional accounting conservatism?", *Accounting Horizons*, Vol. 34 No. 2, pp. 19–40.

Burritt, R., Christ, K. and Schaltegger, S. (2021), "Materials and energy accounting", in Bebbington, J., Larrinaga, C., O'Dwyer, B., Thomson, I. and O'Dwyer, B. (Eds.), *Routledge Handbook of Environmental Accounting*, Routledge, New York, NY, pp. 207–223.

Burritt, R.L., Herzig, C., Schaltegger, S. and Viere, T. (2019), "Diffusion of environmental management accounting for cleaner production: evidence from some case studies", *Journal of Cleaner Production*, Vol. 224, pp. 479–491.

Byrch, C., Milne, M.J., Morgan, R. and Kearins, K. (2015), "Seeds of hope? Exploring business actors' diverse understandings of sustainable development", *Accounting Auditing & Accountability Journal*, Vol. 28 No. 5, pp. 671–705.

Campbell, J.E. and William, F.L. (1991), "Using cases in accounting classes", *Issues in Accounting Education*, Vol. 6 No. 2, pp. 276–283.

Carnegie, G., Parker, L. and Tsahuridu, E. (2021), "It's 2020: What is accounting today?", *Australian Accounting Review*, Vol. 31 No. 1, pp. 65–73.

Carnegie, G.D. (2021), "Accounting 101: redefining accounting for tomorrow", *Accounting Education*, pp. 1–14.

Case Centre (2021), "Online case teaching survey 2021: the results", available at: https://www.thecasecentre.org/caseMethod/features/CTsurvey2021results (accessed 11 January 2022).

Chaiwan, W., Boonmee, C. and Kasemset, C. (2015), "Waste reduction in meat processing industry: The application of MFCA (ISO 14051)", in Kachitvichyanukul, V., Sethanan, K. and Golinska-Dawson, P. (Eds.), *Toward Sustainable Operations of Supply Chain and Logistics Systems*, Springer, Cham, pp. 183–193.

Che Ku Kassim, C.K.H., Adnan, N.L. and Ali, R. (2021), "Institutional pressures influencing environmental management accounting adoption by Malaysian local governments", *Journal of Accounting & Organizational Change* Vol. ahead-of-print, No. ahead-of-print.

Cho, C.H., Kim, A., Rodrigue, M. and Schneider, T. (2020), "Towards a better understanding of sustainability accounting and management research and teaching in North America: a look at the community", *Sustainability Accounting, Management and Policy Journal*, Vol. 11 No. 6, pp. 985–1007.

Cho, C.H. and Mäkelä, H. (2019), "Can accountants save the world? Incorporating sustainability in accounting courses and curricula", available at: https://arc.eaa-online.org/blog/can-accountants-save-world-incorporating-sustainability-accounting-courses-and-curricula (accessed 25 May 2021).

Cho, C.H., Senn, J. and Sobkowiak, M. (2021), "Sustainability at stake during COVID-19: exploring the role of accounting in addressing environmental crises", *Critical Perspectives on Accounting*, p. 102327.

Christ, K.L. and Burritt, R.L. (2015), "Material flow cost accounting: a review and agenda for future research", *Journal of Cleaner Production*, Vol. 108, pp. 1378–1389.

Christ, K.L. and Burritt, R.L. (2016), "ISO 14051: A new era for MFCA implementation and research", *Revista de Contabilidad*, Vol. 19 No. 1, pp. 1–9.

Christ, K.L. and Burritt, R.L. (2019), "Implementation of sustainable development goals: the role for business academics", *Australian Journal of Management*, Vol. 44 No. 4, pp. 571–593.

Christ, K.L., Burritt, R.L. and Schaltegger, S. (2020), "Accounting for work conditions from modern slavery to decent work", *Accounting Auditing & Accountability Journal*, Vol. 33 No. 7, pp. 1481–1504.

Christ, K.L., Rao, K.K. and Burritt, R.L. (2019), "Accounting for modern slavery: an analysis of Australian listed company disclosures", *Accounting Auditing & Accountability Journal*, Vol. 32 No. 3, pp. 836–865.

Cohen, J.A. (2022), "Considerations associated with synchronous and asynchronous video use in online learning", *Development and Learning in Organizations: An International Journal*, Vol. ahead-of-print No. ahead-of-print.

Cottafava, D., Cavaglià, G. and Corazza, L. (2019), "Education of sustainable development goals through students' active engagement", *Sustainability Accounting, Management and Policy Journal*, Vol. 10 No. 3, pp. 521–544.

Coulson, A.B. and Thomson, I. (2006), "Accounting and sustainability, encouraging a dialogical approach; integrating learning activities, delivery mechanisms and assessment strategies", *Accounting Education*, Vol. 15 No. 3, pp. 261–273.

Deegan, C. (2017), "Twenty five years of social and environmental accounting research within Critical Perspectives of Accounting: Hits, misses and ways forward", *Critical Perspectives on Accounting*, Vol. 43, pp. 65–87.

Dekamin, M. and Barmaki, M. (2019), "Implementation of material flow cost accounting (MFCA) in soybean production", *Journal of Cleaner Production*, Vol. 210, pp. 459–465.

Ebaid, I.E.-S. (2021), "Sustainability and accounting education: perspectives of undergraduate accounting students in Saudi Arabia", *Journal of Applied Research in Higher Education*, Vol. ahead-of-print No. ahead-of-print.

Ellet, W. (2007), *The Case Study Handbook: How to Read, Discuss, and Write Persuasively about Cases*, Harvard Business Press, Boston, MA.

Eugenio, T., Carreira, P., Miettinen, N. and Lourenço, I.M.E.C. (2021), "Understanding students' future intention to engage in sustainability accounting: the case of Malaysia and

the Philippines", *Journal of Accounting in Emerging Economies*, Vol. ahead-of-print No. ahead-of-print.

Fakoya, M.B. and Imuezerua, E.O. (2020), "Improving water pricing decisions through material flow cost accounting model: a case study of the Politsi Water Treatment Scheme in South Africa", *Environment, Development and Sustainability*, Vol. 23 2243–2260.

Fakoya, M.B. and van der Poll, H.M. (2013), "Integrating ERP and MFCA systems for improved waste-reduction decisions in a brewery in South Africa", *Journal of Cleaner Production*, Vol. 40, pp. 136–140.

FAO (2017), *The Future of Food and Agriculture–Trends and Challenges,* Annual Report 296, Rome.

Felder, R.M. and Brent, R. (2005), "Understanding student differences", *Journal of Engineering Education*, Vol. 94 No. 1, pp. 57–72.

Garrison, D.R. and Anderson, T. (2003), *E-learning in the 21st Century: A Framework for Research and Practice*, Routledge/Falmer, London.

Garrison, D.R. and Kanuka, H. (2004), "Blended learning: uncovering its transformative potential in higher education", *The Internet and Higher Education*, Vol. 7 No. 2, pp. 95–105.

Geels, F.W. (2002), "Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study", *Research Policy*, Vol. 31 No. 8-9, pp. 1257–1274.

Geels, F.W. (2005), "The dynamics of transitions in socio-technical systems: a multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930)", *Technology Analysis & Strategic Management*, Vol. 17 No. 4, pp. 445–476.

Geels, F.W. and Schot, J. (2007), "Typology of sociotechnical transition pathways", *Research Policy*, Vol. 36 No. 3, pp. 399–417.

Gerbic, P. (2011), "Teaching using a blended approach – what does the literature tell us?", *Educational Media International*, Vol. 48 No. 3, pp. 221–234.

Gray, R. (2019), "Sustainability accounting and education: conflicts and possibilities", in Amaeshi, K., Muthuri, J.N. and Ogbechie, C. (Eds.), *Incorporating Sustainability in Management Education*, Springer International Publishing, Cham, pp. 33–54.

Gray, R., Bebbington, J. and McPhail, K. (1994), "Teaching ethics in accounting and the ethics of accounting teaching: educating for immorality and a possible case for social and environmental accounting education", *Accounting Education*, Vol. 3 No. 1, pp. 51–75.

Gray, R. and Collison, D. (2002), "Can't see the wood for the trees, can't see the trees for the numbers? Accounting education, sustainability and the Public Interest", *Critical Perspectives on Accounting*, Vol. 13 No. 5-6, pp. 797–836.

Grimm, S.D. (2021), "Junkyard planet: using stories to teach managerial accounting with a sustainability theme", *Issues in Accounting Education*, Vol. 36 No. 4, pp. 253–280.

Guenther, E., Jasch, C., Schmidt, M., Wagner, B. and Ilg, P. (2015), "Material Flow Cost Accounting – looking back and ahead", *Journal of Cleaner Production*, Vol. 108, pp. 1249–1254.

Gunarathne, N., Lee, K.-H. and Hitigala Kaluarachchilage, P.K. (2022), "Tackling the integration challenge between environmental strategy and environmental management accounting", *Accounting, Auditing & Accountability Journal*, Vol. ahead-of-print No. ahead-of-print.

Hazelton, J. and Haigh, M. (2010), "Incorporating sustainability into accounting curricula: lessons learnt from an action research study", *Accounting Education*, Vol. 19 1-2, pp. 159–178.

Helms, S.A. (2014), “Blended/hybrid courses: a review of the literature and recommendations for instructional designers and educators”, *Interactive Learning Environments*, Vol. 22 No. 6, pp. 804–810.

Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (Eds.) (2012), *Environmental Management Accounting: Case Studies of South-East Asian Companies*, Routledge, London.

Hesselbarth, C. and Schaltegger, S. (2014), “Educating change agents for sustainability – learnings from the first sustainability management master of business administration”, *Journal of Cleaner Production*, Vol. 62, pp. 24–36.

Higashida, A. (2021), “Supply chain MFCA implementation: emphasizing evidence on coordination”, *Sustainability Accounting, Management and Policy Journal*, Vol. 12 No. 4, pp. 695–718.

Ho, J.Y., Ng, D.K., Wan, Y.K. and Andiappan, V. (2021), “Synthesis of wastewater treatment plant based on minimal waste generation cost: a material flow cost accounting (MFCA) approach”, *Process Safety and Environmental Protection*, Vol. 148, pp. 559–578.

Hopper, T. (2013), “Making accounting degrees fit for a university”, *Critical Perspectives on Accounting*, Vol. 24 No. 2, pp. 127–135.

Hopper, T. (2019), “Stop accounting myopia: – think globally: a polemic”, *Journal of Accounting & Organizational Change*, Vol. 15 No. 1, pp. 87–99.

Hopper, T., Lassou, P. and Soobaroyen, T. (2017), “Globalisation, accounting and developing countries”, *Critical Perspectives on Accounting*, Vol. 43, pp. 125–148.

Hottenroth, H., Sutardhio, C., Weidlich, A., Tietze, I., Simon, S., Hauser, W., Naegler, T., Becker, L., Buchgeister, J., Junne, T., Lehr, U., Scheel, O., Schmidt-Scheele, R., Ulrich, P. and Viere, T. (2022), “Beyond climate change. Multi-attribute decision making for a sustainability assessment of energy system transformation pathways”, *Renewable and Sustainable Energy Reviews*, Vol. 156, p. 111996.

Howieson, B. (2003), “Accounting practice in the new millennium: is accounting education ready to meet the challenge?”, *The British Accounting Review*, Vol. 35 No. 2, pp. 69–103.

Huang, R. and Zhou, Y. (2005), “Designing blended learning focused on knowledge category and learning activities”, in Bonk, C.J. and Graham, C.R. (Eds.), *Handbook of Blended Learning: Global Perspectives, Local Designs*, Pfeiffer Publishing, San Francisco, CA, pp. 296–310.

Ibrahim, N.A., Angelidis, J.P. and Howard, D.P. (2006), “Corporate social responsibility: a comparative analysis of perceptions of practicing accountants and accounting students”, *Journal of Business Ethics*, Vol. 66 2-3, pp. 157–167.

Imai, N. (2019), “Material flow time costing: new management accounting concept consistent with Toyota production system and material flow cost accounting”, in Kokubu, K. and Nagasaka, Y. (Eds.), *Sustainability Management and Business Strategy in Asia*, *Japanese Management and International Studies*, Vol. 16, World Scientific, pp. 113–127.

ISO (2011), *ISO 14051:2011 Environmental Management - Material Flow Cost Accounting - General Framework*, Geneva, Switzerland.

ISO (2017), *ISO 14052: 2017 Environmental Management - Material Flow Cost Accounting - Guidance for Practical Implementation in a Supply Chain*, Geneva, Switzerland.

ISO (2021), *ISO 14053:2021 Environmental Management — Material Flow Cost Accounting — Guidance for Phased Implementation in Organizations*, Geneva, Switzerland.

Jasch, C. (2009), *Environmental and Material Flow Cost Accounting: Principles and Procedures, Eco-Efficiency in Industry and Science*, v. 25, Springer, New York.

Kanger, L. (2021), “Rethinking the multi-level perspective for energy transitions: from regime life-cycle to explanatory typology of transition pathways”, *Energy Research & Social Science*, Vol. 71, p. 101829.

Kasemset, C., Chernsupornchai, J. and Pala-ud, W. (2015), “Application of MFCA in waste reduction: case study on a small textile factory in Thailand”, *Journal of Cleaner Production*, Vol. 108, pp. 1342–1351.

Kasemset, C., Sasiopars, S. and Suwiphat, S. (2013), “The application of MFCA analysis in process improvement: a case study of plastics packaging factory in Thailand”, in Lin, Y.-K., Tsao, Y.-C. and Lin, S.-W. (Eds.), *Proceedings of the Institute of Industrial Engineers Asian Conference 2013, Tapei, Taiwan, July*, Springer, Singapore, pp. 353–361.

Kidwell, L.A., Fisher, D.G., Braun, R.L. and Swanson, D.L. (2013), “Developing learning objectives for accounting ethics using Bloom's taxonomy”, *Accounting Education*, Vol. 22 No. 1, pp. 44–65.

Kintu, M.J., Zhu, C. and Kagambe, E. (2017), “Blended learning effectiveness: the relationship between student characteristics, design features and outcomes”, *International Journal of Educational Technology in Higher Education*, Vol. 14 No. 1, pp. 1–20.

Kokubu, K. and Kitada, H. (2015), “Material flow cost accounting and existing management perspectives”, *Journal of Cleaner Production*, Vol. 108, pp. 1279–1288.

Kokubu, K. and Nakajima, M. (2004), “Material flow cost accounting in Japan: a new trend of environmental management accounting practices”, *Fourth Asia Pacific Interdisciplinary Research in Accounting Conference*, pp. 1–16.

Kokubu, K. and Tachikawa, H. (2013), “Material flow cost accounting: significance and practical approach”, in Kauffman, J. and Lee, K.-M. (Eds.), *Handbook of Sustainable Engineering*, Springer Netherlands, Dordrecht, pp. 351–369.

Krasodomska, J. and Godawska, J. (2021), “E-learning in accounting education: the influence of students’ characteristics on their engagement and performance”, *Accounting Education*, Vol. 30 No. 1, pp. 22–41.

Kusch, A., Gasde, J., Deregowski, C., Woidasky, J., Lang-Koetz, C. and Viere, T. (2021), “Sorting and recycling of lightweight packaging in Germany — Climate impacts and options for increasing circularity using tracer-based-sorting”, *Materials Circular Economy*, Vol. 3 No. 1, pp. 1–15.

Lee, W.E., Birkey, R.N. and Patten, D.M. (2017), “Exposing students to environmental sustainability in accounting: an analysis of its impacts in a US setting”, *Social and Environmental Accountability Journal*, Vol. 37 No. 2, pp. 81–96.

Lehman, G. (2014), “Moral will, accounting and the phronemos”, *Critical Perspectives on Accounting*, Vol. 25 No. 3, pp. 210–216.

Li, Z., Zeng, H., Xiao, X., Cao, J., Yang, C. and Zhang, K. (2019), “Resource value flow analysis of paper-making enterprises: a Chinese case study”, *Journal of Cleaner Production*, Vol. 213, pp. 577–587.

Lux, G., Callimaci, A., Caron, M.-A., Fortin, A. and Smaili, N. (2022), “COVID-19 and emergency online and distance accounting courses: a student perspective of engagement and satisfaction”, *Accounting Education*, pp. 1–35.

Mahmoudi, E., Jodeiri, N. and Fatehifar, E. (2017), “Implementation of material flow cost accounting for efficiency improvement in wastewater treatment unit of Tabriz oil refining company”, *Journal of Cleaner Production*, Vol. 165, pp. 530–536.

Mangion, D. (2006), “Undergraduate education in social and environmental accounting in Australian universities”, *Accounting Education*, Vol. 15 No. 3, pp. 335–348.

Marrone, M., Linnenluecke, M.K., Richardson, G. and Smith, T. (2020), "Trends in environmental accounting research within and outside of the accounting discipline", *Accounting, Auditing & Accountability Journal*, Vol. 33 No. 8, pp. 2167–2193.

Mathews, M.R. (2001), "Some thoughts on social and environmental accounting education", *Accounting Education*, Vol. 10 No. 4, pp. 335–352.

May, N. and Guenther, E. (2020), "Shared benefit by Material Flow Cost Accounting in the food supply chain – The case of berry pomace as upcycled by-product of a black currant juice production", *Journal of Cleaner Production*, Vol. 245, p. 118946.

Mburayi, L. and Wall, T. (2018), "Sustainability in the professional accounting and finance curriculum: an exploration", *Higher Education, Skills and Work-Based Learning*, Vol. 8 No. 3, pp. 291–311.

METI (2010), *Material Flow Cost Accounting: Case Examples*, Tokyo, Japan.

Michelon, G. and Rodrigue, M. (2015), "Demand for CSR: insights from shareholder proposals", *Social and Environmental Accountability Journal*, Vol. 35 No. 3, pp. 157–175.

Mohammad, N. (2012), "Need to implement the environmental accounting education for sustainable development: an overview", *World Academy of Science, Engineering and Technology, International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, Vol. 6, pp. 354–361.

Mughal, N., Arif, A., Jain, V., Chupradit, S., Shabbir, M.S., Ramos-Meza, C.S. and Zhanbayev, R. (2022), "The role of technological innovation in environmental pollution, energy consumption and sustainable economic growth: evidence from South Asian economies", *Energy Strategy Reviews*, Vol. 39, p. 100745.

Nguyen, D.T.T. (2018), "Is Japanese Material Flow Cost Accounting useful to Vietnam? A case study of a Vietnamese seafood processing company", in Lee, K.-H. and Schaltegger, S. (Eds.), *Accounting for Sustainability: Asia Pacific Perspectives*, Springer, Cham, Switzerland, pp. 237–258.

Nguyen, T., Kokubu, K. and Nishitani, K. (2020), "The introduction of material flow cost accounting in Thien Phuoc Manufacturing & Trading Co., Ltd and Vietnam food industries joint stock company", *Journal of International Economics and Management*, Vol. 132, pp. 59–75.

Nishitani, K., Kokubu, K., Wu, Q., Kitada, H., Guenther, E. and Guenther, T. (2022), "Material flow cost accounting (MFCA) for the circular economy: An empirical study of the triadic relationship between MFCA, environmental performance, and the economic performance of Japanese companies", *Journal of Environmental Management*, Vol. 303, p. 114219.

O'Connell, B.T. (2021), "'He who pays the piper calls the tune': university key performance indicators post COVID-19", *Accounting Education*, pp. 1–11.

OECD (2016), *Innovating Education and Educating for Innovation: The Power of Digital Technologies and Skills*, OECD Publishing, Paris.

OECD (2019), *OECD Work on Green Growth 2019-20*, Organisation for Economic Cooperation and Development, France.

OECD (2022), "Economy: Developing countries set to account for nearly 60% of world GDP by 2030, according to new estimates", available at: https://www.oecd.org/dev/pgd/perspectives-global-development-shifting-wealth-press-release.htm (accessed 6 March 2022).

Okada, K., Komori, N. and Kokubu, K. (2019), "Toward sustainable production: the role of emotion in material flow cost accounting practices", in Kokubu, K. and Nagasaka, Y. (Eds.), *Sustainability Management and Business Strategy in Asia*, *Japanese Management and International Studies*, Vol. 16, World Scientific, pp. 95–112.

Onishi, Y., Kokubu, K. and Nakajima, M. (2008), "Implementing Material Flow Cost Accounting in a pharmaceutical company", in Schaltegger, S., Bennett, M., Burritt, R.L. and Jasch, C. (Eds.), *Environmental Management Accounting for Cleaner Production*, Vol. 24, Springer, Dordrecht, Netherlands, pp. 395–409.

Onumah, R.M., Simpson, S.N.Y. and Kwarteng, A. (2021), "Ethics and curriculum design of accounting programmes in a developing country: a qualitative insight", *Accounting Education*, pp. 1–21.

Osgerby, J. (2013), "Students' perceptions of the introduction of a blended learning environment: an exploratory case study", *Accounting Education*, Vol. 22 No. 1, pp. 85–99.

Paechter, M., Maier, B. and Macher, D. (2010), "Students' expectations of, and experiences in e-learning: their relation to learning achievements and course satisfaction", *Computers & Education*, Vol. 54 No. 1, pp. 222–229.

Parsons, S., Davidowitz, B. and Maughan, P. (2020), "Developing professional competence in accounting graduates: An action research study", *South African Journal of Accounting Research*, Vol. 34 No. 2, pp. 161–181.

Pforzheim University (2022), "MaFImA: Material Flow Based Improvement Assessments", available at: https://www.hs-pforzheim.de/en/research/research_institutes/inec/projects/mafima (accessed 28 February 2022).

Pippin, S.E., Stallings, M.A. and Weber, J.L. (2021), "Integrating sustainability into the accounting curriculum: meeting an emerging student demand", *The CPA Journal*, Vol. 91 No. 8/9, pp. 14–16.

Pippin, S.E., Weber, J.L., Wong, J.A. and Bergner, J. (2016), "The inclusion of sustainability in the accounting curriculum", available at: https://www.cpajournal.com/2016/06/17/inclusion-sustainability-accounting-curriculum/ (accessed 10 March 2022).

Powell, L. and McGuigan, N. (2022), "Responding to crises: rewilding accounting education for the Anthropocene", *Meditari Accountancy Research*, Vol. ahead-of-print No. ahead-of-print.

Prinsloo, P. and van Rooyen, A.A. (2007), "Exploring a blended learning approach to improving student success in the teaching of second year accounting", *Meditari Accountancy Research*, Vol. 15 No. 1, pp. 51–69.

Raschke, R.L. and Charron, K.F. (2021), "Review of data analytic teaching cases, have we covered enough?", *Journal of Emerging Technologies in Accounting*, Vol. 18 No. 2, pp. 247–255.

Rinaldi, L. (2022), "Accounting and the COVID-19 pandemic two years on: insights, gaps, and an agenda for future research", *Accounting Forum*, pp. 1–32.

Rogers, E.M. (2003), *Diffusion of Innovations,* 3rd, The Free Press, New York.

Russo, A., Warren, L., Neri, L., Herdan, A. and Brickman, K. (2021), "Enhancing accounting and finance students' awareness of transferable skills in an integrated blended learning environment", *Accounting Education*, pp. 1–25.

Sahu, A.K., Padhy, R.K., Das, D. and Gautam, A. (2021), "Improving financial and environmental performance through MFCA: A SME case study", *Journal of Cleaner Production*, Vol. 279, p. 123751.

Sangster, A., Stoner, G. and Flood, B. (2020), "Insights into accounting education in a COVID-19 world", *Accounting Education*, Vol. 29 No. 5, pp. 431–562.

Saravanamuthu, K. (2015), "Instilling a sustainability ethos in accounting education through the Transformative Learning pedagogy: A case-study", *Crititcal Perspectives on Accounting*, Vol. 32, pp. 1–36.

Schaltegger, S. (2018), "Linking environmental management accounting: A reflection on (missing) links to sustainability and planetary boundaries", *Social and Environmental Accountability Journal*, Vol. 38 No. 1, pp. 19–29.

Schaltegger, S. and Burritt, R. (2017), *Contemporary Environmental Accounting: Issues, Concepts and Practice*, Routledge, London.

Schaltegger, S., Christ, K.L., Wenzig, J. and Burritt, R.L. (2022), "Corporate sustainability management accounting and multi-level links for sustainability – A systematic review", *International Journal of Management Reviews*, pp. 1–21.

Schaltegger, S., Viere, T. and Zvezdov, D. (2012), "Tapping environmental accounting potentials of beer brewing", *Journal of Cleaner Production*, Vol. 29, pp. 1–10.

Schaltegger, S. and Zvezdov, D. (2015a), "Expanding material flow cost accounting. Framework, review and potentials", *Journal of Cleaner Production*, Vol. 108, pp. 1333–1341.

Schaltegger, S. and Zvezdov, D. (2015b), "Gatekeepers of sustainability information: exploring the roles of accountants", *Journal of Accounting & Organizational Change*, Vol. 11 No. 3, pp. 333–361.

Schramski, J.R., Woodson, C.B. and Brown, J.H. (2020), "Energy use and the sustainability of intensifying food production", *Nature Sustainability*, Vol. 3 No. 4, pp. 257–259.

Senaratne, S., Gunarathne, N., Herath, R., Samudrage, D. and Cooray, T. (2022), "Institutional pressures and responses to the introduction of integrated reporting into accounting curricula: the case of Sri Lankan universities", *Accounting Education*, pp. 1–31.

Sharma, U. and Kelly, M. (2014), "Students' perceptions of education for sustainable development in the accounting and business curriculum at a business school in New Zealand", *Meditari Accountancy Research*, Vol. 22 No. 2, pp. 130–148.

Shen, H., Ng, A.W., Zhang, J. and Wang, L. (2020), "Sustainability accounting, management and policy in China: recent developments and future avenues", *Sustainability Accounting, Management and Policy Journal*, Vol. 11 No. 5, pp. 825–839.

Singh, H. (2021), "Building effective blended learning programs", in Tomei, L., Khan, B.H., Affouneh, S., Hussein Salha, S. and Najee Khlaif, Z. (Eds.), *Challenges and Opportunities for the Global Implementation of E-Learning Frameworks*, *Advances in Educational Technologies and Instructional Design*, IGI Global, pp. 15–23.

Smith, G. (2012), "Designing and instructing managerial and cost accounting courses consisting of students in a combined classroom and online environment", *The Journal of International Management Studies*, Vol. 7 No. 1, pp. 70–79.

Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., Vries, W. de, Wit, C.A. de, Folke, C., Gerten, D., Heinke, J., Mace, G.M., Persson, L.M., Ramanathan, V., Reyers, B. and Sörlin, S. (2015), "Sustainability. Planetary boundaries: Guiding human development on a changing planet", *Science*, Vol. 347 No. 6223, pp. 1–12.

Stevenson, L. (2002), "Social and environmental accounting teaching in UK and Irish Universities: a research note on changes between 1993 and 1998", *Accounting Education*, Vol. 11 No. 4, pp. 331–346.

Sulong, F., Sulaiman, M. and Norhayati, M.A. (2015), "Material Flow Cost Accounting (MFCA) enablers and barriers: the case of a Malaysian small and medium-sized enterprise (SME)", *Journal of Cleaner Production*, Vol. 108, pp. 1365–1374.

Tennojiya, T., Higashida, A., Kitada, H. and Kim, J. (2019), "How does Material Flow Cost Accounting continue in practice?: The effective policy from a questionnaire survey", in Kokubu, K. and Nagasaka, Y. (Eds.), *Sustainability Management and Business Strategy in Asia*, *Japanese Management and International Studies*, Vol. 16, World Scientific, pp. 81–94.

Tharapos, M. (2021), "Opportunity in an uncertain future: reconceptualising accounting education for the post-COVID-19 world", *Accounting Education*, pp. 1–12.

The World Bank (2021), "For Mekong Delta Farmers, Diversification is the Key to Climate Resilience", available at: https://www.worldbank.org/en/news/feature/2021/10/21/for-mekong-delta-farmers-diversification-is-the-key-to-climate-resilience (accessed 28 February 2022).

Thomson, I. and Bebbington, J. (2004), "It doesn't matter what you teach?", *Critical Perspectives on Accounting*, Vol. 15, pp. 609–628.

Thomson, I. and Bebbington, J. (2005), "Social and environmental reporting in the UK: a pedagogic evaluation", *Critical Perspectives on Accounting*, Vol. 16 No. 5, pp. 507–533.

Tran, T.T. and Herzig, C. (2022), "Improving decision-making through Material Flow Cost Accounting: the case of VietGreen bottled mineral water company", *International Food and Agribusiness Management Review*, Vol. 25 No. 1, 37-48.

Tranfield, D., Denyer, D. and Smart, P. (2003), "Towards a methodology for developing evidence-informed management knowledge by means of systematic rview", *British Journal of Management*, Vol. 14 No. 3, pp. 207–222.

United Nations (2018), "Quick guide to education indicators for SDG 4", available at: http://uis.unesco.org/sites/default/files/documents/quick-guide-education-indicators-sdg4-2018-en.pdf (accessed 1 March 2022).

United Nations (2022), "Goals 12. Ensure sustainable consumption and production patterns", available at: https://sdgs.un.org/goals/goal12 (accessed 1 March 2022).

University of Birmingham (2022), "University of Birmingham becomes first university to mainstream climate change into accountancy course", available at: https://www.birmingham.ac.uk/news/latest/2022/02/university-of-birmingham-becomes-first-university-to-mainstream-climate-change-into-accountancy-course.aspx (accessed 26 February 2022).

Usubiaga-Liaño, A., Behrens, P. and Daioglou, V. (2020), "Energy use in the global food system", *Journal of Industrial Ecology*, Vol. 24 No. 4, pp. 830–840.

van Helden, J. and Uddin, S. (2016), "Public sector management accounting in emerging economies: a literature review", *Critical Perspectives on Accounting*, Vol. 41, pp. 34–62.

van Mourik, G. and Wilkin, C.L. (2019), "Educational implications and the changing role of accountants: a conceptual approach to accounting education", *Journal of Vocational Education & Training*, Vol. 71 No. 2, pp. 312–335.

Viere, T., Herzig, C., Schaltegger, S. and Leung, R. (2006), "Partnerships for sustainable business development: capacity building in South-East Asia", in Welford, R.J., Hills, P.R. and Young, W. (Eds.), *Partnerships for Sustainable Development: Perspectives from the Asia-Pacific Region*, The Centre of Urban Planning & Environmental Management, The University of Hong Kong, China, pp. 4–15.

Viere, T., Schaltegger, S. and Enden, J. von (2007), "Supply chain information in environmental management accounting – the case of a Vietnamese coffee exporter", *Issues in Social and Environmental Accounting*, Vol. 1 No. 2, pp. 296–310.

Wagner, B. (2015), "A report on the origins of Material Flow Cost Accounting (MFCA) research activities", *Journal of Cleaner Production*, Vol. 108, pp. 1255–1261.

Walz, M. and Günther, E. (2021), "What effects does material flow cost accounting have for companies?: Evidence from a case studies analysis", *Journal of Industrial Ecology*, Vol. 25 No. 3, pp. 593–613.

WECD (1987), *Our Common Future: Report of the World Commission on Environment and Development*, United Nations, New York.

Weil, S., McGuigan, N. and Kern, T. (2011), "The usage of an online discussion forum for the facilitation of case-based learning in an intermediate accounting course: a New Zealand case", *Open Learning*, Vol. 26 No. 3, pp. 237–251.

Weil, S., Silva, T.-A. de and Ward, M. (2014), "Blended learning in accounting: a New Zealand case", *Meditari Accountancy Research*, Vol. 22 No. 2, pp. 224–244.

Weybrecht, G. (2022), "Business schools are embracing the SDGs – But is it enough? – How business schools are reporting on their engagement in the SDGs", *The International Journal of Management Education*, Vol. 20 No. 1, p. 100589.

Wolcott, S.K. and Sargent, M.J. (2021), "Critical thinking in accounting education: status and call to action", *Journal of Accounting Education*, Vol. 56, p. 100731.

Wong, A., George, S. and Tanima, F.A. (2021), "Operationalising dialogic accounting education through praxis and social and environmental accounting: exploring student perspectives", *Accounting Education*, Vol. 30 No. 5, pp. 1–26.

Wynder, M., Wellner, K.-U. and Reinhard, K. (2013), "Rhetoric or Reality? Do accounting education and experience increase weighting on environmental performance in a balanced scorecard?", *Accounting Education*, Vol. 22 No. 4, pp. 366–381.

Wyness, L. and Dalton, F. (2018), "The value of problem-based learning in learning for sustainability: undergraduate accounting student perspectives", *Journal of Accounting Education*, Vol. 45, pp. 1–19.

Yagi, M. and Kokubu, K. (2019), "Waste decomposition analysis in Japanese manufacturing sectors for material flow cost accounting", *Journal of Cleaner Production*, Vol. 224, pp. 823–837.

Zou, T., Zeng, H., Zhou, Z. and Xiao, X. (2019), "A three-dimensional model featuring material flow, value flow and organization for environmental management accounting", *Journal of Cleaner Production*, Vol. 228, pp. 619–633.

Chapter 2

Material Flow Cost Accounting in Developing Countries: A Systematic Literature Review

2.1 Introduction

The objective of this study is to provide a review of the existing literature on material flow cost accounting (MFCA) application in developing countries. There are two major reasons for conducting this review. First, although there is a considerable increase in the quantity of studies and special issue call for papers from peer-reviewed journals on accounting in developing countries (Alawattage et al., 2017; Ghasemi et al., 2019; van Helden and Uddin, 2016), MFCA research has been largely neglected so far. Second, reviews which addressed MFCA in literature have mainly focused on MFCA practices in general (Christ and Burritt, 2015; Guenther et al., 2015; Rieckhof et al., 2015; Schaltegger and Zvezdov, 2015) rather than examining specific regions (e.g., developing countries).

In recent years, developing countries, which are characterized by rapid structure transformation from the agriculture sector to industry and service sectors, have increasingly been confronted by environmental problems including the high consumption of natural resources and massive industrial waste (Dincer, 2000; Divanbeigi *et al.*, 2016; Kuasirikun and Sherer, 2004; Qian *et al.*, 2015; Sharvini *et al.*, 2018). In response to environmental problems, industries in developing countries have made their efforts in adopting various approaches to resource efficiency improvement and waste reduction. A promising tool in this regard is MFCA, as it supports organizations in achieving both economic and environmental performance by analyzing physical material and energy flows as well as related costs (Huang *et al.*, 2019; ISO, 2011; Jasch, 2009).

Using Tranfield *et al.*'s methodology for systematic reviews, we found three key findings:

- First, it reveals a strong bias towards Asian regions in the scope of MFCA research.
- Second, it enhances a better understanding of the use of MFCA beyond eco-efficiency by identifying its benefit for strategic decision-making processes.
- Third, it identifies current accounting systems in developing countries as one of the key challenges in MFCA application.

Drawing from the above findings and gaps in MFCA literature, we describe future paths in MFCA research including the investigation of the current rate of MFCA application and factors influencing the application of MFCA in developing countries by quantitative research, the comparative analysis of various important aspects of MFCA application across these countries, the examination of MFCA application in small and medium-sized enterprises (SMEs), and of the further spread of MFCA application in various manufacturing and service industries in these countries.

The paper is structured as follows. The next section provides a brief introduction to MFCA and general characteristics of accounting in developing countries. Section 2.3 explains the methodology used to undertake the systematic review. Section 2.4 highlights our results, which are summarized in various tables together with detailed analysis. This is followed by Section 2.5, in which our discussion and implications for future research are presented. Section 2.6 concludes the paper. Section 2.7 contains references of the paper.

2.2 MFCA and Accounting in Developing Countries

We start with introducing MFCA and its development. Then, the criteria for choosing developing countries as well as accounting characteristics of these countries are presented.

2.2.1 MFCA

MFCA is regarded as an effective tool to achieve both environmental and economic performance by analyzing both physical flows and monetary units. It appeared in the early 1990s within an environmental management project at the Kunert company in Southern Germany (Wagner, 2015). Since then, it has received considerable attention in practice and academia (Herzig et al., 2012c; ISO, 2011; Jasch, 2009; METI, 2007), bringing together a wide range of different perspectives, such as cleaner production, ecological economics, and management accounting (MA) (Schaltegger and Zvezdov, 2015). Under MFCA, the implementation process includes five steps: (1) engaging management and determining roles and responsibilities; (2) identifying scope and boundary of the process and establishing a material flow model; (3) allocating costs (material cost, energy cost, system cost, and waste management cost); (4) interpreting and communicating MFCA results; and (5) improving production practices and reducing material loss through MFCA results (ISO, 2011). These steps have been formulated as a general framework by the International Organization for Standardization in ISO 14051, followed up by ISO 14052, which focuses on the practical implementation of MFCA in a supply chain and ISO 14053, which focuses on the practical implementation of MFCA in SMEs.

Overall, MFCA has become one of the most promising tools for environmental accounting and accountability. It is a key component of the Environmental Management Accounting (EMA) framework published by Burritt et al. (2009). Besides becoming an international standard in ISO (14051, 14052, and 14053), there is also a growing number of guidance documents on MFCA published by governments and associations (APO, 2014; METI, 2007; The Vietnamese Directorate Standards, Metrology, and Quality, 2018). Meanwhile, a large number of case studies spreading throughout many countries over the world have also demonstrated the effectiveness of MFCA in enhancing corporate environmental and financial performance (Herzig et al., 2012c; Onishi et al., 2008; Schmidt, 2015). Previous MFCA reviews have provided academics, practitioners, and other interested parties with a deeper understanding of MFCA application and diffusion (Christ and Burritt, 2015; Guenther et al., 2015; Rieckhof et al., 2015; Schaltegger and Zvezdov, 2015). For example, Schaltegger and Zvezdov (2015) developed a framework for MFCA to support a wide variety of decision situations. Another example is that of Christ and Burritt (2015) who raised notable problems such as a lack of knowledge and application of MFCA in practice or the need for survey, interview, and statistical research methods to supplement case studies. Moreover, at the time their review was conducted, the evidence on MFCA was limited to three studies from developing countries. With a small amount of such studies, it appears to be helpful to provide a broader understanding of the current state of MFCA application across developing countries and how research into this stream has developed since then.

2.2.2 Accounting in Developing Countries

As of today, there are different criteria to classify world economies, such as gross national income (GNI) per capita (focus on income) of the World Bank (The World Bank, 2020), Human Development Index (focus on a long and healthy life, knowledge, and a standard of living) of the United Nations Development Programme (United Nations Development Programme, 2020) , or aggregation methods (focus on income and fuel exporters/importers) of the United Nations (United Nations, 2020). In this paper, despite the debate and difficulty of defining developing countries in term of various measurable aspects (Hopper et al., 2017), we used the classification of the World Bank as used in previous studies on accounting (Alawattage et al., 2017; Kuttner and Feldbauer-Durstmüller, 2016; van Helden and Uddin, 2016). This

includes four categories: high income, upper-middle income, lower-middle income, and low income. Accordingly, developing countries are not listed among high-income economies.

Accounting in developing countries has been dominated by financial accounting rather than MA due to the effects of professional bodies, legal regulations, and education and training (Hopper et al., 2009). Nonetheless, MA has been broadly applied and has transformed from traditional techniques to contemporary techniques due to various reasons, such as foreign capital's support (Albu and Albu, 2012), government reform, or global competition (Maina Waweru et al., 2004). Despite its transformation, introducing MA innovations has proven to be challenging as traditional MA techniques have commonly been used in many developing countries and there is the effect of culture on MA practices (Endenich et al., 2011; Joshi, 2001; Smith et al., 2008). For example, Indian companies used more traditional MA practices than those in Australian companies, and adopted contemporary techniques more slowly than those in Australian companies (Joshi, 2001). Another example is that traditional MA techniques (budgeting and standard costing) were accepted in Malaysian companies while there were the very low levels of adoption of MA innovations (target costing and balanced scorecard) (Smith et al., 2008).

In recent years, EMA has emerged as the next step in the evolution of MA (Jasch, 2006) in order to help organizations increase both economic and environmental performance. Whilst research on EMA and MFCA has been dominated by European and Australian researchers for a long time (Parker, 2011), with little attention being paid to developing economies (Belal et al., 2013), many scholars have increasingly become interested in these new accounting tools in the context of emerging countries (Herzig et al., 2012c; Jalaludin et al., 2011; Le et al., 2019; Mokhtar et al., 2016). There are such interests in emerging countries, as these countries have an entirely different social-political environment and accounting practices (Ali et al., 2017; Gibson, 1997; Tilt, 2018; Xiaomei, 2004) which have affected EMA and MFCA development and motivated the adaptation and testing of tools in respective contexts (Herzig et al., 2012c). For example, due to the weakness of legislation, Chinese companies will not increase their costs of environmental investment unless legal requirements are strong enough to make pressure for them (Xiaomei, 2004). Another example is that while courses on environmental accounting have been well set up at universities in developed countries such as Australia and the United Kingdom (Gibson, 1997), there has been a lack of these courses at universities in developing countries. In addition, applying models or hypotheses already accepted in developed countries to developing countries could be problematic or unsuitable.

2.3 Methodology

We conducted a systematic review to synthesize and appraise the existing studies on MFCA application from the perspective of developing countries. Our review was guided by Tranfield et al. (2003) approach including three main stages: (3.1) planning the review, (3.2) conducting the review, and (3.3) reporting the review.

2.3.1 Planning the Review

At the stage of planning, we prepared a review protocol comprising review question, key words, inclusion criteria, and exclusion criteria. The research question was: What is the current state of knowledge concerning MFCA application in developing countries? To answer this question, keywords were limited to "material and energy flow cost accounting", "material flow cost accounting", "MFCA", "flow cost accounting", "energy cost accounting", "material flow accounting", "input/output balance", "ISO 14051", and "ISO 14052". Subsequently, the above keywords were searched from five databases: ISI Web of Science, ScienceDirect, ProQuest, SpringerLink, and Emerald. To identify relevant publications, we specified inclusion and exclusion criteria, as shown in **Table 2.1**.

Table 2.1 Selection Criteria of the Systematic Review

No.	Criteria	Inclusion	Exclusion
1	Publication type	Articles, books, conference papers	Any other publication type
2	Theme	Material flow cost accounting	Any other research area
3	Availability	Full text	Not available as full text
4	Language	English	Any other language
5	Location	Developing countries	Developed countries
6	Level	Corporate level	Any other level

2.3.2 Conducting the Review

At the stage of conducting, we selected and appraised relevant studies through inclusion and exclusion criteria identified at the previous stage. Searching for studies based on keywords in five databases revealed 1147 publications that were stored in the bibliographic management software Citavi 6.0. To filter relevant publications, we applied the process suggested by Viegas et al. (2016). This process consists of four steps as follows: (1) elimination of repeated or duplicate publications, (2) alignment of the titles with the theme, (3) alignment of abstracts with the theme, and (4) availability of full-text publications in the databases. After eliminating redundant publications within and between databases, a total of 684 publications were kept. From the selected publications, we reduced 565 publications on an analysis of the title and abstract. As a result, 119 publications were included after screening. In the last step of this process, we excluded 5 publications due to a lack of availability. As a result, 114 relevant publications with full text were chosen. After that, we eliminated 3 publications not written in English, 71 publications due to location criteria, and 12 publications because they were not examining MFCA at corporate level.

2.3.3 Reporting Results

Figure 2.1 presents a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram of the literature selection process, resulting in 28 publications found in the review.

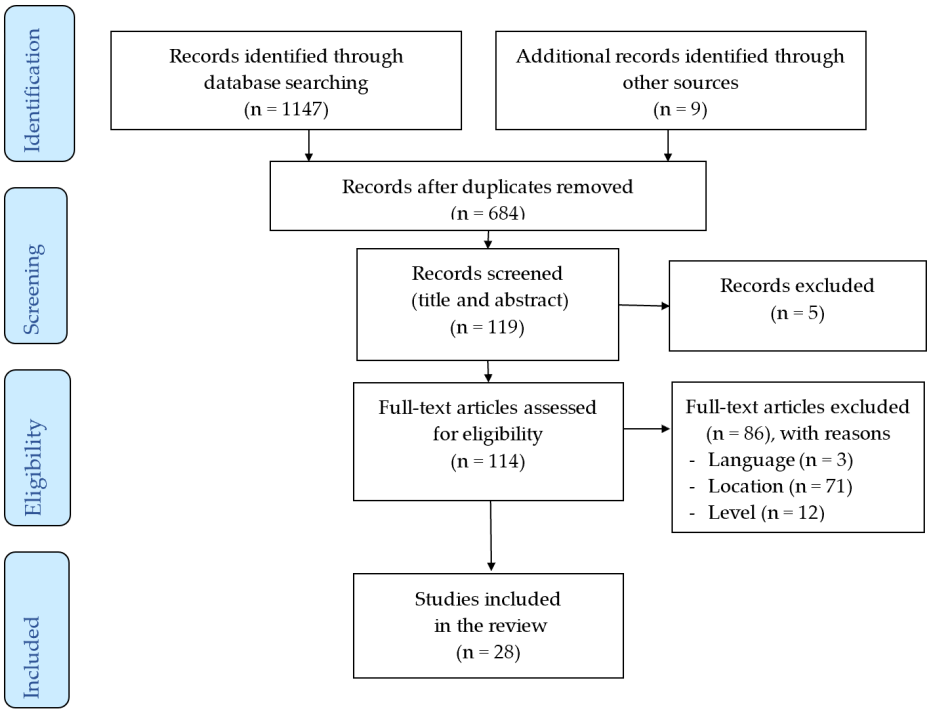

Figure 2.1 PRISMA Flow Diagram

All 28 publications were extracted into a Microsoft Excel worksheet for in-depth analysis. We followed previous studies on the systematic review (Stechemesser and Guenther, 2012; Tranfield et al., 2003) and used an analytic framework with guiding questions including bibliographic analysis, background analysis, and thematic analysis, as shown in **Table 2.2**.

Table 2.2 An Analytic Framework

Categories and Sub-categories	Questions
Bibliography	
Year	In which year was the publication published?
Type	What is the kind of publication?
Journal's name	If it is a journal, what is the journal's name?
Journal's discipline	What is the journal's discipline?
Authors' name	Who are the publication's authors?
Authors' geographic origin	What is the geographic origin of the authors?
Authors' discipline	What are the author's disciplines?
Background	
Methodology	What is the methodology used in research?
Location	Which country does the publication focus on?
Size	Which size is subject of the publication?
Industry	Which industry sector is subject of the publication?
Themes	
Benefits	What are MFCA application's benefits described in the publication?
Process	How were MFCA application's steps described in the publication?
Enablers and barriers	What are the enablers of and barriers to MFCA application described in the publication?

2.4 Analysis of Results

This section is structured as follows. First, bibliographic findings are analyzed by year, type, and author. Second, publications are characterized according to methodology, location, size, and industry. Finally, themes of publications are synthesized.

2.4.1 Bibliographic Findings

In our review, we identified 28 publications published during ten years between 2009 and 2018. Given that our review covers one decade, the total number of publications is relatively low. **Figure 2.2** shows fluctuations in the volume of MFCA publications in developing countries.

Starting from one publication in 2009 (Weidong et al., 2009), there is a notable increase in the number of publications in 2012. Three years later, in 2015, the number of yearly publications reaches its peak, accounting for one-fourth of total publications. This turning point can be explained in terms of an edited book and a special issue published in these two years. First, the book by Herzig et al. (2012c) on EMA case studies of South-East Asian companies contributes to four out of six publications in 2012. This book resulted from a large EMA capacity building and research program in South-East Asia which was carried out between late 2003 and early 2008, funded by the German Federal Ministry for Economic Cooperation and Development (Viere et al., 2006). Second, the special issue of the Journal of Cleaner Production attracted many MFCA publications in 2015, out of which three publications focused on MFCA application in developing countries.

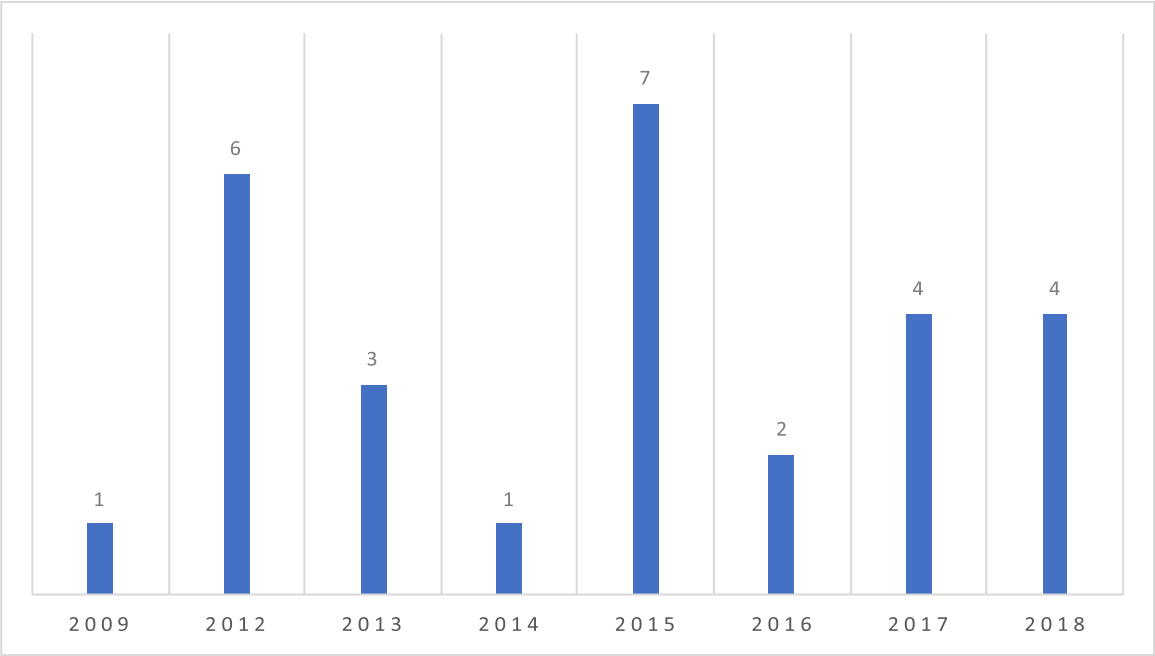

Figure 2.2 Studies on Material Flow Cost Accounting (MFCA) Application in Developing Countries from 2009 to 2018.

There are three types of publications found in our review: journal articles (in total: 16; 58%), conference papers (6; 21%), and book chapters (6; 21%). Articles published in journals are related to the discipline of environmental and sustainability management (Journal of Cleaner Production; Environment, Development and Sustainability; International Journal of Environmental Science and Development), accounting (Asian Journal of Accounting and Governance; Asia-Pacific Management Accounting Journal; Journal of Accounting and Management), and governance and control (Risk Governance & Control: Financial Markets & Institutions). The distribution of journal articles is presented in **Table 2.3**. Notably, journals with the most publications on MFCA in developing countries are not accounting journals. While the Journal of Cleaner Production alone accounts for 10 out of 16 journal articles, only three articles could be found in three different accounting journals. However, following rankings such as the ranking of the Chartered Association of Business Schools, these accounting journals are not highly ranked. We could not find papers on MFCA in developing countries from well-known journals in the field of accounting, such as Accounting, Organizations and Society; Accounting Forum; Management Accounting Research; and Accounting, Auditing & Accountability Journal.

Table 2.3 MFCA Publications in Developing Countries by Journals

Journal Name	Number of Publications
Journal of Cleaner Production	10
Environment, Development and Sustainability	1
International Journal of Environmental Science and Development	1
Asian Journal of Accounting and Governance	1
Asia-Pacific Management Accounting Journal	1
Journal of Accounting and Management	1
Risk Governance & Control: Financial Markets & Institutions	1
Total	**16**

In our review sample, 56 different authors contribute to the literature of MFCA in developing countries. The following observations could reflect the novelty of MFCA, which is being researched by scholars from many different countries and disciplines. An interesting observation can be made by looking at the major contributors since it could enrich the knowledge about who mainly contributed to the development of MFCA literature in developing countries. It appears surprising that the top four authors come from developed countries, although other authors coming from developing countries are also interested in this field. Specifically, three authors (Stefan Schaltegger, Tobias Viere, and Christian Herzig), who contributed a high number of publications on MFCA in developing countries, come from Germany in which research on MFCA has a long-standing history. Moreover, it is notable that Roger Burritt coming from Australia and Chompoonoot Kasemset coming from Thailand (however, based in the United Kingdom) also contributed a considerable number of publications on this topic. Other major authors mainly come from developing countries such as Malaysia (Denny Ng, Mohd Norhayati, Maliah Sulaiman), Thailand (Watcharin Chaiwan, Rungchat Chompu-inwai), and South Africa (Michael Fakoya). Although studies on MFCA have received attention from a very small group of researchers, our review shows a wide variety of authors coming from both developed countries and developing countries, which has been not explicitly presented in prior studies (Christ and Burritt, 2015; Schaltegger et al., 2013). A further interesting observation is that publications are often developed by a team of authors coming from various disciplines, bringing together perspectives in accounting (e.g., Michael Fakoya), management (e.g., Christian Herzig), life cycle assessment (e.g., Tobias Viere), engineering (e.g., Chawis Boonmee), and environmental science (e.g., Nova Ulhasanah). This result shows that MFCA knowledge has been enriched by diverse and interdisciplinary perspectives rather than only focusing on accounting research.

2.4.2 Background of Publications

As can be seen in **Table 2.4**, 26 out of 28 publications used a qualitative research design (case studies). This number illustrates a general trend in MFCA research as it is a suitable strategy during the first stages of investigating the implementation of MFCA in developing countries because the case method is suitable for exploratory research (Hancock and Algozzine, 2006). However, case studies primarily investigate MFCA implementation at one company in a specific country (Doorasamy, 2014; Fakoya, 2015; Kasemset et al., 2013) rather than examining multiple cases across sectors and/or countries (e.g., comparative research designs). Two papers used a quantitative method to collect data by conducting a survey (Salim et al., 2017; Yagi and Kokubu, 2018). Surveying 123 companies, Salim et al. (2017), for example, show that there is a low level of MFCA implementation in Malaysia. Another example is that Yagi and Kokubu (2018) analyze the characteristics of material flow management to facilitate the expanded use of MFCA through surveying 101 firms in Thailand.

With regard to the location of MFCA studies, our analysis reveals that MFCA has been studied in nine developing countries, namely, Thailand, China, South Africa, Malaysia, Vietnam, the Philippines, Indonesia, Iran, and Sri Lanka. There is a strong bias towards emerging countries in Asia (86% of all publications), while Africa accounts for only 14% of the publications. With ten publications, Thailand attracted many scholars to carry out their research on MFCA application (Chaiwan et al., 2015; Chattinnawat et al., 2018; Chompu-inwai and Apinun, 2015; Chompu-inwai et al., 2015; Herzig et al., 2012e; Jakrawatana et al., 2016; Kasemset and Boonmee, 2017; Kasemset et al., 2015; Kasemset et al., 2013; Yagi and Kokubu, 2018). Following this country, there are four publications focusing on China, four publications focusing on South Africa, two publications focusing on Malaysia, and two publications focusing on Vietnam.

Table 2.4 Publications on MFCA in Developing Countries by Method, Location, Size, and Industry

No.	Method	Location	Size	Industry	Reference
1	Case study	China	SME	Construction machinery cab, the fuel oil tank, the hydraulic fluid tank, and the hangar	Weidong *et al.* (2009)
2	Case study	Thailand	SME	Wood	Chompu-inwai *et al.* (2015)
3	Case study	South Africa	Micro	Micro-brewery	Fakoya (2015)
4	Case study	Thailand	Small	Textile	Kasemset and Boonmee (2017)
5	Case study	Thailand	Small	Textile	Kasemset *et al.* (2015)
6	Case study	Thailand	Medium	Pajamas production	Chattinnawat *et al.* (2018)
7	Survey	Thailand	Not identified	Agriculture and food, consumer products, industrials, property and construction, resources, services, and technology	Yagi and Kokubu (2018)
8	Case study	Indonesia	Large	Textile and towels	Herzig *et al.* (2012a)
9	Case study	China	Large	Plastics	Zhang and Liu (2015)
10	Case study	The Philippines	Small	Electroplating industry	Herzig *et al.* (2012b)
11	Case study	Sri Lanka	Not identified	Crepe rubber	Dunuwila *et al.* (2018)
12	Case study	Iran	Not identified	Oil	Mahmoudi *et al.* (2017)
13	Case study	South Africa	Large	Brewery	Fakoya and van der Poll (2013)
14	Case study	Vietnam	Small	Seafood	Nguyen (2018)
15	Case study	China	Not identified	Liquid crystal display and optoelectronic	Trappey *et al.* (2013)
16	Case study	Malaysia	SME	Metal parts for the automotive industry	Sulong *et al.* (2015)
17	Case study	South Africa	Not identified	Hotel	Nyide (2016)
18	Case study	The Philippines	Large	Snack	Herzig *et al.* (2012d)
19	Survey	Malaysia	Not identified	Manufacturing	Salim *et al.* (2017)
20	Case study	Thailand	Not identified	Starch and ethanol production	Jakrawatana *et al.* (2016)
21	Case study	China	Large	Iron and steel	Zhou *et al.* (2017)
22	Case study	Indonesia	Large	Cement	Ulhasanah and Goto (2012)
23	Case study	Thailand	Medium	Paper	Herzig *et al.* (2012e)
24	Case study	Vietnam	Medium	Beer brewing	Schaltegger *et al.* (2012)
25	Case study	Thailand	SME	Pottery and decorative ceramics	Chompu-inwai and Apinun (2015)
26	Case study	Thailand	Not identified	Plastics packaging	Kasemset *et al.* (2013)
27	Case study	South Africa	Not identified	Paper	Doorasamy (2014)
28	Case study	Thailand	Not identified	Meat ball production	Chaiwan *et al.* (2015)

In terms of size of companies under study, our review shows that there are six publications investigating MFCA in large enterprises (Fakoya and van der Poll, 2013; Herzig et al., 2012a, 2012d; Ulhasanah and Goto, 2012; Zhang and Liu, 2015; Zhou et al., 2017). Besides, we also found 12 publications examining MFCA in SMEs (Chattinnawat et al., 2018; Chompu-inwai and Apinun, 2015; Chompu-inwai et al., 2015; Fakoya, 2015; Herzig et al., 2012b, 2012e; Kasemset and Boonmee, 2017; Kasemset et al., 2015; Nguyen, 2018; Schaltegger et al., 2012; Sulong et al., 2015; Weidong et al., 2009). Concerning SMEs, for example, MFCA helped a Chinese company increase both environmental performance and the community's recognition and trust (Weidong et al., 2009). Drawing from our review, MFCA application becomes important and potential not only in large enterprises but also in SMEs that has been emphasized in ISO 14051 (ISO, 2011) and ISO 14053 (ISO, 2019). Due to a lack of information, we could not identify firm size in other publications.

Regarding the industry focus, the review shows that 26 publications concentrated on manufacturing industries while there are two cases in terms of the hotel industry (Nyide, 2016; Yagi and Kokubu, 2018). More specifically, some scholars paid attention to some large industries such as oil (Mahmoudi et al., 2017), iron and steel (Zhou et al., 2017), metal parts (Sulong et al., 2015), and other manufacturing industries such as paper production (Herzig et al., 2012e; Doorasamy, 2014), textile manufacturing (Chattinnawat et al., 2018; Kasemset and Boonmee, 2017; Kasemset et al., 2015; Herzig et al., 2012a), beer brewing (Fakoya, 2015; Fakoya and van der Poll, 2013; Schaltegger et al., 2012), and food (Chaiwan et al., 2015; Herzig et al., 2012d; Nguyen, 2018). We also found interesting results obtained from one case relating to the hotel industry (Nyide, 2016). This case is the only one focusing on the implementation of MFCA in the service industry. In one other case, agriculture, manufacturing and construction, and service industries were investigated together (Yagi and Kokubu, 2018).

2.4.3 Themes

Overall, we found three main themes emerging from analyzing the literature on MFCA application in developing countries: the benefits of MFCA application, the process of MFCA application, and enablers of and barriers to MFCA application. These themes are presented in the following.

2.4.3.1 Benefits of MFCA Application in Developing Countries

A large variety of benefits from applying MFCA in developing countries could be found. MFCA is shown to assist companies to identify underestimated costs, reduce losses, waste, and environmental impacts (Doorasamy, 2014; Dunuwila et al., 2018; Kasemset et al., 2015; Trappey et al., 2013); increase product quality and competitiveness (Chompu-inwai et al., 2015; Jakrawatana et al., 2016); improve processes as well as resource efficiency (Jakrawatana et al., 2016; Mahmoudi et al., 2017; Zhang and Liu, 2015); and support decision-making (Doorasamy, 2014; Fakoya, 2015; Fakoya and van der Poll, 2013; Herzig et al., 2012d, 2012e; Schaltegger et al., 2012). These benefits, recognized among various contexts and various industries, can be grouped into two broad categories: eco-efficiency and strategic decision-making. Eco-efficiency is defined as "a management philosophy that encourages business to search for environmental improvements that yield parallel economic benefits" (WBCSD, 2006). This is a widely acknowledged benefit of EMA application in standards and frameworks such as the ones published by the International Federation of Accountants (IFAC) (IFAC, 2005) or the International Organization for Standardization (ISO) (ISO, 2011). It is interesting to note that our review of the literature also stresses MFCA's role for strategic decisions, which had not been made explicitly by ISO (2011). Strategic decision-making plays a pivotal role in an organization due to its long-term effects (Lenz and Engledow, 1986) and therefore has also been widely addressed in the literature of accounting and control for sustainability strategy (Ghosh et al., 2019). In various studies of our sample, it is shown how MFCA can support

managers in ensuring the future sustainability of an organization (e.g., implementing cleaner production processes) (Doorasamy, 2014; Herzig et al., 2012e; Schaltegger et al., 2012). For example, Herzig et al. (2012e) show that MFCA information helps managers at a paper manufacturer develop long-term thinking by encouraging greater and cleaner production of Grade A paper and a competitive business strategy for cost reduction.

2.4.3.2 Process of MFCA Application in Various Contexts

MFCA is known as an effective tool with benefits recognized through the process of its application in various contexts. With some slight differences among cases studies in the steps of MFCA application, 23 cases present explicitly how companies applied this tool in practice. For example, Dunuwila et al. (2018) describe MFCA application at a crepe company in which the manufacturing process was illustrated in more detail as follows: rubber latex collection, standardization, coagulation, milling, drying, folding, dry blanket milling, cutting, and packing. Based on MFCA calculation, three improvement options regarding reduction of fresh water, chemicals, and electricity use were suggested, leading to a notable reduction in the need for water and electricity, emission of greenhouse gases, and costs at the same time.

As we mentioned in Section 2.2.1, there are five steps to implement MFCA guided by ISO (ISO, 2011). These steps are (1) engaging management and determining roles and responsibilities; (2) identifying scope and boundary of the process and establishing a material flow model; (3) allocating costs (material cost, energy cost, system cost, and waste management cost); (4) interpreting and communicating MFCA results; and (5) improving production practices and reducing material loss through MFCA results. In most of the reviewed studies, the first step was presented implicitly at best (or even ignored). An exception is the case of Chompu-inwai and Apinun (2015), who describe comprehensively and clearly all steps.

2.4.3.3 Enablers of and Barriers to MFCA Application

Five publications show explicitly enablers of and/or barriers to MFCA application (Sulong et al., 2015; Fakoya and van der Poll, 2013; Nyide, 2016; Salim et al., 2017; Yagi and Kokubu, 2018). First, Salim et al. (2017) highlight that there is a direct positive impact of supplier integration on MFCA application, while companies with bigger ecological environmental uncertainty are less motivated to apply MFCA. Second, Yagi and Kokubu (2018) reveal that hazardous waste and raw material management could facilitate the promotion of MFCA. Third, Fakoya and van der Poll (2013) emphasize the importance of integrating enterprise resource planning and MFCA to speed up the availability of waste information in terms of both quantity and cost figures to overcome existing challenges at a brewery company. Fourth, Sulong et al. (2015) reveal that there are many enablers of MFCA implementation, such as innovative attributes (relative advantage, compatibility, complexity, trialability, observability; see also Burritt et al. (2019)), type of innovation decision (authority innovation-decision from top managers), communication channels (constant meetings and cooperation), nature of social system (top management commitment and team composition), and change agent's promotion efforts. Besides, this study shows barriers to MFCA implementation in the case of the Alpha company, such as performance appraisal issues, and vendor constraint. Fifth, Nyide (2016) shows various challenges in terms of MFCA implementation including data accuracy, the understanding of data and capital budgeting, and limited experience and knowledge of MFCA. We also found some additional enablers of and barriers to MFCA implementation in other publications when describing the benefits and steps of MFCA implementation. These are related to supply chain integration (Herzig et al., 2012a, 2012b, 2012d; Kasemset et al., 2015), environmental strategy (Herzig et al., 2012a; Zhang and Liu, 2015; Nguyen, 2018; Herzig et al., 2012d), support from government (Chompu-inwai et al., 2015; Dunuwila et al., 2018; Nguyen, 2018), training and education (Chompu-inwai et al., 2015; Weidong et al., 2009; Zhang and Liu, 2015), and the combination of MFCA with other techniques (Chompu-inwai

and Apinun, 2015; Trappey et al., 2013; Ulhasanah and Goto, 2012; Zhou et al., 2017).

Current accounting systems including data availability and cost allocation appear to be the key challenge in MFCA application across many cases. In terms of data availability, this challenge was found in six reviewed cases (Doorasamy, 2014; Fakoya, 2015; Fakoya and van der Poll, 2013; Herzig et al., 2012a; Jakrawatana et al., 2016; Schaltegger et al., 2012). It is caused by separating database systems between different departments, such as the accounting department, environment department, and production department, hampering the necessary collection of both physical and monetary data. Moreover, data availability in the context of developing countries is different to that of developed countries due to the differences in technological capacity and MA development (Hopper et al., 2009). While this is seen to be an enabler of MFCA application in prior studies (Jasch, 2009; Strobel and Redmann, 2004), our review shows that it represents a barrier to MFCA application in many developing countries. In cases where it was not presented as a barrier to a developing country company (e.g., in the case of Nguyen's (2018) MFCA study of a seafood company), this might be due to the fact that the application only focused on one simple process. If the case was expanded to a broader level for all processes, the firm may possibly also struggle with the same problem in terms of data availability. As a consequence of the lack of availability of data, it is reported that costs are difficult to calculate and allocate (Jakrawatana et al., 2016). While MFCA requires the analysis of each process with sufficient and detailed information about inputs and outputs in both physical and monetary units, a traditional accounting system has no records of costs for each production line or environmental cost classification. As a result, it is hard for accountants to find a reasonable basis for allocating environmental costs, which is consistent with prior studies of EMA (IFAC, 2005; Xiaomei, 2004).

2.5 Discussion and Implications for Future Research

2.5.1 Empirical Evidence on MFCA Application in Developing Countries

Despite an increase in MFCA case study research published in recent years (Christ and Burritt, 2015), the total number of publications concerning MFCA application in developing countries is still limited. Drawing from current literature, our knowledge about the level of MFCA application in emerging countries remains limited to insights from individual company case studies. There is one article showing a low level of MFCA application in the context of Malaysia through surveying 123 enterprises (Salim et al., 2017). This provides some first insights into MFCA diffusion in a developing country context as prior survey-based research has been primarily concerned with EMA application in general rather than examining MFCA specifically (Christ and Burritt, 2015). Nonetheless, in the study by Salim et al. (2017), we are not certain about how many companies know about MFCA, how many companies know about MFCA but not apply it, and how many companies know about MFCA and apply it in practice in the context of developing countries despite many case-based efforts in proving various benefits of MFCA and the ability of its application. Do companies know about MFCA and if yes, what do they know about it? Are (or will) they (be) interested in applying MFCA? In addition, as mentioned in Section 2.4.3, many enablers of and barriers to MFCA implementation are primarily reviewed through case studies. While there are many empirical studies investigating motivations and challenges in EMA implementation more generally (Christ and Burritt, 2013; Lima Ribeiro and Aibar-Guzman, 2010; Mokhtar et al., 2016), it becomes a major shortfall in the current MFCA literature. Hence, we argue that quantitative research is necessary to provide a better understanding of practical MFCA application in these countries. Moreover, it seems that capacity development programs can make a positive contribution to the dissemination of MFCA in practice (Burritt et al., 2009) and enhancing our knowledge about its dissemination through wider research on MFCA in developing countries. The strong bias towards Asian studies in our sample might be due to a capacity development program carried out in early 2000 in South-East Asia, resulting in the publication of project outcomes (pilot case studies) as well

as subsequent research activities in the region (Herzig et al., 2012c). Another reason might be that regional chapters of academic and practitioner networks (such as the Environmental Management Accounting Network—Asia Pacific or the Australasian Centre for Social and Environmental Accounting Research Group) have been most active in these regions for many years. The fact is that studies on MFCA in the regions of Latin America and the Caribbean could not be found and studies on MFCA in the region of Africa are limited to four publications (Doorasamy, 2014; Fakoya, 2015; Fakoya and van der Poll, 2013; Nyide, 2016) in our review. We propose future research to further investigate MFCA in these regions to fill the gap in the literature. Lastly, the findings and insights are commonly limited to a single company (Fakoya, 2015; Weidong et al., 2009) or a single country (Salim et al., 2017; Yagi and Kokubu, 2018). A comparison between countries would be difficult to make due to the lack of heterogeneity among studies with regard to perspectives, methods, and sectors. Hence, we suggest future research to further elaborate on MFCA application and diffusion from a comparative perspective, which has received heightened attention in research on MA (Wijewardena and Zoysa, 1999), EMA (Olalekan and Jumoke, 2017), and corporate social responsibility (Jamali et al., 2009; Ramasamy and Ting, 2004), to compare important aspects of MFCA application between countries.

2.5.2 MFCA Application in SMEs in Developing Countries

It is notable that SMEs in emerging countries, which play a vital role in job creation and global economic growth, account for an approximately 67% share of formal SMEs in the world (Kumar, 2017). Nonetheless, there are many key constraints to SMEs in developing countries, such as access to finance, competition, and taxation (Bruhn et al., 2017). For example, while on average 43% of businesses with 20 to 99 employees rate access to finance as a major constraint to current operations in low-income countries, only 11% of businesses of the same size rate access to finance as a constraint in high-income countries (Bouri et al., 2011). Due to capital intensity, SMEs in developing countries are less productive and contribute less productivity growth than large firms. While large firms are both more innovative and more productive, SMEs are less likely to engage in increasing innovation and productivity (Kumar, 2017). MFCA is regarded as an innovative approach which could help organizations in enhancing economic and environmental performance. Despite its benefits, we argue that constraints of SMEs in developing countries seem to hamper MFCA application in these nations. Priorities of SMEs in developing countries include seeking short-term profits and minimizing taxation rather than focusing on solving environmental problems derived from their activities. For example, SMEs in Thailand tend to cut production costs, and usually do not know how to manage waste effectively despite very high resource consumption rates (Chompu-inwai et al., 2015). In addition, due to resource constraints, for SMEs it is difficult to "hire some environment accountants to implement the environment budget method and the environmental protection achievement examination system" (Weidong et al., 2009, p. 32). We think that leaders of enterprises could hesitate to invest in an innovative approach such as MFCA since they are not certain about the benefits that this approach could bring as well as potential costs that they need to spend. While there are nearly 21 million SMEs in developing countries (Bruhn et al., 2017), MFCA literature has investigated a minority of these enterprises (e.g., 12 publications found in our review). Hence, future research could further investigate how MFCA could be applied in SMEs in developing countries to overcome their existing constraints. Drawing from our review, the effect of firm size on MFCA implementation was not investigated. Therefore, we also call for conducting more studies to fill this gap in the current literature.

2.5.3 MFCA Application in Manufacturing and Service Sectors in Developing Countries

Developing countries are characterized by the process of rapid industrialization. As a result, structural transformation started mostly in the 1900s and the economy has significantly moved from the agriculture sector to industry and service sectors (Divanbeigi et al., 2016). According

to the World Development Indicators of the World Bank in March 2016, the average value added (% GDP) in the agricultural, industry, and service sectors were 40%, 20%, and 40%, respectively, in 1960 and 20%, 30%, and 50%, respectively, in 2010. In addition, the industrialization in developing countries has also led to a considerable increase in economic growth. According to data from the International Monetary Fund in 2019, GDP growth was 4.6% for developing countries while it was 1.7% for developed countries. Some emerging nations experienced high growth rates, such as China (5.8%), the Philippines (6.2%), and Vietnam (6.5%). Nonetheless, the industrialization in these nations has increasingly produced adverse environmental problems due to the release of air and water pollutants and the disposal of hazardous wastes. Overall, developing countries often demonstrate a lack of attention to environmental protection, inappropriate or ineffective environmental standards, and underdeveloped pollution control techniques.

Mani and Wheeler (1998) revealed that the top ten pollution-intensive industries include iron and steel, non-ferrous metals, industrial chemicals, petroleum refineries, non-metallic mineral products, pulp and paper, other chemicals, rubber products, leather products, and metal products. In our review, there is one case in iron and steel, one case in the oil industry, one case in metal parts, and two cases in paper production. As we mentioned in Section 2.4.2 in terms of sub-industry sectors, some major industries in the economy of developing countries, which have made a strong and negative impact on the environment, are missing in MFCA literature, such as chemicals and chemical products (12.1% of GDP in 2015) and non-metallic mineral products (5.5% of GDP in 2015) (UNIDO, 2017). Hence, the lack of data on multiple sectors appears to be a gap in current knowledge. It seems necessary to examine further how MFCA application could improve companies' economic and environmental performance in manufacturing sectors in which there are both high contributions to GDP and intensive pollution (for example, manufacturing of basic metals accounts for 10.7% of GDP in developing countries while it accounts for 4.6% of GDP in developed countries in 2015 (UNIDO, 2017)). Besides, in our review, there are two publications concerning the service industry (Nyide, 2016; Yagi and Kokubu, 2018). Although other scholars have already recommended future research to further investigate MFCA in the service industry (e.g., Christ and Burritt (2015)), there seems to be still a need to do more in this regard. Not surprisingly, MFCA tends to be applied in industries with significant material and energy flows; however, given the importance of the service industry in the economy of developing countries as well as the cumulative impacts related to this industry, it remains an important call for future research.

2.6 Conclusions

This paper provides a better understanding of MFCA application in developing countries. Our study has shown that MFCA research has primarily focused on Asian developing countries. Moreover, while the use of MFCA is often associated with improving eco-efficiency, the reviewed studies also indicate a high relevance for strategic decision-making processes within organizations. Finally, one of the key challenges in MFCA application reported in developing country studies lies in existing accounting systems with limited data availability and insufficient cost allocation.

Nonetheless, this research was also confronted with some limitations. The first limitation relates to databases used to search relevant publications. It is possible that publications matching the research focus have been not found because they are contained in other databases. The second limitation refers to language, since some studies might have not been conducted in English.

Based on our findings and gaps identified in the MFCA literature, we suggest paths for further research as follows. First, quantitative research is necessary to better understand the current level of MFCA application as well as to confirm factors that have been shown to influence MFCA implementation in developing countries by exploratory case study research, and also in

other regions beyond Asia. Second, comparative studies into MFCA application among countries appears promising to better understand the different factors influencing the take-up of innovative accounting methods such as MFCA. Third, future research could further investigate the process of MFCA application in SMEs in developing countries. SMEs play a crucial role in emerging countries (World Bank, 2019) and the usage of MA (including MFCA) could be both lower and different in SMEs compared to larger entities (Lavia López and Hiebl, 2015). Fourth, in spite of the dominance of research on MFCA in manufacturing industries, future studies could continue to further examine these industries more broadly since "the importance of manufacturing industries is increasing in developing economies compared with a declining trend in industrialized economies" (UNIDO, 2017, p. 161). Along with manufacturing industries, there is also a need to further investigate MFCA application and diffusion in service industries due to their importance in the economy of developing countries as well as the environmental impacts associated with the service sector.

2.7 References

Alawattage, C., Wickramasinghe, D., Tsamenyi, M. and Uddin, S. (2017), "Doing critical management accounting research in emerging economies", *Advances in Scientific and Applied Accounting*, Vol. 10 No. 2, pp. 177–188.

Albu, N. and Albu, C.N. (2012), "Factors associated with the adoption and use of management accounting techniques in developing countries: The case of Romania", *Journal of International Financial Management & Accounting*, Vol. 23 No. 3, pp. 245–276.

Ali, W., Frynas, J.G. and Mahmood, Z. (2017), "Determinants of corporate social responsibility (CSR) disclosure in developed and developing countries: A literature review", *Corporate Social Responsibility and Environmental Management*, Vol. 24 No. 4, pp. 273–294.

APO (2014), "Manual on Material Flow Cost Accounting: ISO 14051", available at: https://www.apo-tokyo.org/publications/wp-content/uploads/sites/5/Manual_on_Material_Flow_Cost_Accounting_ISO14051-2014.pdf (accessed 26 May 2020).

Belal, A.R., Cooper, S.M. and Roberts, R.W. (2013), "Vulnerable and exploitable: The need for organisational accountability and transparency in emerging and less developed economies", *Accounting Forum*, Vol. 37 No. 2, pp. 81–91.

Bouri, A., Breij, M., Diop, M., Kempner, R., Klinger, B. and Stevenson, K. (2011), "Report on Support to SMEs in Developing Countries through Financial Intermediaries", available at: https://www.eib.org/attachments/dalberg_sme-briefing-paper.pdf (accessed 10 February 2020).

Bruhn, M., Hommes, M., Khanna, M., Singh, S., Sorokina, A. and Wimpey, J.S. (2017), "MSME Finance Gap: Assessment of The Shortfalls and Opportunities in Financing Micro, Small, and Medium Enterprises in Emerging Markets (English)", available at: http://documents.worldbank.org/curated/en/653831510568517947/MSME-finance-gap-assessment-of-the-shortfalls-and-opportunities-in-financing-micro-small-and-medium-enterprises-in-emerging-markets (accessed 10 March 2020).

Burritt, R.L., Herzig, C., Schaltegger, S. and Viere, T. (2019), "Diffusion of environmental management accounting for cleaner production: Evidence from some case studies", *Journal of Cleaner Production*, Vol. 224, pp. 479–491.

Burritt, R.L., Herzig, C. and Tadeo, B.D. (2009), "Environmental management accounting for cleaner production: The case of a Philippine rice mill", *Journal of Cleaner Production*, Vol. 17 No. 4, pp. 431–439.

Chaiwan, W., Boonmee, C. and Kasemset, C. (2015), "Waste reduction in meat processing industry: The application of MFCA (ISO 14051)", in Kachitvichyanukul, V., Sethanan, K. and Golinska-Dawson, P. (Eds.), *Toward Sustainable Operations of Supply Chain and Logistics Systems*, *EcoProduction*, Springer International Publishing, Cham, Switzerland, pp. 183–193.

Chattinnawat, W., Suriya, W. and Jindapanpisan, P. (2018), "Application of MFCA with LEAN to improve pajama production process: A case study of Confederate International Co., Ltd", in Lee, K.-H. and Schaltegger, S. (Eds.), *Accounting for Sustainability: Asia Pacific Perspectives*, *Eco-Efficiency in Industry and Science*, Vol. 33, Springer International Publishing, Cham, Switzerland, pp. 209–235.

Chompu-inwai, R. and Apinun, T. (2015), "The application of Material Flow Cost Accounting for loss reduction in the pottery and decorative ceramics production process", in Zhang, Z., Zhang, R., Fernandez, V. and Liu, S. (Eds.), *2015 International Conference on Logistics, Informatics and Service Sciences (LISS), Barcelona, Spain, 27-29 July*, IEEE, New York, USA, pp. 1–6.

Chompu-inwai, R., Jaimjit, B. and Premsuriyanunt, P. (2015), "A combination of Material Flow Cost Accounting and design of experiments techniques in an SME: the case of a wood products manufacturing company in northern Thailand", *Journal of Cleaner Production*, Vol. 108, pp. 1352–1364.

Christ, K.L. and Burritt, R.L. (2013), "Environmental management accounting: the significance of contingent variables for adoption", *Journal of Cleaner Production*, Vol. 41, pp. 163–173.

Christ, K.L. and Burritt, R.L. (2015), "Material flow cost accounting: a review and agenda for future research", *Journal of Cleaner Production*, Vol. 108, pp. 1378–1389.

Dincer, I. (2000), "Renewable energy and sustainable development: a crucial review", *Renewable and Sustainable Energy Reviews*, Vol. 4 No. 2, pp. 157–175.

Divanbeigi, R., Paustian, N. and Loayza, N.V. (2016), "Structural transformation of the agricultural sector: a primer (English). Research & Policy Briefs", available at: http://documents.worldbank.org/curated/en/561951467993197265/Structural-transformation-of-the-agricultural-sector-a-primer (accessed 20 January 2020).

Doorasamy, M. (2014), "The effectiveness of Material Flow Cost Accounting (MFCA) in identifying non-product output costs and its impact on environmental performance in paper manufacturing companies: A case study in Kwa-Zulu Natal", *Journal of Accounting and Management*, Vol. 4 No. 3, pp. 51–69.

Dunuwila, P., Rodrigo, V. and Goto, N. (2018), "Financial and environmental sustainability in manufacturing of crepe rubber in terms of material flow analysis, material flow cost accounting and life cycle assessment", *Journal of Cleaner Production*, Vol. 182, pp. 587–599.

Endenich, C., Brandau, M. and Hoffjan, A. (2011), "Two decades of research on comparative management accounting - achievements and future directions", *Australian Accounting Review*, Vol. 21 No. 4, pp. 365–382.

Fakoya, M.B. (2015), "Adopting material flow cost accounting model for improved waste-reduction decisions in a micro-brewery", *Environment, Development and Sustainability*, Vol. 17 No. 5, pp. 1017–1030.

Fakoya, M.B. and van der Poll, H.M. (2013), "Integrating ERP and MFCA systems for improved waste-reduction decisions in a brewery in South Africa", *Journal of Cleaner Production*, Vol. 40, pp. 136–140.

Ghasemi, R., Habibi, H.R., Ghasemlo, M. and Karami, M. (2019), "The effectiveness of management accounting systems: evidence from financial organizations in Iran", *Journal of Accounting in Emerging Economies*, Vol. 9 No. 2, pp. 182–207.

Ghosh, B., Herzig, C. and Mangena, M. (2019), "Controlling for sustainability strategies: findings from research and directions for the future", *Journal of Management Control*, Vol. 30 No. 1, pp. 5–24.

Gibson, K. (1997), "NOTES Courses on environmental accounting", *Accounting, Auditing & Accountability Journal*, Vol. 10 No. 4, pp. 584–593.

Guenther, E., Jasch, C., Schmidt, M., Wagner, B. and Ilg, P. (2015), "Material Flow Cost Accounting – looking back and ahead", *Journal of Cleaner Production*, Vol. 108, pp. 1249–1254.

Hancock, D.R. and Algozzine, B. (2006), *Doing Case Study Research: A Practical Guide for Beginning Researchers*, Columbia University: Teachers College Press, New York, USA.

Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (2012a), "EMA for eco-efficiency in a towel production firm", in Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (Eds.), *Environmental Management Accounting: Case studies of South-East Asian Companies*, Routledge, London, UK, pp. 59–75.

Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (2012b), "Environmental impact assessment, compliance monitoring and reporting in electroplating", in Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (Eds.), *Environmental Management Accounting: Case studies of South-East Asian Companies*, Routledge, London, UK, pp. 148–172.

Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (Eds.) (2012c), *Environmental Management Accounting: Case studies of South-East Asian Companies*, Vol. 36, Routledge, London, UK.

Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (2012d), "Material flow cost accounting in a snack producer", in Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (Eds.), *Environmental Management Accounting: Case studies of South-East Asian Companies*, Routledge, London, UK, pp. 98–116.

Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (2012e), "Relevant environmental costing and decision-making in a SAA paper manufacturer", in Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (Eds.), *Environmental Management Accounting: Case studies of South-East Asian Companies*, Routledge, London, UK, pp. 173–190.

Hopper, T., Lassou, P. and Soobaroyen, T. (2017), "Globalisation, accounting and developing countries", *Critical Perspectives on Accounting*, Vol. 43, pp. 125–148.

Hopper, T., Tsamenyi, M., Uddin, S. and Wickramasinghe, D. (2009), "Management accounting in less developed countries: what is known and needs knowing", *Accounting, Auditing & Accountability Journal*, Vol. 22 No. 3, pp. 469–514.

Huang, S., an Chiu, Chao, P. and Wang, N. (2019), "The application of Material Flow Cost Accounting in waste reduction", *Sustainability*, Vol. 11 No. 5, pp. 1–27.

IFAC (2005), *International Guidance Document of Environmental Management Accounting*, New York.

ISO (2011), *Environmental Management - Material Flow Cost Accounting - General Framework*, Switzerland.

ISO (2019), *Environmental Management— Material Flow Cost Accounting— Guidance for Practical Implementation in SMEs*, Switzerland.

Jakrawatana, N., Pingmuangleka, P. and Gheewala, S.H. (2016), "Material flow management and cleaner production of cassava processing for future food, feed and fuel in Thailand", *Journal of Cleaner Production*, Vol. 134, pp. 633–641.

Jalaludin, D., Sulaiman, M. and Nazli Nik Ahmad, N. (2011), "Understanding environmental management accounting (EMA) adoption: a new institutional sociology perspective", *Social Responsibility Journal*, Vol. 7 No. 4, pp. 540–557.

Jamali, D., Sidani, Y. and El-Asmar, K. (2009), "A three country comparative analysis of managerial CSR perspectives: Insights from Lebanon, Syria and Jordan", *Journal of Business Ethics*, Vol. 85 No. 2, pp. 173–192.

Jasch, C. (2006), "Environmental management accounting (EMA) as the next step in the evolution of management accounting", *Journal of Cleaner Production*, Vol. 14 No. 14, pp. 1190–1193.

Jasch, C. (2009), *Environmental and Material Flow Cost Accounting: Principles and Procedures, Eco-Efficiency in Industry and Science, v. 25*, Springer, Dordrecht, Netherlands.

Joshi, P.L. (2001), "The international diffusion of new management accounting practices: the case of India", *Journal of International Accounting, Auditing and Taxation*, Vol. 10 No. 1, pp. 85–109.

Kasemset, C. and Boonmee, C. (2017), "An integration method of MFCA, dynamic programming, and multiple criteria decision making in operations improvement: A case study", in *2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Singapore, 10-13 December*, IEEE, pp. 745–749.

Kasemset, C., Chernsupornchai, J. and Pala-ud, W. (2015), "Application of MFCA in waste reduction: case study on a small textile factory in Thailand", *Journal of Cleaner Production*, Vol. 108, pp. 1342–1351.

Kasemset, C., Sasiopars, S. and Suwiphat, S. (2013), "The application of MFCA analysis in process improvement: A case study of plastics packaging factory in Thailand", in Lin, Y.-K., Tsao, Y.-C. and Lin, S.-W. (Eds.), *Proceedings of the Institute of Industrial Engineers Asian Conference 2013*, Springer, Singapore, pp. 353–361.

Kuasirikun, N. and Sherer, M. (2004), "Corporate social accounting disclosure in Thailand", *Accounting, Auditing & Accountability Journal*, Vol. 17 No. 4, pp. 629–660.

Kumar, R. (2017), "Targeted SME financing and employment effects: what do we know and what can we do differently? (English). Jobs working paper", available at: http://documents.worldbank.org/curated/en/577091496733563036/Targeted-SME-financing-and-employment-effects-what-do-we-know-and-what-can-we-do-differently (accessed 6 March 2020).

Kuttner, M. and Feldbauer-Durstmüller, B. (2016), "Comparative management accounting in developing countries–State-of-the-art and future perspectives", *International Journal of Business Research*, Vol. 16 No. 3, pp. 81–104.

Lavia López, O. and Hiebl, M.R.W. (2015), "Management accounting in small and medium-sized enterprises: current knowledge and avenues for further research", *Journal of Management Accounting Research*, Vol. 27 No. 1, pp. 81–119.

Le, T.T., Nguyen, T. and Phan, T. (2019), "Environmental management accounting and performance efficiency in the Vietnamese construction material industry—A managerial implication for sustainable development", *Sustainability*, Vol. 11 No. 19, p. 5152.

Lenz, R.T. and Engledow, J.L. (1986), "Environmental analysis units and strategic decision-making: A field study of selected 'leading-edge' corporations", *Strategic Management Journal*, Vol. 7 No. 1, pp. 69–89.

Lima Ribeiro, V.P. and Aibar-Guzman, C. (2010), "Determinants of environmental accounting practices in local entities: evidence from Portugal", *Social Responsibility Journal*, Vol. 6 No. 3, pp. 404–419.

Mahmoudi, E., Jodeiri, N. and Fatehifar, E. (2017), "Implementation of material flow cost accounting for efficiency improvement in wastewater treatment unit of Tabriz oil refining company", *Journal of Cleaner Production*, Vol. 165, pp. 530–536.

Maina Waweru, N., Hoque, Z. and Uliana, E. (2004), "Management accounting change in South Africa", *Accounting, Auditing & Accountability Journal*, Vol. 17 No. 5, pp. 675–704.

Mani, M. and Wheeler, D. (1998), "In search of pollution havens? Dirty industry in the world economy, 1960 to 1995", *The Journal of Environment & Development No.* 7, pp. 215–247.

METI (2007), *Guide for Material Flow Cost Accounting,* 1st, Japan.

Mokhtar, N., Jusoh, R. and Zulkifli, N. (2016), "Corporate characteristics and environmental management accounting (EMA) implementation: evidence from Malaysian public listed companies (PLCs)", *Journal of Cleaner Production*, Vol. 136, pp. 111–122.

Nguyen, D.T.T. (2018), "Is Japanese Material Flow Cost Accounting useful to Vietnam? A case study of a Vietnamese seafood processing company", in Lee, K.-H. and Schaltegger, S. (Eds.), *Accounting for Sustainability: Asia Pacific Perspectives*, *Eco-Efficiency in Industry and Science*, Vol. 33, Springer International Publishing, Cham, Switzerland, pp. 237–258.

Nyide, C.J. (2016), "Material flow cost accounting as a tool for improved resource efficiency in the hotel sector: A case of emerging market", *Risk Governance and Control: Financial Markets and Institutions*, Vol. 6 No. 4, pp. 428–435.

Olalekan, I.O. and Jumoke, O.O. (2017), "Identifying barriers to environmental management accounting practices: A comparative study of Nigeria and South Africa", *The Business and Management Review*, Vol. 9 No. 1, pp. 168–179.

Onishi, Y., Kokubu, K. and Nakajima, M. (2008), "Implementing Material Flow Cost Accounting in a pharmaceutical company", in Schaltegger, S., Bennett, M., Burritt, R.L. and Jasch, C. (Eds.), *Environmental Management Accounting for Cleaner Production*, *Eco-Efficiency in Industry and Science*, Vol. 24, Springer Netherlands, Dordrecht, Netherlands, pp. 395–409.

Parker, L.D. (2011), "Twenty-one years of social and environmental accountability research: A coming of age", *Accounting Forum*, Vol. 35 No. 1, pp. 1–10.

Qian, W., Burritt, R. and Chen, J. (2015), "The potential for environmental management accounting development in China", *Journal of Accounting & Organizational Change*, Vol. 11 No. 3, pp. 406–428.

Ramasamy, B. and Ting, H.W. (2004), "A comparative analysis of corporate social responsibility awareness: Malaysian and Singaporean firms", *Journal of Corporate Citizenship No.* 13, pp. 109–123.

Rieckhof, R., Bergmann, A. and Guenther, E. (2015), "Interrelating material flow cost accounting with management control systems to introduce resource efficiency into strategy", *Journal of Cleaner Production*, Vol. 108, pp. 1262–1278.

Salim, K., Amir, A.M. and Sulaiman, M. (2017), "Material Flow Cost Accounting, perceived ecological environmental uncertainty, supplier integration and business performance: A study of manufacturing sector in Malaysia", *Asian Journal of Accounting and Governance*, Vol. 8 Special Issue, pp. 107–121.

Schaltegger, S., Gibassier, D. and Zvezdov, D. (2013), "Is environmental management accounting a discipline? A bibliometric literature review", *Meditari Accountancy Research*, Vol. 21 No. 1, pp. 4–31.

Schaltegger, S., Viere, T. and Zvezdov, D. (2012), "Tapping environmental accounting potentials of beer brewing", *Journal of Cleaner Production*, 29-30, pp. 1–10.

Schaltegger, S. and Zvezdov, D. (2015), "Expanding material flow cost accounting. Framework, review and potentials", *Journal of Cleaner Production*, Vol. 108, pp. 1333–1341.

Schmidt, M. (2015), "The interpretation and extension of Material Flow Cost Accounting (MFCA) in the context of environmental material flow analysis", *Journal of Cleaner Production*, Vol. 108, pp. 1310–1319.

Sharvini, S.R., Noor, Z.Z., Chong, C.S., Stringer, L.C. and Yusuf, R.O. (2018), "Energy consumption trends and their linkages with renewable energy policies in East and Southeast Asian countries: Challenges and opportunities", *Sustainable Environment Research*, Vol. 28 No. 6, pp. 257–266.

Smith, M., Abdullah, Z. and Abdul Razak, R. (2008), "The diffusion of technological and management accounting innovation: Malaysian evidence", *Asian Review of Accounting*, Vol. 16 No. 3, pp. 197–218.

Stechemesser, K. and Guenther, E. (2012), "Carbon accounting: a systematic literature review", *Journal of Cleaner Production*, Vol. 36, pp. 17–38.

Strobel, M. and Redmann, C. (2004), "Flow Cost Accounting, an accounting approach based on the actual flows of materials", in Bennett, M. and Bouma, J.J. (Eds.), *Environmental Management Accounting: Informational and Institutional Developments*, *Eco-Efficiency in Industry and Science*, Vol. 9, Kluwer Academic Publishers, Dordrecht, Netherlands, pp. 67–82.

Sulong, F., Sulaiman, M. and Norhayati, M.A. (2015), "Material Flow Cost Accounting (MFCA) enablers and barriers: the case of a Malaysian small and medium-sized enterprise (SME)", *Journal of Cleaner Production*, Vol. 108, pp. 1365–1374.

The Vietnamese Directorate Standards, Metrology, and Quality (2018), "Material Flow Cost Accounting - MFCA: Basic Content and Applied Guideline", available at: https://tcvn.gov.vn/wp-content/uploads/2019/03/17.-LVP-66A-T12.2018.-88t-Sach-MFCA-Final-20.12-mi.pdf (accessed 26 May 2020).

The World Bank (2020), "World Bank Country and Lending Groups", available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups (accessed 10 June 2020).

Tilt, C.A. (2018), "Making social and environmental accounting research relevant in developing countries: A matter of context?", *Social and Environmental Accountability Journal*, Vol. 38 No. 2, pp. 145–150.

Tranfield, D., Denyer, D. and Smart, P. (2003), "Towards a methodology for developing evidence-

informed management knowledge by means of systematic review", *British Journal of Management*, Vol. 14 No. 3, pp. 207–222.

Trappey, A.J., Yeh, M.F., Wu, S.C.-Y. and Kuo, A.Y. (2013), "ISO14051-based Material Flow Cost Accounting system framework for collaborative green manufacturing", in *Proceedings of the 2013 IEEE 17th International Conference on Computer Supported Cooperative Work in Design (CSCWD), Whistler, BC, Canada, 27-29 June*, IEEE, pp. 639–644.

Ulhasanah, N. and Goto, N. (2012), "Preliminary design of eco-city by using industrial symbiosis and waste co-processing based on MFA, LCA, and MFCA of cement industry in Indonesia", *International Journal of Environmental Science and Development*, pp. 553–561.

UNIDO (2017), "Industrial Development Report 2018 - Demand for Manufacturing: Driving Inclusive and Sustainable Industrial Development", available at: https://www.unido.org/resources-publications-flagship-publications-industrial-development-report-series/industrial-development-report-2018 (accessed 9 March 2020).

United Nations (2020), "World Economic Situation Prospects", available at: https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2020_Annex.pdf (accessed 10 June 2020).

United Nations Development Programme (2020), "Human Development Index (HDI)", available at: http://hdr.undp.org/en/content/human-development-index-hdi (accessed 10 June 2020).

van Helden, J. and Uddin, S. (2016), "Public sector management accounting in emerging economies: A literature review", *Critical Perspectives on Accounting*, Vol. 41, pp. 34–62.

Viegas, C.V., Bond, A.J., Vaz, C.R., Borchardt, M., Pereira, G.M., Selig, P.M. and Varvakis, G. (2016), "Critical attributes of sustainability in higher education: a categorisation from literature review", *Journal of Cleaner Production*, Vol. 126, pp. 260–276.

Viere, T., Herzig, C., Schaltegger, S. and Leung, R. (2006), "Partnerships for sustainable business development: capacity building in South-East Asia", in Welford, R., Hills, P. and Young, W. (Eds.), *Partnerships for Sustainable Development: Perspectives from the Asia-Pacific Region*, Hong Kong: The Centre of Urban Planning and Environmental Management, pp. 4–15.

Wagner, B. (2015), "A report on the origins of Material Flow Cost Accounting (MFCA) research activities", *Journal of Cleaner Production*, Vol. 108, pp. 1255–1261.

WBCSD (2006), "Eco-efficiency Learning Module", available at: https://www.wbcsd.org/Projects/Education/Resources/Eco-efficiency-Learning-Module (accessed 10 March 2020).

Weidong, Z., Ryoichi, N., Chen, Z. and Pinlong, C. (2009), "A case study on the implementation of MFCA in SMEs: HNJC company", *Asia-Pacific Management Accounting Journal*, Vol. 42, pp. 29–42.

Wijewardena, H. and Zoysa, A. de (1999), "A comparative analysis of management accounting practices in Australia and Japan: An empirical investigation", *The International Journal of Accounting*, Vol. 34 No. 1, pp. 49–70.

World Bank (2019), "World Bank Group Support for Small and Medium Enterprises A Synthesis of Evaluative Findings (English)", available at: http://documents.worldbank.org/curated/en/640401570040096569/World-Bank-Group-Support-for-Small-and-Medium-Enterprises-A-Synthesis-of-Evaluative-Findings (accessed 10 March 2020).

Xiaomei, L. (2004), "Theory and practice of environmental management accounting", *International Journal of Technology Management & Sustainable Development*, Vol. 3 No. 1, pp. 47–57.

Yagi, M. and Kokubu, K. (2018), "Corporate material flow management in Thailand: The way to material flow cost accounting", *Journal of Cleaner Production*, Vol. 198, pp. 763–775.

Zhang, B. and Liu, J. (2015), "Empirical study on MFCA introduced in Sekisui Chemical Group and its enlightenment", in Yarlagadda, P. (Ed.), *Proceedings of the 3rd International Conference on*

Advances in Energy and Environmental Science 2015, Zhuhai, China, 25-26 July, Atlantis Press, Paris, France, pp. 1456–1460.

Zhou, Z., Zhao, W., Chen, X. and Zeng, H. (2017), "MFCA extension from a circular economy perspective: Model modifications and case study", *Journal of Cleaner Production*, Vol. 149, pp. 110–125.

Chapter 3

Material Flow Cost Accounting in Vietnam - A Multi-level Exploration

3.1 Introduction

Increased productivity is a key driver of economic growth in support of reduced poverty, and is a grand challenge being addressed by the United Nations Sustainable Development Goals (United Nations Economic and Social Commission for Asia and the Pacific, 2016). Unfortunately, rapid economic growth can also lead to global environmental problems including resource scarcity (Beckerman, 1992), waste, and severe pollution (Grossman and Krueger, 1995; Managi and Kaneko, 2006; OECD, 2008). The OECD (2019) emphasizes that creation and diffusion of new ideas, products, processes and methods are fundamental to any transition to a greener global economy. Hence, at the international macro-level, nations are challenged to achieve higher economic growth, increased productivity and reduced environmental impacts.

Improved productivity at the macro-level needs support from both meso-level institutions, such as government agencies, industry associations and non-government organizations (Kokubu and Nakajima, 2004; Wagner, 2015), and appropriate accounting techniques. Meso-level institutions can play a vital role in moving towards broader dissemination of new accounting techniques which support the application of greener management practices (Johnstone, 2018; Mia, 2005). Schaltegger *et al.* (2022, p. 17) observe, however, that until now, "practically no methods have been proposed … to how to broaden the management accounting scope including linkages to the meso- and macro-level in an effective way".

Productivity increases are also required at the entity-level (Tuttle and Heap, 2007). Under pressure to increase productivity and lower environmental impacts, companies seek tools for effective resource management (Kokubu and Kitada, 2015; Sahu *et al.*, 2021). Material flow cost accounting (MFCA) is a key tool which has been introduced for entities and their supply chains, with the aim of increasing combined economic and environmental efficiency (eco-efficiency) (Christ and Burritt, 2015). MFCA provides a way to promote green productivity at the micro-level (APO, 2006, 2014). Past research has shown that MFCA supports management in strengthening productivity growth while minimizing or reducing negative environmental effects at the corporate level. For example, when firms in developing countries have low productivity because of financial constraints (Bloom *et al.*, 2010), successful examples of MFCA applications have demonstrated its effectiveness in achieving green productivity through waste reduction and associated cost savings (Sahu *et al.*, 2021; Tran and Herzig, 2020).

While MFCA benefits have been demonstrated in prior studies (Herzig *et al.*, 2012; Sulong *et al.*, 2015) the main focus has been on solving corporate level management challenges and assessing the potential for efficiency without explicitly considering the connectedness of corporate MFCA with meso- and macro-level issues (Gibassier and Alcouffe, 2018; Hopper, 2019; Schaltegger, 2018). In addition, prior studies pay limited attention to the role of actors at the meso-level in moving towards broader dissemination of new management techniques and innovations (Johnstone, 2018; Mia, 2005). However, understanding the links between micro-, meso- and macro-levels of analysis is important in the search for green productivity, as shown by recent calls for research on the relationship between micro-level applications and higher-level challenges (Bebbington and Unerman, 2020; Lin and Bhardwaj, 2020). Against this background, the following research question is addressed:

In what ways are macro-, meso- and micro-level links related to the development of material flow cost accounting?

The paper is the first to use a multi-level approach to explore how macro-, meso- and micro-level contextual and transformational linkages interact to encourage (or discourage) take-up of material flow cost accounting. Using the case of Vietnam, the research identifies challenges for the integration of effort to develop MFCA across the different levels and suggests ways to overcome these.

The remainder of the paper is organized as follows. Section 3.2 details MFCA and the multi-level theoretical perspective upon which the study is based. In Section 3.3, the research method is outlined. Section 3.4 presents research findings. These are discussed in Section 3.5. Section 3.6 provides a brief conclusion, including areas for future research and potential limitations. Finally, Section 3.6 presents appendix and Section 3.7 provides references of the paper.

3.2 Theoretical Foundation

This section includes two parts. First, key information is provided about MFCA as a tool for improving materials productivity by reducing waste through identifying non-product outputs. Second, the multi-level analytical framework to be used is introduced.

3.2.1 Material Flow Cost Accounting

According to the International Organization for Standardization (ISO, 2011, p. 3), MFCA is "a tool for quantifying the flows and stocks of materials in processes or production lines in both physical and monetary units". The tool supports waste reduction and enhancement of profitability. MFCA originated from the concept of input-output, mass-balance, or material flows in the early 1920s and 1930s. It then evolved via environmental management projects and rapidly disseminated in Germany and Japan through eco-efficiency projects. In Japan, the use of MFCA spread with the support of the Japanese Ministry of Economy, Trade, and Industry (Wagner, 2015). In 2011, based on the initial ideas developed by the Japanese Ministry of Economy, Trade, and Industry and discussions involving 28 national committees worldwide, MFCA was published as a new international standard, ISO 14051, which promised a new era for MFCA implementation and research (Christ and Burritt, 2016). It was later extended to include supply chains in ISO 14052 (ISO, 2017).

Two main research streams on MFCA are identifiable. The first addresses the application of MFCA in different contexts such as industries, regions or institutional environments (Sahu *et al.*, 2021; Sulong *et al.*, 2015), while the second considers conceptual/methodological developments (ISO, 2011; Jasch, 2009; Wagner, 2015). Through case studies, MFCA applications have played a key role in the transfer of MFCA knowledge to different organizations (Christ and Burritt, 2015) in developed and developing countries (Herzig *et al.*, 2012; METI, 2010). Furthermore, case studies demonstrate the various environmental and economic benefits of MFCA application, such as resource efficiency (e.g., waste reduction and cost savings) and support for strategic decisions (Herzig *et al.*, 2012).

There is a lack of theoretical framework used in research on MFCA (Christ and Burritt, 2015). Some frameworks and theories adopted in studies on environmental (management) accounting provide potential for addressing this deficiency, such as contingency theory (Gunarathne *et al.*, 2022; Nkundabanyanga *et al.*, 2021), institutional theory (Che Ku Kassim *et al.*, 2021; Imtiaz Ferdous *et al.*, 2019), legitimacy theory (Deegan, 2017; Owen, 2008), and stakeholder theory (Marrone *et al.*, 2020). Recently, the diffusion of innovation theory of Rogers (2003) has been used in studies on MFCA (Burritt *et al.*, 2019; Sulong *et al.*, 2015). However, there are still other unexplored theoretical approaches (Parker, 2011) that may be able to contribute to the further development of MFCA literature.

Prior research has examined the process of applying MFCA (Dunuwila *et al.*, 2018; Kasemset *et al.*, 2015; Sulong *et al.*, 2015) and identified enablers of and barriers to MFCA adoption at the entity level (Tran and Herzig, 2020; Walz and Günther, 2021). For example, MFCA application has helped a small textile factory in Thailand to reduce waste and costs (Kasemset *et al.*, 2015). Nevertheless, the perspectives of a broader set of actors have not been examined in the MFCA context. In particular, with focus on the micro-level it is unclear whether and how MFCA has been supported by the government and other social actors, in socio-technical regimes, and linked with the meso- and macro-levels. Recently, Schaltegger *et al.* (2022) suggest the use of a multi-level framework to show the links between corporate sustainability management accounting across levels. Following this suggestion, the paper adopts Geels' (2002) multi-level framework as the basis for analysis.

3.2.2 A Multi-level Framework

The multi-level framework has been widely used as an analytical framework to understand transitions concerning technological innovations and to explain the social factors in transition pathways (Geels, 2019; Geels and Schot, 2007; Kanger, 2021). This framework distinguishes three levels of analysis and their connections: (1) macro-level landscape developments, (2) meso-level sociotechnical regimes, and (3) micro-level niche-innovations (see **Figure 3.1**).

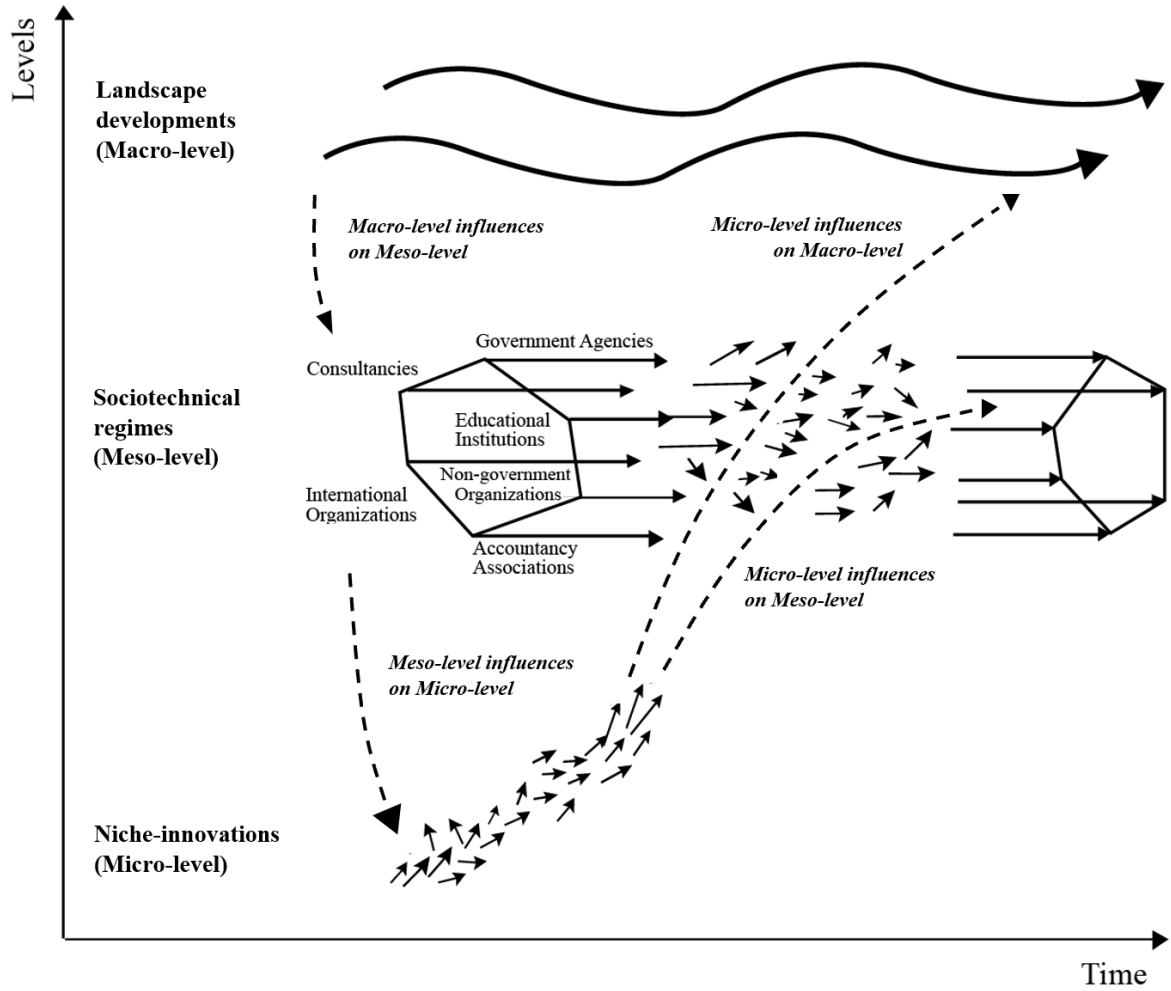

Figure 3.1 Multi-level Framework

Source: Adapted from Geels and Schot (2007, p. 401)

Landscape developments at the macro-level are related to external pressures which develop over long periods of time, set in the epochal environmental crisis (Bebbington *et al.*, 2020). These pressures include global developments and challenges to planetary boundaries (Linnenluecke and Smith, 2019). Socio-technical regimes refer to sets of rules introduced by various social actors at the meso-level, such as government agencies, consultants, professional associations and international organizations. Finally, niche-innovations occur at the corporate micro-level and include administrative innovations (Geels, 2002; Geels and Schot, 2007).

The multi-level framework is adopted because it provides a two-way contextual and transformational analytical bridge across macro-, meso- and micro-levels. It also focuses on the analysis of social actors and their interactions with innovations, such as MFCA, at different levels. Finally, it provides a framework for understanding potential barriers to MFCA transition over time (Geels, 2002; Geels, 2005).

3.3. Research Design

3.3.1 Case Study Method

The research method chosen constitutes an exploratory, qualitative design. A single exploratory case study (Yin, 2009) is used to explore how contextual and transformational processes are interlinked at multiple levels (Geels, 2005) and help improve the take-up of MFCA in practice (Herzig *et al.*, 2006). The study provides an in-depth understanding of MFCA development, its application in Vietnam and, given prior research on the benefits of MFCA, its links to green productivity in the Vietnamese context. Vietnam was chosen as the case-setting for three reasons. First, Vietnam has integrated MFCA into its national productivity program with an emphasis on resolving both productivity and environmental problems. Second, Vietnam is a member of the Asian Productivity Organization (APO) which focuses on pursuing 'green' productivity. Finally, Vietnam has very low productivity (VEPR and GRIPS, 2020) and environmental performance indexes (Huang and Xu, 2019) in comparison with other ASEAN countries. This suggests there is interest in MFCA at multiple levels which provides a suitable setting in which to consider the various macro-, meso- and micro-level links associated with MFCA take-up and develop a greater understanding of how these relationships can be leveraged in the future.

3.3.2 Data Collection

Primary data was collected through interviews which provide insights into interviewee experience with MFCA (Kvale, 2007). Secondary data was obtained from documentary texts, reports, articles, videos, and regulations through sources, such as the Vietnamese Government and the APO (see **Appendix 3.1**). Secondary data provides a basis for triangulating the research findings from interviews (Saunders *et al.*, 2012).

Purposive and snowball sampling (Saunders *et al.*, 2012) were used to provide the basis for selecting sufficient interviewees from various stakeholder groups. An invitation letter was forwarded to potential interviewees covering the objectives of the research, the interview procedures, and commitments in relation to research ethics such as data confidentiality, security of interview record, and anonymity in quotations taken from interviews. Based on this letter and expert knowledge of the authors, different actors in Vietnam were contacted and a set of interviews established.

The process lead to 17 interviews in 7 business organizations (BU1-BU7), 4 consultancies (CO1-CO4), 1 government agency (GA1), 2 non-government organizations (NG1-NG2), 2 education institutions (EI1-EI2), and 1 accountancy body (AB1). The majority of the interviewees (70.5%) had more than ten years of work experience, which increased the quality of responses and insights provided. They had knowledge about accounting, finance, sustainability, circular economics, cleaner production, and material control.

Before the interviews were conducted, three pilot interviews with independent parties were used to ensure the quality and appropriateness of themes of interview questions. Following this feedback, the list of questions was revised and completed and an interview guide developed (see **Appendix 3.2**) and checked by two co-authors. The semi-structured, in-depth interviews were used to identify perceptions of interviewees about the development of MFCA in Vietnam and the reasons for and against its implementation. The interview guide contains three parts: background information (e.g., name of reporter, name of interviewee, date, and place of interview); experience of the interviewee; and main and probing questions about MFCA. Based on the guide, interviews were carried out in two stages. First, for purposive sampling, in December 2019 one researcher travelled to interviewee workplaces in Vietnam to conduct the interviews. Second, snowball sampling led to telephone interviews being undertaken between March and August 2020. The length of interviews ranged from 64 to 122 minutes, with an average of 96 minutes. With one exception, these interviews were recorded. For all interviews detailed notes were made immediately afterwards for later analysis.

3.3.3 Transcription and Coding

All interviews were conducted in Vietnamese, transcribed in Vietnamese, coded and translated in English, using MAXQDA 2020 software. One researcher initially conducted and transcribed the interviews and undertook backwards translation between the English and Vietnamese languages. The coding process was undertaken in two cycles (Saldaña, 2013). First, attributed coding and descriptive coding were conducted to summarize the data. Attributed coding obtained information about the participants' setting and characteristics, while descriptive coding, based on sentences, was used to assign labels to the topics of interview data. Second, pattern coding was used to group these summaries into a smaller number of themes (Miles and Huberman, 1994). To enhance the reliability of the coding, the researcher checked all coding − three times as to transcripts of BU5, BU7, CO3, CO4, GA1, EI2, and twice as to the other interviewees. In addition, the interviewer asked the interviewees to confirm the meanings of messages during the interviews.

3.4. Results

Analysis of results is organized in terms of top-down contextual multi-level settings, followed by bottom-up transformational settings across levels.

3.4.1 Top-down Contextual Settings

3.4.1.1 Context - landscape to Regime Level

Vietnam has signed up to the United Nations Sustainable Development Goals and is aware of global environmental issues. In response, it has a sustainable development strategy (Prime Minister, 2012b), national action plan to meet the Goals (Prime Minister, 2017) and reports on progress towards meeting them (United Nations Sustainable Development Goals, 2018). Vietnam has only exceeded one of nine planetary boundaries (Rockström *et al.*, 2009), carbon dioxide emissions, and is one of the best performers in this context (O'Neill *et al.*, 2018). Stimulated by macro-level landscape activities, using a network of meso-level organizations to help achieve the Goals, Vietnam is targeting improved socio-economic and environmental performance (Prime Minister, 2004; United Nations Vietnam, 2021).

Before current concern with global environmental problems, a strategy for socio-economic development (2001–2010) was passed at the 9th National Congress of the Party (MPI, 2001). The strategy emphasized the importance of increased productivity and economic development while protecting the environment. In response to this strategy, there have been many international projects and programs between Vietnam and developed countries. In particular, an international project, "Environmental Management Accounting for Small and Medium-

Sized Enterprises in South-East Asia (EMA-SEA)", was managed and funded by Capacity Building International–Germany in collaboration with the Vietnam Cleaner Production Centre (VNCPC) as a local partner (Viere *et al.*, 2006). In addition, programs were conducted by the Institute of Management Technology in collaboration with the Association for Overseas Technical Cooperation and Sustainable Partnerships–Japan, to gain MFCA experience from knowledgeable Japanese experts (IMT, 2016).

Following this, a socio-economic development strategy (2011–2020) was passed at the 11th National Congress of the Party (MPI, 2011). Based on this strategy, the Prime Minister signed a major decision (Decision No. 712/QĐ-TTg) on the "National Program on Enhancing Productivity and Quality of Products and Goods of Vietnamese Enterprises until 2020", with the main responsibility delegated to the Ministry of Science and Technology (MOST) (Prime Minister, 2010). State funding for these projects covered the costs of training expert teams and consultants and guiding the application of management systems, models, and tools for improving productivity (Article 5, Prime Minister, 2010). MFCA was selected as a major means towards enhancing productivity, the elimination of waste and increased profits. According to GA1, in the face of macro-level pressures two main social groups, the MOST and the APO, cooperated with industrial associations and the Ministry of Industry and Trade's local centers (see **Figure 3.2**) to organize seminars and workshops on MFCA.

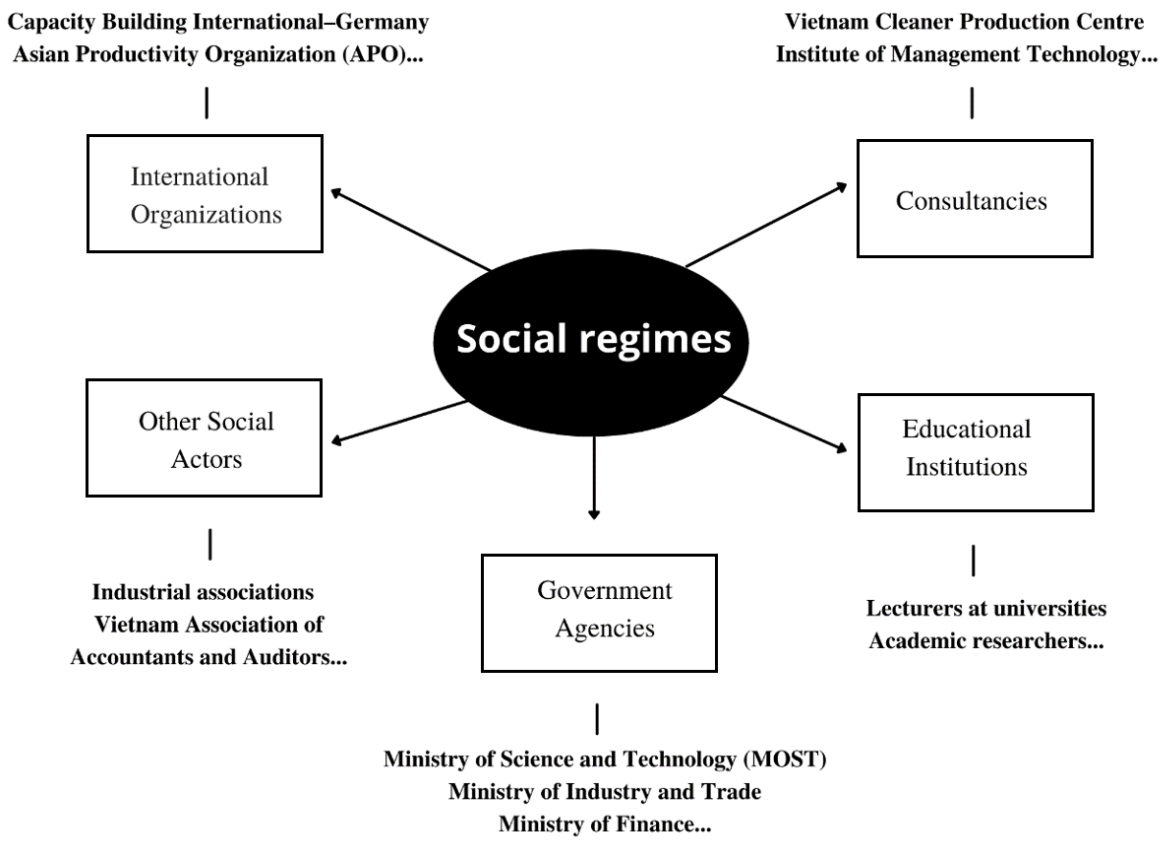

Figure 3.2 Social Regimes in relation to MFCA in Vietnam

3.4.1.2 Context - regime to Niche Micro-level

In 2004, MFCA emerged in Vietnam through the EMA-SEA project. The project focused on development and application of environmental management accounting (EMA) training materials and the transfer of know-how and skills concerning EMA, including MFCA, through training sessions and company projects. Various participants, including representatives from small and medium-sized enterprises (SMEs), consulting companies, industry institutions,

ministries, and universities were selected to attend these training sessions (Viere *et al.*, 2006). For example, in 2005, the VNCPC organized three training courses on EMA for 416 participants in three cities: Hanoi, Danang and Ho Chi Minh City (VNCPC, 2005). The courses provided opportunities for corporations to engage with EMA, address environmental problems, and increase productivity through MFCA. The VNCPC played a key role in contacting SMEs for pilot company projects (VNCPC, 2004). Four companies were chosen to implement EMA: Chau Thanh Tam Shrimp Farm, Neumann Vietnam, Sai Gon Beer, and Tan Loc Food (Herzig *et al.*, 2012). A consultant who worked for the VNCPC recounted:

> *In the period of 2004–2005, I attended this project with the role of supporting and evaluating potential factories. As a local partner, I contacted many Vietnamese companies to find suitable ones for this project […] I also attended courses in the program of Train the Trainers since 2006 (CO3).*

Train the Trainers seminars helped develop a generation of South-East Asian EMA experts to contribute to MFCA development at the corporate level in Vietnam. In 2006, ten Vietnamese attendees of these seminars were able to conduct in-house training and provide support for EMA implementation in businesses. An interviewee indicated:

> *I attended various Train the Trainers seminars […] After that, I conducted two training courses for Vietnamese participants in two provinces including Nha Trang and Long An in 2007 and 2008 organized by the VNCPC […] (EI2).*

According to an evaluation of the initial dissemination phase, more than 1,000 participants from government, academia and business attended training seminars carried out by local resource persons and company projects revealed notable environmental and economic savings (InWEnt, 2008). More detailed insights into the potential benefits from the EMA approach were given by case studies developed as a part of the EMA-SEA project to analyse the application of tools, mostly in SMEs. For example, with the application of MFCA in the case of Sai Gon Beer the managers were surprised that "bottle filling and bottle washing were amongst the most important drivers of water and energy consumption" (Herzig *et al.*, 2012, p. 282). EMA information helped the company focus on wastewater hot spots, to increase environmental and economic performance.

Along with the VNCPC, MFCA diffusion has also been encouraged from the meso-level through the active effort of the Institute of Management Technology. The Institute of Management Technology started to research MFCA in 2010 and trained 1,200 people from over 100 enterprises through workshops and practical visits, and successfully implemented MFCA in 10 enterprises from different industries, such as food (e.g., Bibica Corporation of the PAN Group) and electricity (Asia Refrigeration Industry Co. Ltd) (IMT, 2016).

According to the interview data, the MOST regime played a major role in disseminating MFCA at the corporate level. The MOST guided the application of MFCA in 40 enterprises in 2017, supported by workshops designed to increase productivity and competitive advantages of Vietnamese enterprises (MOST, 2016). The APO also contributed to the success of the National Program. A consultant trained at the APO's *Training of Trainers* course stated:

> *Vietnam is one of the most active countries in implementing MFCA within the APO's members. After attending the APO's course, we started to diffuse MFCA […] through the 712 National Program […] Firstly, there were six enterprises that implemented MFCA. Then, we registered to further conduct MFCA projects with 15, 30, 40 enterprises in various industries […](GA1).*

Vietnamese enterprises specifically report on successfully applying MFCA following the program, including Nhat Tuong Co. Ltd. (furniture industry) (MOIT, 2015), Quang Ngai Sugar Joint Stock Company (food and beverage industry) (STAMEQ, 2015), Thanh An Co. Ltd

(seafood industry) (STAMEQ, 2017), Dai Dung Steel Structure Corporation (steel industry) (VietQ.vn, 2020b), and Vietnam Blue Renewable Energy (energy industry) (VietQ.vn, 2020a). For example, between 2013 and 2014, Quang Ngai Sugar Joint Stock Company implemented MFCA in three manufacturing factories: Thach Bich Mineral Water, Dung Quat Beer, and Biscafun Candy. As a result, leading to reduction in material waste and costs, improved processes and enhanced competitive competence (STAMEQ, 2015).

Given the interview data, MFCA shows opportunities for improvements. This is reflected by two interviewees: one from a company and one from a government agency.

> *Applying MFCA in the seafood production, we have recognized its benefits. MFCA helps us reduce a huge amount of water, time, and laborers for cleaning fish […]. In particular, we have made three by-products by analyzing continuous improvements (BU7).*

> *Without MFCA, a furniture company had a material loss of over 20% […]. After applying MFCA consulted by us, the company improved its manufacturing processes and saved this loss (GA1).*

Vietnamese university researchers have also assisted the diffusion of MFCA, in the seafood (Nguyen, 2018) and steel industries (Nguyen, 2017). Moreover, the EMA-SEA project provided qualified trainers to help diffuse MFCA to businesses and educate students. A lecturer trained through this project comments:

> *I have taught MFCA for students in both the field of accounting and environmental economics […]. In 2018, I have trained MFCA for about 35 managers from various enterprises (EI2).*

MFCA has also been diffused in multinational corporations, such as Canon Vietnam, where its application led to reduced use of resources, waste and costs (Canon, 2006). Nevertheless, this appears to be the exception as interview data indicates multinational companies, use other management accounting tools to control their production activities (BU3, BU4, CO1).

In summary, encouraged by macro-level pressures, application of MFCA has been widely encouraged by meso-level institutions in various industries and businesses. At the meso-level various social actors, including the VNCPC, Institute of Management Technology, MOST, APO and academic researchers (see **Figure 3.2**), have taken an active role because of pressures from the macro-level for the country to achieve a sustainable economy through increased productivity and meeting its global commitments.

3.4.2 Bottom-up Transformational Processes

3.4.2.1 Transformation from Niche to Regime Level

While the 712 National Program actively contributed to the diffusion of MFCA in many Vietnamese enterprises, successful application has conversely affected various regime actors such as the APO, the MOST, and other social actors (see **Figure 3.2**).

According to GA1, enterprises successfully applying MFCA were selected to report results at the APO workshops. In a typical story of MFCA application, Thanh An Co. Ltd operating in the seafood sector, adopted MFCA in 2014 to process shrimp products. After applying this tool, the company saved more than VND 240 million per year, increased employee productivity, and considerably reduced environmental effects. Drawing on these improvements, the MOST invited the company to attend the APO's MFCA workshop in Bangladesh in 2017, to share the company's experience and discuss advantages and disadvantages when applying MFCA in practice (STAMEQ, 2017).

The successful outcome of the National Program at the corporate level led to a public document called "Material Flow Cost Accounting–MFCA: Basic Content and Applied Guideline" (STAMEQ, 2018). This is the first MFCA document published in Vietnamese by a governmental agency–The Directorate for Standards, Metrology and Quality of Vietnam under MOST. The document provides guidance in three parts: (1) basic content, (2) MFCA implementation steps, and (3) application practice. Typical examples are presented in terms of enhancing the effectiveness of materials and energy usage for four industries: furniture, beverage, seafood, and vegetable and fruit processing. In addition, the advantages and disadvantages of MFCA implementation are emphasized, making it a valuable future source for diffusing MFCA tools in Vietnam. In essence, the important time dimension for learning between the different levels is illustrated, as the future influence from the meso- to micro-level is brought into perspective (see **Figure 3.1**).

The learning effect between levels is also illustrated by the observation that the benefits of MFCA have been communicated through a national television channel. Since 2020, the VTV2 channel has broadcast a monthly "Productivity and Quality" section in which practical application of MFCA is demonstrated. For example, MAFA Co. Ltd., which manufactures helmets, increased productivity by 35% through the application of MFCA (VTV, 2020). Other examples of MFCA application in SMEs, such as Ben Linh company, which produces nail clippers, were also aired (VTV, 2018). Meanwhile, the MFCA concept and its successful examples at the corporate level have attracted increasing interest from other social actors, such as the Ministry of Finance (MOF) (Vietnamese Finance Journal, 2020), the Vietnam Association of Accountants and Auditors (VAA, 2020), and the Ministry of Industry and Trade through electronic newspapers or websites (Industry and Trade Magazine, 2019; VAA, 2020; Vietnamese Finance Journal, 2020).

3.4.2.2 Transformation from Niche to Landscape Level

Applying MFCA at the corporate level can contribute to increasing a country's productivity and economic growth in aggregate (STAMEQ, 2020). Few studies consider the macro-level role of corporate MFCA needed for such a transformation. However, the potential contribution to the United Nations Sustainable Development Goals and the macro-environmental resource economy is recognized by BU7 and EI2. For example, while manufacturing seafood (e.g., Surimi or Pangasius) is very important to the national economy, the industry has generated volumes of polluted wastewater as well as used scarce natural resources (Pham *et al.*, 2010). One director of a small enterprise in the seafood industry indicates the potential connection with macro-level net zero waste goals as follows:

> *MFCA is appropriate with our sustainable strategy and core values […]. With MFCA, we save a vast amount of water and materials and achieve zero waste (BU7).*

Also, the PAN Group shows the link between MFCA and macro-environmental objectives through its application of MFCA:

> "The PAN Group and its members have had plans and detailed actions to contribute to the implementation of the Paris Agreement towards the United Nations Sustainable Development Goals […] applying MFCA over many years reduced losses and wastes arising from manufacturing processes […] With our practical solutions, current and future projects, the PAN Group expects to make our contributions to reducing global greenhouse gases" (PAN Group, 2020).

Overall, the potential for MFCA to transform macro-level waste management, through new technical processes and product innovation at the corporate level, could help towards increased national productivity and reduced environmental impacts. As such developing a greater understanding of niche to landscape transformation is important as it may help to create a

feedback loop in which additional support for corporate level MFCA adoption is ultimately provided at the macro-level. However, there are six main barriers to MFCA transformation across levels, as considered next.

3.4.3 Barriers to MFCA Transformation across Levels in Vietnam

Perceptions of interviewees about MFCA implementation across different levels in Vietnam reveal six barriers to progress (see **Table 3.1** and **Table 3.2**). These barriers include: low environmental awareness and corruption, a high level of compliance with taxation, insufficient data, accounting secrecy, ineffective communication, and a lack of close collaboration among social actors.

Table 3.1 Barriers to Implementation of MFCA Linkages across Levels

	Barriers	Macro-meso	Meso-micro	Micro-meso	Micro-macro
1	Low environmental awareness and corruption		x	x	
2	High level of compliance with taxation		x		
3	Insufficient data			x	
4	Accounting secrecy			x	
5	Ineffective communication		x	x	x
6	A lack of close collaboration among social actors	x	x		

Table 3.2 Interviewee Numbers Revealing Perceived Barriers to Links

Interviewee group	Business (n=7)	Consultant (n=4)	Government agency (n=1)	Non-government agency (n=2)	Educational institution (n=2)	Accountancy body (n=1)	Total (n=17)
Macro-meso-level	0	1	0	1	0	0	2
Meso-micro-level	6	2	1	2	1	1	13
Micro-meso-level	4	3	1	2	2	1	13
Micro-macro-level	0	0	1	1	0	0	2
Total	**10**	**6**	**3**	**6**	**3**	**2**	**30**

Note: Maximum number of interviewees for each element is indicated in row 1.

3.4.3.1 Low Environmental Awareness and Corruption (Meso-micro, Micro-meso)

Meso-micro

While the MOST has tried to stimulate MFCA adoption focusing on increased productivity, the Ministry of Natural Resources and Environment (MONRE) has made new regulations on national environmental standards on wastewater (MONRE, 2011), industrial emissions, and toxic waste (MONRE, 2013, 2017). Unfortunately, interviewees indicated that the regulations have been too weak to solve environmental problems. Although corruption in Vietnam has decreased over the years, bribery associated with the demonstration of good environmental results and hiding unlawful environmental activities remains a common occurrence (Transparency International, 2021). This was not apparent from the interviews; however, it is possible that examples of such behavior were not divulged because of the potential negative impact. One business participant acknowledged poor environmental practices, stating:

Each year the company must pay hundreds of millions of Vietnam Dong as we cannot meet the standards of wastewater [...] The fines have been prohibitively high. This situation has led to our bribery behavior (BU5).

Micro-meso

A low degree of awareness and concern about the environmental effects of activities is a large barrier to MFCA application in Vietnam. Many Vietnamese manufacturers have illegally released toxic emissions into the environment (VnExpress, 2016). Interviewees from the different groups confirmed that environmental problems are not the key focus of Vietnamese enterprises as they pursue the goals of productivity and profits (BU5, BU6, BU7, GA1, NG1, NG2, EI2, AB1). An MFCA consultant stated that:

A few years ago, we focused on environmentally friendly aspects, but Vietnamese companies ignored them since the environment is not their priority (GA1).

Information about the environment is not perceived as relevant to the accounting profession (BU3, BU4, BU5, BU6). They did not realize the connection between corporate waste and the macro-level. This is interesting given numerous prior case studies have identified the win-win potential associated with MFCA where economic and environmental performance can be improved simultaneously. The lack of understanding was shared by an accountant who works for a company in an industrial park which plays a key role in achieving national sustainable development:

Industrial park requires us to ensure releasing wastewater into its general system at least level 3 [a range of 1-5, with level 1 (best) and 5 (worst)]. Why do we need to invest in wastewater treatment system to achieve the level 1? This is the responsibility of industrial zone (BU3).

3.4.3.2 High Level of Compliance with Taxation (Meso-micro)

According to BU5, CO2, EI2 and AB1, the need for compliance with taxation legislation has hindered interest in voluntary MFCA application. Compliance refers to statutory control, which is one of the accounting values affected by national culture (Gray and Vint, 1995). Vietnamese accounting has primarily focused on recording transactions and compliance (e.g., taxation by the MOF), rather than on management accounting (Bui, 2011). A participant from an accounting body emphasized:

The workshops in terms of management accounting organized by our accounting body have received very little attention from accounting practitioners who are more interested in taxation compliance (AB1).

Interview evidence confirms conventional management accounting tools, such as standard costing, dominate practice (BU4, BU5, BU6). While ISO 14051 is regarded as a voluntary standard to promote MFCA at the corporate level (Christ and Burritt, 2016), this standard appears not to be commonly understood or implemented in the Vietnamese enterprises. Although companies have applied other ISO standards, such as ISO 14001, ISO 22000, and ISO 9000:2015 (BU1, BU2, BU3), which are good for promoting image, they see ISO 14051, primarily as an internal management standard (GA1).

3.4.3.3 Insufficient Data (Micro-meso)

Insufficient data has been a key barrier to MFCA application found in previous studies from a corporate perspective (Doorasamy, 2014; Fakoya and van der Poll, 2013; Schaltegger *et al.*, 2012). This barrier was also highlighted by a consultant (CO4) and an educator (EI2). Although the VNCPC was the first social actor to cultivate the application of MFCA in Vietnam in the early 2000s, this actor did not integrate MFCA in its consulting activities until later because of

insufficient data. Instead, it pursued Resource Efficient and Cleaner Production to solve environmental problems (VNCPC, 2015). A consultant emphasized that:

> *Applying MFCA in practice is very difficult as there is insufficient information […] We survey losses and suggest improvement options, instead of analyzing inputs and outputs according to MFCA (CO4).*

3.4.3.4 Accounting Secrecy (Micro-meso)

Secrecy in accounting refers to a preference for confidentiality rather than "a more transparent, open and publicly accountable approach" (Gray, 1988, p. 8). While the Japanese Ministry of Economy, Trade, and Industry published MFCA case studies with both specific figures and companies (METI, 2010), this is not the same in Vietnam. Given the public MFCA document, the name of enterprises is not mentioned despite including specific figures (STAMEQ, 2018). When specific companies are introduced, there is little information about financial figures, especially monetary environmental indicators. Because successful MFCA stories have not been widely published, it is difficult to disseminate MFCA, as Vietnamese enterprises are interested in practical case examples. A finance director commented:

> *There must be enterprises applying successfully MFCA […] Saying is easy, but persuading the managers is not easy. There must be specific figures and time to measure (BU1).*

Indeed, a high degree of secrecy hampers the process of MFCA diffusion. In this regard, an MFCA expert shared the difficulties in accessing accounting figures which could be used to demonstrate the advantages of applying MFCA:

> *Vietnamese accounting is a very sensitive subject […] Accountants only provide information when leaders agree and trust us […] When hearing about accounting or costs, a company is not willing to provide real figures. Many Vietnamese companies have two or three sources of accounting figures depending on internal needs, taxation purposes, visitors or external parties […] (GA1).*

Evidence indicates that even if data is available, MFCA application is more difficult when an enterprise wants to keep the real figures secret. To overcome this challenge trust needs to be built between expert consultants and the enterprise looking for guidance to apply MFCA. An MFCA consultant stated:

> *Our consulting strategy is to emphasize the company's problems and show places in which economic losses occurred through initial estimation. But we need to commit the secrecy of shared information (GA1).*

3.4.3.5 Ineffective Communication (Meso-micro, Micro-meso, Micro-macro)

Meso-micro

Although the government has attempted to diffuse MFCA via the national program (STAMEQ, 2020), there appears to be a lack of information about this program in Vietnamese enterprises. A finance director stated:

> *I do not know what MFCA is […] There are no governmental agencies that could understand and implement MFCA […] (BU1).*

Since most SMEs focus on pursuing short-term profit goals and have little interest in innovative management tools, it is difficult to communicate MFCA in Vietnam. An interviewee from a non-government organization provided information:

SMEs have a lack of knowledge about the strategies of sustainably and long-term business development […] They do not pay attention to search for information or participate in seminars (NG1).

Micro-meso

Successful MFCA stories appear largely unknown by educators, members of accounting associations, and consultants (EI1, AB1, CO1, CO2).

Micro-macro

Although the government proposed actions to enhance communication about sustainable development (Prime Minister, 2018) through various channels such as social media and the recognition of sustainable enterprises (NG2), there is a lack of communication on the connection between MFCA and macro-levels to solve national environmental problems. For example, the 712 program emphasized its contribution to national productivity, without highlighting macro-environmental impacts (STAMEQ, 2020). According to GA1, the Vietnamese government's MFCA communication is not as good as in other countries like Thailand and Malaysia.

3.4.3.6 A Lack of Close Collaboration among Social Actors (Macro-meso, Meso-micro)

Macro-meso

Pressures are brought from the global level onto the meso-level of government agencies and other institutions such as the MONRE, MOF (MOF and MONRE, 2013; Prime Minister, 2012b), and Vietnam Business Council for Sustainable Development (VBCSD, 2020), but there is little analysis of the role of MFCA for this link. For example, MFCA is not an integrated tool in implementing sustainable development of the Vietnam Business Council for Sustainable Development which has a close connection with government agencies such as the MONRE, and Vietnamese sustainable development enterprises (NG2).

Similarly, based on the Ministry of Industry and Trade's action programs towards the green growth strategy (Prime Minister, 2012a), various institutions such as the VNCPC participated in implementing these programs in which MFCA was not encouraged. There are supportive programs for other innovative tools, instead of MFCA (CO4).

Meso-micro

There is a lack of close collaboration between the MONRE (focus on achieving green outcomes) and MOST (focus on productivity) to promote MFCA towards green productivity. Based on information available from the MONRE website, MFCA seems to have no effect on the MONRE although this governmental agency has focused on environmental protection policies (MONRE, 2011, 2013, 2017). Also, the role of accounting bodies, industrial associations, and consultants is limited in diffusing information about corporate MFCA successes (GA1, NG2, AB1).

In addition, environmental management and accounting are separated between the MONRE and MOF. No projects are evident in which both the environmental and accounting aspects of the two institutions are combined. While the MONRE sets environmental legislation and standards, the MOF regulates environmental protection tax (MOF, 2012, 2015b, 2018), environmental fees for wastewater (MOF and MONRE, 2013), and regulations on information disclosures on the stock exchange (MOF, 2015a, 2020). A consultant shared:

Because there are no legislative regulations on MFCA, enterprises did not apply it. This is a barrier to MFCA application (CO3).

3.5. Discussion

The paper explores four links with and six barriers to MFCA practice in Vietnam using a multi-level framework. From the potential links explored – macro-meso, meso-micro, micro-meso, and micro-macro – results reveal concerns in need of further research as discussed in the following sub-sections.

3.5.1 Lack of Engagement at Macro-level

There is a lack of engagement between MFCA and the goal of achieving green productivity at the macro-level. The noticeable lack of engagement of interviewees with MFCA and macro-level links (only GA1, BU7, and EI2) in the Vietnamese contextual and transformational settings implies either that green productivity is viewed as a meso- and micro-level issue, or that there is a roadblock between the macro- and meso-levels, and the micro- and macro-levels. Indeed, barriers raised in interviews to the roll-out of MFCA are heavily focused on matters arising between social actors at the meso-level and actions at the niche level, rather than understanding broader, long run issues.

Besides, there is little evidence on the connection of MFCA with macro-level green productivity strategies due to problems with awareness, communication, and collaboration. First, there is the lack of enterprises' social responsibility concerning macro-environmental problems. Once these enterprises decide to emphasize profits they could not think beyond short-term mindsets and towards ecological consequences for future generations. The inconsistencies in time horizon and focus overlook the fact that in the long-run economic success and environmental performance are not mutually exclusive but are more likely to be mutually dependent. Second, policy makers and social actors may not know/recognize the power of MFCA in addressing macro-level challenges. Hence, MFCA appears to be disconnected with the macro-meso links. Third, macro-levels put pressure on social regimes; however, only the MOST is involved with MFCA, with a lack of collaboration with social actors such as the MONRE and the Vietnam Business Council for Sustainable Development.

3.5.2 Meso-level Policy Guidance on MFCA

The regime-level compliance orientation, set in the context of secrecy, corruption and what appears to be poor awareness and communication, all act to check the potential contribution of green productivity MFCA-based development.

To date, there are no existing legislative regulations or guidance on MFCA proposed by the Vietnamese MOF. Nguyen (2020) emphasizes that legislation on environmental accounting is a major factor affecting MFCA application in Vietnam (a similar finding for other South-East Asian countries has been shown by Herzig *et al.* (2012)). However, social actors such as the MOF and accounting associations have not yet demonstrated their involvement in diffusing EMA or MFCA while other developing countries such as the Philippines or Sri Lanka have actively published guidelines on environmental cost accounting and EMA (Gunarathne *et al.*, 2014; Reyes, 2002) as well as promoted a balanced policy mix for environmental protection using the promotion of an EMA based information strategy as a complement to command and control regulation (Burritt *et al.*, 2009).

A further meso-level consideration is that because professional accounting associations, including both the Vietnam Association of Accountants and Auditors and Vietnam Association of Certified Public Accountants, operate under the state management of the MOF political considerations play a greater part in the development of MFCA. Government agencies maintain a monopoly over the accounting and auditing certification, practice and regulatory process (Bui, 2011). As Vietnamese enterprises still need to support the introduction of MFCA (Yagi and Kokubu, 2020), the MOF might be better suited to be the leading/collaborative unit for

proposing and diffusing MFCA guidance to accountants, instead of the MOST alone as from the interviews it appeared ineffective as accountants were unaware of the MFCA guideline.

3.5.3 Potential Meso-level Reporting Pressures

MFCA becomes common at the corporate level when the tool originates from the information needs of enterprises which could be brought about by internal (e.g., corporate strategy) or external (e.g., reporting and stakeholder) pressures. In particular, MFCA has been applied in a small seafood company because this tool is appropriate with the company's sustainable strategy (BU7). This is consistent with prior cases such as a textile company in Indonesia and a snack producer in the Philippines (Herzig *et al.*, 2012). However, based on perceived low environmental awareness in companies, external pressure at the institutional meso-level is necessary not only to make companies meet reporting needs (Zhang and Liu, 2015), but also to improve their own corporate performance (Kasemset *et al.*, 2015; Kokubu and Tachikawa, 2013). Given the compliance culture observed, the MOF could introduce MFCA reporting pressure in the control of taxation and environmental activities. For example, in order to promote green productivity at the government agency level, MFCA calculations could be integrated into reports concerning environmental protection tax and environmental protection fees. Such an approach seems congruent with accounting values in Vietnam (e.g., statutory control) as there is high interest in the taxation of Vietnamese enterprises.

In addition, the MONRE could promote MFCA as a policy tool to strengthen the effectiveness of existing government policies/regulations (Savage *et al.*, 2001). For example, Environmental Impact Assessment Reporting concerning the MONRE, could be integrated with MFCA. This approach would lead to the provision of transparent corporate MFCA information which could be aggregated for policy making at higher levels such as for industries, regions, and at the national level. Given a lack of control of existing environmental policy implementation (Schirmbeck, 2017), this aggregation of the MFCA approach could also guide meso-level legislative institutions towards preventing illegal environmental activities at the micro-level (Burritt *et al.*, 2009).

However, enterprises may face many challenges in complying with new regulations, recognizing their change needs, and a lack of knowledge about MFCA. Hence, social actors should facilitate the process of MFCA application. In this regard, qualified consulting experts should be available to support the enterprises. These experts should enhance their roles, including developing an understanding of the need for change, establishing an information-exchange relationship, diagnosing clients' problems, creating intent to change in the client, translating intent into action, stabilizing adoption and discouraging discontinuation, and achieving a terminal relationship (Rogers, 2003).

3.5.4 Effective Communication between Levels

Strengthening the roles of meso-level social actors in building social trust is necessary to overcome the barriers to MFCA diffusion such as the high secrecy of accounting values. Moreover, social trust could develop and maintain positive relationships, which are beneficial for greater interorganizational contact and information access through both public and private institutions (Kim *et al.*, 2016). To build social trust, communication (content and choice of communication channels) should be improved.

Policymakers have not yet considered MFCA as a powerful tool to solve environmental problems in Vietnam. Given the 712 National Program, MFCA is a management tool to increase productivity and reduce costs, with little communicative emphasis on waste reduction or environmental performance. This situation is similar to some developing countries (Nakajima, 2019), but is different from some developed countries such as Germany and Japan, as MFCA has been diffused with a strong connection with environmental management and eco-efficiency

(Wagner, 2015). Therefore, MFCA communication needs to emphasize further environmental aspects (Schaltegger, 2018; Schaltegger *et al.*, 2017).

In doing so, it is necessary to accumulate typical examples showing the links between MFCA and other emerging concepts in existing legislations and strategies, such as a circular economy or sustainability reporting. Examples such as the PAN Group, Canon Vietnam or Quang Ngai Sugar Joint Stock Company should be made and encouraged by various government agencies, especially the MOF and MONRE in different ways, such as national programs, taxation incentives, financial support, and sustainability awards.

Noticeably, a positive sign is that information transparency in the sustainability reports of companies listed on the stock exchange is regulated by the MOF. This regulation requires that companies provide information on greenhouse gas emissions, management of raw materials, energy consumption, and water consumption in related impact reports of the company on the environment (MOF, 2015a, 2020). If MFCA is communicated as a powerful tool to ensure the implementation of regulations on information disclosures, there could be a breakthrough in MFCA. Similarly, the MONRE promotes MFCA as a strategic tool to conduct circular economy, which was integrated into the Environmental Protection Law (National Assembly of Vietnam, 2020). This could open a new door for MFCA development due to the potential links between MFCA and circular economy (Nishitani *et al.*, 2022).

The MOST has taken advantage of mass media channels (e.g., websites, televisions, newspapers) to introduce MFCA success stories and increase social trust in implementing this tool. However, Rogers (2003) emphasized that mass media channels are relatively more important at the knowledge stage while interpersonal channels are relatively more important at the persuasion stage. Therefore, it is recommended that government agencies have close collaborations with private institutions, such as consultancies, the Vietnam Business Council for Sustainable Development, and industry associations, to strengthen face-to-face communication, as these institutions are engaged in the enterprises' business activities.

3.5.5 Looking ahead to Actions Taken by Policy Makers

Vietnam is pursuing a transition toward a circular economy, thereby contributing to limiting global warming and achieving sustainable development goals (UNDP Vietnam, 2021). However, a transition toward a circular economy is a challenge due to less coherence regarding how the circular economy may be implemented in practices (Millar *et al.*, 2019) and a lack of relevant standardized tools (Roos Lindgreen *et al.*, 2022). It is notable that the concept of circular economy was embedded in the Revised Vietnamese Environmental Protection Law valid from January 2022. However, incentive policies, specific regulations, and guidance on processes to implement a circular economy in Vietnam are still limited, which was reflected by the opinion of institutional experts posted on a government's official communication channel (National Assembly of Vietnam, 2021). Hence, there is a need for policy makers to seek innovative management tools to deal with multiple sources of complexity in circular economy transitions. It is arguable that MFCA, as a standardized tool in ISO 14051, 14052, 14053, can help Vietnam achieve a circular economy (Nishitani *et al.*, 2022).

As one of the few studies providing implications for policy-making on MFCA, our exploratory findings show that a government agency (e.g., the MOST) and other social actors had a positive effect on the take-up of MFCA; however, there are still some barriers across levels to the diffusion of MFCA in Vietnam. Based on a better understanding of the MFCA context and transformation, our recommendations (including meso-level policy guidance on MFCA, potential meso-level reporting pressures, and effective communication between levels) are crucial for policy makers to enhance the diffusion of MFCA. These recommendations are also consistent with feedback from different interviewees (e.g., social actors).

These recommendations could be applicable in other emerging nations in which contemporary management accounting tools, such as MFCA, are not common (Alawattage *et al.*, 2007; Hopper *et al.*, 2009). Furthermore, if guidance on EMA and MFCA does not exist, especially in local languages, it will be hard to diffuse a new management tool (Setthasakko, 2010). According to Kokubu and Nakajima and the Indian Productivity Council (2018), guidance on MFCA could facilitate the diffusion of this tool. Additionally, typical successful examples should be presented in various industries as they are helpful for convincing managers of MFCA's use by illustrating practical stories. If there are no reporting pressures, it will be difficult to persuade managers to apply MFCA since most SMEs in developing countries are pursuing short-term profit objectives rather than being interested in environmental problems (Nguyen, 2016; Sahu *et al.*, 2021). When institutional factors are powerful in these countries (Qian *et al.*, 2021), reporting pressures that require the information provision from MFCA figures have the potential to overcome poor compliance practices with existing environmental regulations. Furthermore, effective communication is very important to diffuse MFCA. Without knowing about this tool, companies have difficulty in accessing its benefits. However, going from knowledge to application is challenging; therefore, effective communication is essential to disseminate MFCA, including both content and communication channels.

3.6. Conclusions

By enhancing our understanding of the *macro-, meso- and micro-level links related to the development of material flow cost accounting* in Vietnam, this study aimed to show how further take-up of material flow cost accounting in practice can be encouraged. Overall, the findings reveal a paradoxical situation where connections are found between macro-economic strategies and national productivity programs and MFCA implementation by business corporations at the micro-level, but where broader take-up is hampered by a number of barriers including: low environmental awareness and corruption, a high level of compliance with taxation legislation, insufficient data, accounting secrecy, ineffective communication, a lack of close collaboration among social actors. Thus while the findings reveal the importance of contextual and transformational processes involving MFCA across the three levels, thereby demonstrating the active support of key social actors in transforming MFCA towards increased productivity while reducing environmental impacts, there is also a need to break the stalemate and find better ways to harness these multi-level processes to improve take-up by companies. Recommendations for how this can be achieved were subsequently made.

In terms of *theoretical contributions*, the research demonstrates the importance of top-down (context) and bottom-up (transformation) links across three levels of analysis, using the multi-level perspective framework, as proposed by Schaltegger et al. (2022). Overall, the study illustrates a novel application of the framework used to reveal these linkages and barriers to linkages in the chosen setting of Vietnam and MFCA. More specifically, the links with MFCA context and transformation were examined with the results indicating four potential links: macro-meso, meso-micro, micro-meso, and micro-macro. In the context of the chosen developing country, Vietnam, analysis reveals the close connection of corporate MFCA with the meso-level regime, through the government agency (the MOST), consultancies (the VNCPC and Institute of Management Technology), international organizations (the APO, Capacity Building International–Germany, and the Association for Overseas Technical Cooperation and Sustainable Partnerships–Japan), and Vietnamese researchers. Furthermore, the results show how MFCA is linked with the meso-economic national productivity program, to encourage transformation toward waste reduction and green productivity (Prime Minister, 2010, 2020), which encourages development of MFCA through funding, consultancies, workshops, and published MFCA guidelines.

Future research is needed to extend knowledge about how corporate MFCA can contribute to achieving macro-level sustainable development goals such as the critical issue of waste

reduction leading to greener productivity. In addition, because the current case study explores MFCA in Vietnam, to develop generalizations further research can examine comparison with multi-level settings in other countries, as well as empirical analysis across a larger number of companies. This could involve the use of quantitative research methods to complement the qualitative approach taken here and provide a more complete picture of tensions that exist in multi-level settings.

Our study also contributes to *policy-making* and *managerial practice*. First, our study identified and explored six barriers to MFCA application beyond internal organizational boundaries, which are not discovered in prior studies (Walz and Günther, 2021). In the light of these findings, key existing issues at macro-level, meso-level, and across levels are discussed, thereby making specific recommendations for policy makers to enhance MFCA context and transformation in Vietnam. Our qualitative findings contribute to the MFCA literature in the area of policy-making and response to call made by Tennojiya *et al.* (2019). Despite the current exploration of MFCA in Vietnam, to improve generalization further research is needed to reveal whether recommendations may be applicable in other countries in which contemporary management accounting tools (including MFCA) are not common, but where some institutional and cultural characteristics are similar.

Finally, the findings demonstrate that corporate MFCA has a close link to waste reduction which enhances green productivity. In light of better macro-management for enhancing productivity and reducing environmental consequences, three recommendations can be made for policy makers in Vietnam, including meso-level policy guidance on MFCA, potential meso-level reporting pressures, and effective communication between levels.

3.7 Appendix

Appendix 3.1 List of Secondary Data

Sources	Reference
APO	APO (2006, 2014)
Directorate for Standards, Metrology and Quality	STAMEQ (2015, 2017, 2018, 2020)
Ministry of Industry and Trade (Vietnam)	MOIT (2015)
MOF	MOF (2012, 2015a, 2015b, 2018, 2020)
MONRE	MOF and MONRE (2013) MONRE (2011, 2013, 2017)
MOST	MOST (2016)
Ministry of Planning and Investment (Vietnam)	MPI (2001, 2011)
National Assembly of Vietnam	National Assembly of Vietnam (2020, 2021)
Others	Canon (2006) IMT (2016) Industry and Trade Magazine (2019) InWEnt (2008) Nguyen (2016, 2017, 2018, 2020) O'Neill et al. (2018) PAN Group (2020) Pham et al. (2010) Rockström et al. (2009) Transparency International (2021) UNDP Vietnam (2021) United Nations Sustainable Development Goals (2018) United Nations Vietnam (2021) VAA (2020) VBCSD (2020) Viere et al. (2006) Vietnamese Finance Journal (2020) VietQ.vn (2020a, 2020b) VTV (2018, 2020)
Prime Minister (Vietnam)	Prime Minister (2004, 2010, 2012a, 2012b, 2017, 2018, 2020)
VNCPC	VNCPC (2004, 2005, 2015)

Appendix 3.2 Interview Questions

Experience of interviewees

1. Could you please share with me your working experience?
2. Could you please describe your current work?
   - What is your position/role?
   - How long have you worked in this position/role?
   - What is the most interesting part of your current work?
   - What is the most difficult part of your current work? How do you deal with that?

Material Flow Cost Accounting (MFCA)

1. Have you heard of MFCA?
   - If yes, in which context and what do you know about it?
   - If no, what do you think first when you hear of MFCA?
2. How would you describe the level of awareness and application of MFCA in Vietnam?
   - Why do you think that the level of awareness is low (high)?
3. In your view, what are the main reasons for (not) applying MFCA in Vietnam?
   - Could you please tell me more about the reason (1) you mentioned?
   - As you said …., could you please explain/clarify this point?
   - Could you please give an example to illustrate what you said?
   - You mentioned two reasons (1 and 2), are there any reasons that you would like to add?
4. How can MFCA application be enhanced in Vietnam?
   - Why do you think that (A) is important to enhance MFCA application in Vietnam?
   - There is an opinion of an interviewee in our research. He/she said that…. Do you agree/disagree with that?
   - As I understood from what you said, you mean that…. Does that agree with what you wanted to say?
   - If MFCA application is compulsory, do you think that this is a good way to motivate the diffusion of MFCA in Vietnam?
   - From your perspective, who play a major role in enhancing the diffusion of MFCA in Vietnam? And why?

3.8 References

Alawattage, C., Hopper, T. and Wickramasinghe, D. (2007), "Introduction to management accounting in less developed countries", *Journal of Accounting & Organizational Change*, Vol. 3 No. 3, pp. 183–191.

APO (2006), *Handbook on Green Productivity*, Cober Printing Limited, Canada.

APO (2014), *Manual on Material Flow Cost Accounting: ISO 14051*, Asian Productivity Organization, Japan.

Bebbington, J., Österblom, H., Crona, B., Jouffray, J.-B., Larrinaga, C., Russell, S. and Scholtens, B. (2020), "Accounting and accountability in the Anthropocene", *Accounting, Auditing & Accountability Journal*, Vol. 33 No. 1, pp. 152–177.

Bebbington, J. and Unerman, J. (2020), "Advancing research into accounting and the UN Sustainable Development Goals", *Accounting, Auditing & Accountability Journal*, Vol. 33 No. 7, pp. 1657–1670.

Beckerman, W. (1992), "Economic growth and the environment: Whose growth? Whose environment?", *World Development*, Vol. 20 No. 4, pp. 481–496.

Bloom, N., Mahajan, A., McKenzie, D. and Roberts, J. (2010), "Why do firms in developing countries have low productivity?", *American Economic Review*, Vol. 100 No. 2, pp. 619–623.

Bui, V. (2011), "A Study of the Development of Accounting in Vietnam", PhD Thesis, RMIT University, RMIT University, 2011.

Burritt, R.L., Herzig, C., Schaltegger, S. and Viere, T. (2019), "Diffusion of environmental management accounting for cleaner production: Evidence from some case studies", *Journal of Cleaner Production*, Vol. 224, pp. 479–491.

Burritt, R.L., Herzig, C. and Tadeo, B.D. (2009), "Environmental management accounting for cleaner production: The case of a Philippine rice mill", *Journal of Cleaner Production*, Vol. 17 No. 4, pp. 431–439.

Canon (2006), *Canon Sustainability Report 2006*, Japan.

Che Ku Kassim, C.K.H., Adnan, N.L. and Ali, R. (2021), "Institutional pressures influencing environmental management accounting adoption by Malaysian local governments", *Journal of Accounting & Organizational Change* Vol. ahead-of-print No, No. ahead-of-print.

Christ, K.L. and Burritt, R.L. (2015), "Material flow cost accounting: a review and agenda for future research", *Journal of Cleaner Production*, Vol. 108, pp. 1378–1389.

Christ, K.L. and Burritt, R.L. (2016), "ISO 14051: A new era for MFCA implementation and research", *Revista de Contabilidad*, Vol. 19 No. 1, pp. 1–9.

Deegan, C. (2017), "Twenty five years of social and environmental accounting research within Critical Perspectives of Accounting Hits, misses and ways forward", *Critical Perspectives on Accounting*, Vol. 43, pp. 65–87.

Doorasamy, M. (2014), "The effectiveness of Material Flow Cost Accounting (MFCA) in identifying non-product output costs and its impact on environmental performance in paper manufacturing companies: A case study in Kwa-Zulu Natal", *Journal of Accounting and Management*, Vol. 4 No. 3, pp. 51–69.

Dunuwila, P., Rodrigo, V. and Goto, N. (2018), "Financial and environmental sustainability in manufacturing of crepe rubber in terms of material flow analysis, material flow cost accounting and life cycle assessment", *Journal of Cleaner Production*, Vol. 182, pp. 587–599.

Fakoya, M.B. and van der Poll, H.M. (2013), "Integrating ERP and MFCA systems for improved waste-reduction decisions in a brewery in South Africa", *Journal of Cleaner Production*, Vol. 40, pp. 136–140.

Geels, F.W. (2002), "Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study", *Research Policy*, Vol. 31 8-9, pp. 1257–1274.

Geels, F.W. (2005), "The dynamics of transitions in socio-technical systems: A multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930)", *Technology Analysis & Strategic Management*, Vol. 17 No. 4, pp. 445–476.

Geels, F.W. (2019), "Socio-technical transitions to sustainability: a review of criticisms and elaborations of the multi-level perspective", *Current Opinion in Environmental Sustainability*, Vol. 39, pp. 187–201.

Geels, F.W. and Schot, J. (2007), "Typology of sociotechnical transition pathways", *Research Policy*, Vol. 36 No. 3, pp. 399–417.

Gibassier, D. and Alcouffe, S. (2018), "Environmental management accounting: The missing link to sustainability?", *Social and Environmental Accountability Journal*, Vol. 38 No. 1, pp. 1–18.

Gray, S.J. (1988), "Towards a theory of cultural influence on the development of accounting systems Internationally", *Abacus*, Vol. 24 No. 1, pp. 1–15.

Gray, S.J. and Vint, H.M. (1995), "The impact of culture on accounting disclosures: Some international evidence", *Asia-Pacific Journal of Accounting*, Vol. 2 No. 1, pp. 33–43.

Grossman, G.M. and Krueger, A.B. (1995), "Economic growth and the environment", *The Quarterly Journal of Economics*, Vol. 110 No. 2, pp. 353–377.

Gunarathne, A., Ranasinghe, A.B. and Peiris, S. (2014), *Environmental Management Accounting (EMA) Guidelines for Sri Lankan Enterprises*, Institute of Certified Management Accountants of Sri Lanka.

Gunarathne, N., Lee, K.-H. and Hitigala Kaluarachchilage, P.K. (2022), "Tackling the integration challenge between environmental strategy and environmental management accounting", *Accounting, Auditing & Accountability Journal*, ahead-of-print ahead-of-print.

Herzig, C., Viere, T., Burritt, R. and Schaltegger, S. (2006), "Understanding and Supporting Management Decision- Making. South East Asian Case Studies on Environmental Management Accounting", in Schaltegger, S., Bennett, M. and Burritt, R. (Eds.), *Sustainability Accounting and Reporting*, Springer Netherlands, pp. 491–507.

Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (Eds.) (2012), *Environmental Management Accounting: Case Studies of South-East Asian Companies.*, Routledge.

Hopper, T. (2019), "Stop accounting myopia: – think globally: a polemic", *Journal of Accounting & Organizational Change*, Vol. 15 No. 1, pp. 87–99.

Hopper, T., Tsamenyi, M., Uddin, S. and Wickramasinghe, D. (2009), "Management accounting in less developed countries: what is known and needs knowing", *Accounting, Auditing & Accountability Journal*, Vol. 22 No. 3, pp. 469–514.

Huang, B. and Xu, Y. (2019), *Environmental Performance in Asia: Overview, Drivers, and Policy Implications*, ADBI Institute.

IMT (2016), "IMT Reported on MFCA Case Study in Vietnam – Asia Pacific Economic Cooperation", available at: https://www.imt.vn/bao-cao-ung-dung-mfca-tai-viet-nam-hoi-nghi-mfca-khu-vuc-apec/ (accessed 25 September 2021).

Imtiaz Ferdous, M., Adams, C.A. and Boyce, G. (2019), "Institutional drivers of environmental management accounting adoption in public sector water organisations", *Accounting, Auditing & Accountability Journal*, Vol. 32 No. 4, pp. 984–1012.

Indian Productivity Council (2018), *Booklet on Glean: MFCA linked Lean (APO Demonstration Project)*, New Delhi, India.

Industry and Trade Magazine (2019), "Diffusion of 712 program - The effectiveness of communication", available at: https://congthuong.vn/lan-toa-chuong-trinh-712-hieu-qua-tu-cong-tac-truyen-thong-124201.html (accessed 15 October 2021).

InWEnt (2008), "Survey of EMA Dissemination Activities 2006-2007. Results and Analysis", available at: https://docplayer.net/87927213-Survey-of-ema-sea-dissemination-activities-results-and-analysis.html (accessed 1 March 2022).

ISO (2011), *ISO 14051:2011 Environmental Management - Material Flow Cost Accounting - General Framework*, Geneva, Switzerland.

ISO (2017), *ISO 14052: 2017 Environmental Management - Material Flow Cost Accounting - Guidance for Practical Implementation in a Supply Chain*, Geneva, Switzerland.

Jasch, C. (2009), *Environmental and Material Flow Cost Accounting: Principles and Procedures, Eco-Efficiency in Industry and Science*, v. 25, Springer, New York.

Johnstone, L. (2018), "Theorising and modelling social control in environmental management accounting research", *Social and Environmental Accountability Journal*, Vol. 38 No. 1, pp. 30–48.

Kanger, L. (2021), "Rethinking the Multi-level Perspective for energy transitions: From regime life-cycle to explanatory typology of transition pathways", *Energy Research & Social Science*, Vol. 71, p. 101829.

Kasemset, C., Chernsupornchai, J. and Pala-ud, W. (2015), "Application of MFCA in waste reduction: case study on a small textile factory in Thailand", *Journal of Cleaner Production*, Vol. 108, pp. 1342–1351.

Kim, P. H., Wennberg, K. and Croidieu, G. (2016), "Untapped riches of meso-level applications in multilevel entrepreneurship mechanisms", *Academy of Management Perspectives*, Vol. 30 No. 3, pp. 273–291.

Kokubu, K. and Kitada, H. (2015), "Material flow cost accounting and existing management perspectives", *Journal of Cleaner Production*, Vol. 108, pp. 1279–1288.

Kokubu, K. and Nakajima, M. (2004), "Material flow cost accounting in Japan: A new trend of environmental management accounting practices", in *Fourth Asia Pacific Interdisciplinary Research in Accounting Conference*, Vol. 4, pp. 1–16.

Kokubu, K. and Tachikawa, H. (2013), "Material Flow Cost Accounting: Significance and Practical Approach", in Kauffman, J. and Lee, K.-M. (Eds.), *Handbook of Sustainable Engineering*, Springer Netherlands, Dordrecht, pp. 351–369.

Kvale, S. (2007), *Doing interviews*, Sage, Los Angeles.

Lin, C. and Bhardwaj, K.D. (2020), *Green Productivity for SDGs. Review of Emerging and Priority Needs*, Asian Productivity Organization, Japan.

Linnenluecke, M.K. and Smith, T. (2019), "A primer on global environmental change", *Abacus*, Vol. 55 No. 4, pp. 810–824.

Managi, S. and Kaneko, S. (2006), "Economic growth and the environment in China: an empirical analysis of productivity", *International Journal of Global Environmental Issues*, Vol. 6 No. 1, pp. 89–133.

Marrone, M., Linnenluecke, M.K., Richardson, G. and Smith, T. (2020), "Trends in environmental accounting research within and outside of the accounting discipline", *Accounting, Auditing & Accountability Journal*, Vol. 33 No. 8, pp. 2167–2193.

METI (2010), *Material Flow Cost Accounting: Case Examples*, Tokyo, Japan.

Mia, A.H. (2005), "The role of government in promoting and implementing environmental management accounting: The case of Bangladesh", in Rikhardsson, P.M., Bennett, M., Bouma, J.J. and Schaltegger, S. (Eds.), *Implementing Environmental Management Accounting: Status and Challenges*, *Eco-Efficiency in Industry and Science*, Vol. 18, Springer-Verlag, Berlin/Heidelberg, pp. 297–320.

Miles, M.B. and Huberman, A.M. (1994), *Qualitative Data Analysis: An Expanded Sourcebook,* third ed., Sage Publications, United States of America.

Millar, N., McLaughlin, E. and Börger, T. (2019), "The Circular Economy: Swings and Roundabouts?", *Ecological Economics*, Vol. 158, pp. 11–19.

MOF (2012), "Circular No. 159/2012/BTC: Guidance on implementing some articles of Environmental Protection Law", available at: http://vanban.monre.gov.vn/Admin/Uploads/VanBan/TT%20159-2012-BTC.pdf (accessed 31 December 2021).

MOF (2015a), "Circular No. 155/2015/BTC: Guidance on information disclosure on the stock exchange", available at: http://vbpl.vn/botaichinh/Pages/vbpq-van-ban-goc.aspx?ItemID=91233 (accessed 31 December 2021).

MOF (2015b), "Circular No. 60/2015/BTC: Guidance on implementing some articles of Environmental Protection Law", available at: http://vanban.monre.gov.vn/Admin/Uploads/VanBan/TT%2060-2015-BTC.pdf (accessed 31 December 2021).

MOF (2018), "Circular No. 106/2018/BTC: Guidance on implementing some articles of Environmental Protection Law", available at: http://vanban.monre.gov.vn/Admin/Uploads/VanBan/106-2018-tt-btc.pdf (accessed 31 December 2021).

MOF (2020), "Circular No. 96/2020/BTC: Guidance on information disclosure on the stock exchange", available at: https://thuvienphapluat.vn/van-ban/Chung-khoan/Thong-tu-96-2020-TT-BTC-quy-dinh-cong-bo-thong-tin-tren-thi-truong-chung-khoan-459000.aspx (accessed 30 December 2021).

MOF and MONRE (2013), "Regulation on environmental protection fee for wastewater", available at: http://vanban.monre.gov.vn/Admin/Uploads/VanBan/63_2013_TTLT-BTC-BTNMT.pdf (accessed 31 December 2021).

MOIT (2015), "Applying MFCA pilot model at a furniture company", available at: https://nscl.vn/ap-dung-thu-nghiem-mo-hinh-mfca-tai-doanh-nghiep-san-xuat-do-noi-that/ (accessed 21 June 2021).

MONRE (2011), "Regulation on industrial wastewater", available at: http://vanban.monre.gov.vn/DocViewer.aspx?IDLVB=1 (accessed 31 December 2021).

MONRE (2013), "National technical standards on environment", available at: http://vanban.monre.gov.vn/Admin/Uploads/VanBan/TT%2032-2013-BTNMT%20quy%20chu%E1%BA%A9n%20k%E1%BB%B9%20thu%E1%BA%ADt%20qu%E1%BB%91c%20gia%20v%E1%BB%81%20m%C3%B4i%20tr%C6%B0%E1%BB%9Dng.PDF (accessed 31 December 2021).

MONRE (2017), "Circular on environmental monitoring techniques", available at: http://vanban.chinhphu.vn/portal/page/portal/chinhphu/hethongvanban?class_id=1&mode=detail&document_id=191603&category_id=0 (accessed 31 December 2021).

MOST (2016), "Decision No. 943/QĐ-BKHCN on signing the list of science and technology tasks", available at: https://www.most.gov.vn/vn/Pages/ChiTietVanBan.aspx?vID=28010&TypeVB=1 (accessed 17 October 2021).

MPI (2001), "Socio-Economic Development Strategy 2001-2010", available at: https://www.mpi.gov.vn/Pages/tinbai.aspx?idTin=1553&idcm=195 (accessed 31 December 2021).

MPI (2011), "Socio-Economic Development Strategy 2011-2020", available at: https://www.mpi.gov.vn/Pages/tinbai.aspx?idTin=1552&idcm=195 (accessed 31 December 2021).

Nakajima, M. (2019), "Development and possibilities of MFCA as a tool of sustainability management: In view of Japanese, German, and some Asian experiences", in Kokubu, K.

and Nagasaka, Y. (Eds.), *Sustainability Management and Business Strategy in Asia*, *Japanese Management and International Studies*, Vol. 16, World Scientific, pp. 65–80.

National Assembly of Vietnam (2020), "Law No. 72/2020/QH14 on Environmental Protection", available at: https://thuvienphapluat.vn/van-ban/Tai-nguyen-Moi-truong/Luat-so-72-2020-QH14-Bao-ve-moi-truong-2020-431147.aspx (accessed 31 December 2021).

National Assembly of Vietnam (2021), "Reccomendations for institutional improvement on Circular Economy in Vietnam", available at: https://quochoi.vn/tintuc/Pages/tin-hoat-dong-cua-quoc-hoi.aspx?ItemID=61214 (accessed 20 January 2022).

Nguyen, D.T.T. (2018), "Is Japanese Material Flow Cost Accounting useful to Vietnam? A case study of a Vietnamese seafood processing company", in Lee, K.-H. and Schaltegger, S. (Eds.), *Accounting for Sustainability: Asia Pacific Perspectives*, *Eco-Efficiency in Industry and Science*, Vol. 33, Springer International Publishing, Cham, pp. 237–258.

Nguyen, T. (2016), "Small and Medium-Sized Enterprises and Sustainable Development: The Case of Vietnam", Doctorate Thesis, RMIT University, 2016.

Nguyen, T. (2020), "Factors affecting the decision to apply material flows cost accounting in Thai Nguyen based steel production enterprises", *VNU Journal of Science: Economics and Business*, Vol. 36 No. 3, pp. 43–54.

Nguyen, T.N. (2017), "Environmental cost management accounting in steel production enterprises in Vietnam", Doctorate Thesis, National Economic University, 2017.

Nishitani, K., Kokubu, K., Wu, Q., Kitada, H., Guenther, E. and Guenther, T. (2022), "Material flow cost accounting (MFCA) for the circular economy: An empirical study of the triadic relationship between MFCA, environmental performance, and the economic performance of Japanese companies", *Journal of Environmental Management*, Vol. 303, p. 114219.

Nkundabanyanga, S.K., Muramuzi, B. and Alinda, K. (2021), "Environmental management accounting, board role performance, company characteristics and environmental performance disclosure", *Journal of Accounting & Organizational Change*, Vol. 17 No. 5, pp. 633–659.

O'Neill, D.W., Fanning, A.L., Lamb, W.F. and Steinberger, J.K. (2018), "A good life for all within planetary boundaries", *Nature Sustainability*, Vol. 1 No. 2, pp. 88–95.

OECD (2008), *OECD Environmental Outlook to 2030*, Organisation for Economic Cooperation and Development, France.

OECD (2019), *OECD Work on Green Growth 2019-20*, Organisation for Economic Cooperation and Development, France.

Owen, D. (2008), "Chronicles of wasted time?", *Accounting, Auditing & Accountability Journal*, Vol. 21 No. 2, pp. 240–267.

PAN Group (2020), "Vietnam commits to reduce green house emissions and tries to achieve climate change goal", available at: https://thepangroup.vn/viet-nam-cam-ket-giam-phat-thai-khi-nha-kinh-va-no-luc-dat-muc-tieu-ve-bien-doi-khi-hau-2521.htm (accessed 16 October 2021).

Parker, L.D. (2011), "Twenty-one years of social and environmental accountability research: A coming of age", *Accounting Forum*, Vol. 35 No. 1, pp. 1–10.

Pham, T.A., Kroeze, C., Bush, S.R. and Mol, A.P.J. (2010), "Water pollution by Pangasius production in the Mekong Delta, Vietnam: causes and options for control", *Aquaculture Research*, Vol. 42 No. 1, pp. 108–128.

Prime Minister (2004), "Decision 153/2004/QĐ-TTG on strategy for sustainable development", available at: https://vanban.vcci.com.vn/quyet-dinh-1532004qd-ttg-cua-thu-tuong-chinhh-phu-ve-viec-ban-hanh-dinh-huong-chien-luoc-phat-trien-ben-vung-o-viet-nam-chuong-trinh-nghi-su-21-cua-viet-nam (accessed 7 July 2021).

Prime Minister (2010), "Decision 712/QD-TTg on improving productivity and quality of product, goods until 2020", available at: https://www.most.gov.vn/Images/Attachments/06ca9823b9fb4ce3a428e3d7c1e31729-Quyet%20dinh%20so%20712_QD_TTG.PDF (accessed 25 December 2021).

Prime Minister (2012a), "National strategies on green growth", available at: http://www2.chinhphu.vn/portal/page/portal/chinhphu/noidungchienluocphattrienkinhtexahoi?_piref33_14725_33_14721_14721.strutsAction=ViewDetailAction.do&_piref33_14725_33_14721_14721.docid=1514&_piref33_14725_33_14721_14721.substract= (accessed 4 July 2021).

Prime Minister (2012b), "Vietnamese sustainable developemnt strategy in the period of 2011-2020", available at: http://vanban.chinhphu.vn/portal/page/portal/chinhphu/hethongvanban?class_id=2&mode=detail&document_id=157753 (accessed 31 December 2021).

Prime Minister (2017), "The national action plan for the implementation of the 2030 sustainable development agenda", available at: https://vietnam.un.org/en/4123-national-action-plan-implementation-2030-sustainable-development-agenda (accessed 1 July 2021).

Prime Minister (2018), "Decision No. 1045/QĐ-TTg on enhancing communication on sustainable development and national competitive advantage", available at: https://thuvienphapluat.vn/van-ban/thuong-mai/Quyet-dinh-1045-QD-TTg-2018-phe-duyet-Chuong-trinh-truyen-thong-ve-Phat-trien-ben-vung-391683.aspx (accessed 30 December 2021).

Prime Minister (2020), *Decision No. 1322/QĐ-TTg on improving productivity and quality of product, goods in the period of 2021-2030*, available at: http://www2.chinhphu.vn/portal/page/portal/chinhphu/noidungchuongtrinhquocgiakhac?_piref33_14737_33_14736_14736.strutsAction=ViewDetailAction.do&_piref33_14737_33_14736_14736.docid=4936&_piref33_14737_33_14736_14736.substract= (accessed 26 December 2021).

Qian, W., Tilt, C. and Belal, A. (2021), "Social and environmental accounting in developing countries: contextual challenges and insights", *Accounting, Auditing & Accountability Journal*, Vol. 34 No. 5, pp. 1021–1050.

Reyes, M.F. (2002), "The greening of accounting: Putting the environment onto the agenda of the accountancy profession in the Philippines", in Bennett, M., Bouma, J.J. and Wolters, T. (Eds.), *Environmental Management Accounting: Informal and Institutional Developments*, *Eco-Efficiency in Industry and Science*, Vol. 9, Kluwer Academic, Dordrecht, London, pp. 215–220.

Rockström, J., Steffen, W., Noone, K., Persson, A., Chapin, F.S., Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J., Nykvist, B., Wit, C.A. de, Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P.K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R.W., Fabry, V.J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P. and Foley, J.A. (2009), "A safe operating space for humanity", *Nature*, Vol. 461 No. 7263, pp. 472–475.

Rogers, E.M. (2003), *Diffusion of Innovations,* third ed., The Free Press, New York.

Roos Lindgreen, E., Opferkuch, K., Walker, A.M., Salomone, R., Reyes, T., Raggi, A., Simboli, A., Vermeulen, W.J.V. and Caeiro, S. (2022), "Exploring assessment practices of companies actively engaged with circular economy", *Business Strategy and the Environment*, pp. 1–25.

Sahu, A.K., Padhy, R.K., Das, D. and Gautam, A. (2021), "Improving financial and environmental performance through MFCA: A SME case study", *Journal of Cleaner Production*, Vol. 279, p. 123751.

Saldaña, J. (2013), *The Coding Manual for Qualitative Researchers*, Sage Publications.

Saunders, M., Lewis, P. and Thornhill, A. (2012), *Research Methods for Business Students,* sixth ed., Pearson Education, England.

Savage, D.E., Ligon, P.J. and Lomsek, J. (2001), *Environmental Management Accounting: Policies and Linkages*, New York.

Schaltegger, S. (2018), "Linking environmental management accounting: A reflection on (missing) links to sustainability and planetary boundaries", *Social and Environmental Accountability Journal*, Vol. 38 No. 1, pp. 19–29.

Schaltegger, S., Christ, K.L., Wenzig, J. and Burritt, R.L. (2022), "Corporate sustainability management accounting and multi-level links for sustainability – A systematic review", *International Journal of Management Reviews*, pp. 1–21.

Schaltegger, S., Etxeberria, I.Á. and Ortas, E. (2017), "Innovating corporate accounting and reporting for sustainability - Attributes and challenges", *Sustainable Development*, Vol. 25 No. 2, pp. 113–122.

Schaltegger, S., Viere, T. and Zvezdov, D. (2012), "Tapping environmental accounting potentials of beer brewing", *Journal of Cleaner Production*, Vol. 29, pp. 1–10.

Schirmbeck, S. (2017), *Vietnam's environmental policies at a crossroads salinated rice fields, hunted-out national parks, and eroding beaches-and what we can do about it*, Hanoi, Vietnam.

Setthasakko, W. (2010), "Barriers to the development of environmental management accounting", *EuroMed Journal of Business*, Vol. 5 No. 3, pp. 315–331.

STAMEQ (2015), "Project on quality productivity improvement of Quang Ngai Sugar Joint Stock Company", available at: https://tcvn.gov.vn/2015/09/du-an-cai-tien-nang-suat-chat-luong-cua-cong-ty-co-phan-duong-qquang-ngai/ (accessed 2 October 2021).

STAMEQ (2017), "Expanding MFCA model at Thanh An Co. Ltd", available at: https://tcvn.gov.vn/2017/04/nhan-rong-mo-hinh-mfca-tai-cong-ty-tnhh-thanh-an/ (accessed 16 October 2021).

STAMEQ (2018), "Material Flow Cost Accounting - MFCA: Basic Content and Applied Guideline", available at: https://tcvn.gov.vn/wp-content/uploads/2019/03/17.-LVP-66A-T12.2018.-88t-Sach-MFCA-Final-20.12-mi.pdf (accessed 26 May 2021).

STAMEQ (2020), "Effectiveness of 712 Program", available at: https://tcvn.gov.vn/2020/05/diem-nhan-hieu-qua-tu-chuong-trinh-712/ (accessed 31 December 2021).

Sulong, F., Sulaiman, M. and Norhayati, M.A. (2015), "Material Flow Cost Accounting (MFCA) enablers and barriers: the case of a Malaysian small and medium-sized enterprise (SME)", *Journal of Cleaner Production*, Vol. 108, pp. 1365–1374.

Tennojiya, T., Higashida, A., Kitada, H. and Kim, J. (2019), "How Does Material Flow Cost Accounting Continue in Practice?: The Effective Policy from a Questionnaire Survey", in Kokubu, K. and Nagasaka, Y. (Eds.), *Sustainability Management and Business Strategy in Asia*, *Japanese Management and International Studies*, Vol. 16, World Scientific, pp. 81–94.

Tran, T.T. and Herzig, C. (2020), "Material flow cost accounting in developing countries: A systematic review", *Sustainability*, Vol. 12 No. 13, p. 5413.

Transparency International (2021), "Corruption Perceptions Index 2020", available at: https://images.transparencycdn.org/images/CPI2020_Report_EN_0802-WEB-1_2021-02-08-103053.pdf (accessed 20 June 2021).

Tuttle, T. and Heap, J. (2007), "Green productivity: moving the agenda", *International Journal of Productivity and Performance Management*, Vol. 57 No. 1, pp. 93–106.

UNDP Vietnam (2021), "Consultation on Circular Economy Policies and the Viet Nam Circular Economy Hub – ways towards a low-carbon and circular Viet Nam", available at: https://www.vn.undp.org/content/vietnam/en/home/presscenter/pressreleases/consultation-on-circular-economy-policies-and-the-viet-nam-circu.html (accessed 20 January 2022).

United Nations Economic and Social Commission for Asia and the Pacific (2016), "Increasing productivity for reviving economic growth and supporting sustainable development", in *Economic and Social Survey of Asia and the Pacific*, pp. 94–133.

United Nations Sustainable Development Goals (2018), "Knowledge Platform. Vietnam", available at: https://sustainabledevelopment.un.org/memberstates/vietnam (accessed 1 July 2021).

United Nations Vietnam (2021), "Our work on the sustainable development goals in Viet Nam", available at: https://vietnam.un.org/en/sdgs (accessed 1 July 2021).

VAA (2020), "The relationship between green design and MFCA", available at: https://www.hoiketoanhcm.org.vn/vn/trao-doi/moi-quan-he-giua-thiet-ke-xanh-va-ke-toan-chi-phi-dong-nguyen-vat-lieu/ (accessed 16 October 2021).

VBCSD (2020), "About Vietnam Business Council for Sustainable Development", available at: http://en.vbcsd.vn/about.asp (accessed 1 August 2021).

VEPR and GRIPS (2020), "Viet Nam Productivity Report. Viet Nam Institute for Economic and Policy and Japanese National Graduate Institute for Policy Studies", available at: https://www.grips.ac.jp/forum/pdf20/[EN]VNProductivityReport_PreliminaryFinal2020_0904.pdf (accessed 13 July 2021).

Viere, T., Herzig, C., Schaltegger, S. and Leung, R. (2006), "Partnerships for sustainable business development: Capacity building in South-East Asia", in Welford, R.J., Hills, P.R. and Young, W. (Eds.), *Partnerships for Sustainable Development: Perspectives from the Asia-Pacific Region*, The Centre of Urban Planning & Environmental Management, The University of Hong Kong, China, pp. 4–15.

Vietnamese Finance Journal (2020), "Productivity improvement at enterprises - Multiplying typical models", available at: http://tapchitaichinh.vn/tai-chinh-kinh-doanh/cai-tien-nang-suat-tai-doanh-nghiep-nhan-them-nhieu-mo-hinh-kieu-mau-320035.html (accessed 16 October 2021).

VietQ.vn (2020a), "Applying integrated management system ISO 9001, ISO 14001 and MFCA tool helps Vietnam renewable blue energy company increase productivity up to 25%", available at: http://vietq.vn/cong-ty-tnhh-nang-luong-tai-tao-xanh-ap-dung-htql-tich-hop-iso-9001-iso-14001-va-cong-cu-mfca-giup-tang-nang-suat-den-25-d179004.html (accessed 21 June 2021).

VietQ.vn (2020b), "Benefits from MFCA application at Dai Dung Steel Company", available at: http://vietq.vn/loi-ich-tu-viec-ap-dung-mfca-tai-cong-ty-thep-dai-dung-d180053.html (accessed 21 June 2021).

VNCPC (2004), *Vietnam Cleaner Production Centre - Annual Report 2004*, Vietnam Cleaner Production Centre.

VNCPC (2005), *Vietnam Cleaner Production Centre - Annual Report 2005*, Vietnam Cleaner Production Centre.

VNCPC (2015), "Davos Declaration on the Promotion of Resource Efficient and Cleaner Production (RECP) in Developing and Transition Countries Adopted", available at: https://www.recpnet.org/news-items/davos-declaration-on-the-promotion-of-resource-efficient-and-cleaner-production-recp-in-developing-and-transition-countries-adopted/ (accessed 9 October 2021).

VnExpress (2016), "Vietnam suffers 50 major toxic waste scandals in 2016", available at: https://e.vnexpress.net/news/news/vietnam-suffers-50-major-toxic-waste-scandals-in-2016-3521238.html (accessed 14 October 2021).

VTV (2018): *Saving and operating effectively due to MFCA*, available at: https://vtv.vn/kinh-te/tiet-kiem-va-hoat-dong-hieu-qua-nho-ap-dung-mfca-201812131512258.htm (accessed 31 December 2021).

VTV (2020), *Productivity-Quality: MFCA - Material Flow Cost Accounting*, available at: https://vtv.vn/video/nang-suat-chat-luong-mfca-hach-toan-chi-phi-dong-nguyen-lieu-456323.htm (accessed 16 October 2021).

Wagner, B. (2015), "A report on the origins of Material Flow Cost Accounting (MFCA) research activities", *Journal of Cleaner Production*, Vol. 108, pp. 1255–1261.

Walz, M. and Günther, E. (2021), "What effects does material flow cost accounting have for companies? Evidence from a case studies analysis", *Journal of Industrial Ecology*, Vol. 25 No. 3, pp. 593–613.

Yagi, M. and Kokubu, K. (2020), "A framework of sustainable consumption and production from the production perspective: Application to Thailand and Vietnam", *Journal of Cleaner Production*, Vol. 276, pp. 124–160.

Yin, R.K. (2009), *Case Study Research: Design and Methods,* fourth ed, Sage Publications, Thousand Oaks, CA.

Zhang, B. and Liu, J. (2015), "Empirical study on MFCA introduced in Sekisui Chemical Group and its enlightenment", in Yarlagadda, P. (Ed.), *Proceedings of the 3rd International Conference on Advances in Energy and Environmental Science 2015, Zhuhai, China, 25-26 July*, Atlantis Press, Paris, France, pp. 1456–1460.

Chapter 4

Blended Case-Based Learning in a Sustainability Accounting Course: An Analysis of Student Perspectives

4.1 Introduction

Education for sustainable development contributes to the pursuit of the United Nations Sustainable Development Goals (SDGs) because it fosters learning in the next generation, for example, accountants and managers, who are enabled to support achieving these goals. Target 4.7 of SDG 4 focuses on the quality enhancement of education to ensure that learners acquire the knowledge and skills needed to promote sustainable development. Accounting education contributes to achieving this target and to mitigating or adapting to global challenges (Wyness and Dalton, 2018). However, currently, accounting education does not meet the educational needs of future accountants and business executives from a sustainability aspect (Al-Hazaima *et al.*, 2021).

Accounting education has faced challenges in enhancing deep learning and developing professional skills towards sustainability (Boyce *et al.*, 2012; Gray *et al.*, 1994; Wong *et al.*, 2021). To overcome these challenges, educational pedagogy is of vital importance. Gray (2019) exemplified this need, saying:

> "It seems to me that education is failing−and possibly even worthless−if it cannot help an individual address conflicting and difficult notions: otherwise what is education for? […] I can see for an education for accounting and sustainability that makes any sense lies in embracing a multitude of approaches which challenge how we teach, rather than what we teach" (p. 46).

Indeed, accounting educators need to discover and adopt creative and dialogic pedagogical approaches to cultivate student learning towards sustainability (Boyce, 2004; Contrafatto, 2013; Gray, 2013; Saravanamuthu, 2015; Thomson and Bebbington, 2004) since this concept is complex and associated with dynamic relationships between multiple dimensions (Bebbington, 1997; Bebbington *et al.*, 2017; Gray *et al.*, 1994). To fill the gap between educational needs and teaching practice, this paper explores how a blended case-based learning approach can enhance students' learning towards accounting for sustainability. The findings are relevant for accounting educators as they show practical evidence on students' learning outcomes for sustainability in both knowledge and professional skills. Furthermore, the paper provides practical implications in relation to pedagogical strategies to enhance learning in accounting for sustainability reflected insightfully from students' voices.

The paper is structured as follows. Section 4.2 introduces the literature on sustainability in accounting education and blended case-based learning to build up our research question. Section 4.3 outlines the research methodology, before findings are presented (Section 4.4) and discussed (Section 4.5). Conclusions are drawn for research and educational practice in Section 4.6. Section 4.7 contains appendix, followed by references of the paper (Section 4.8).

4.2 Literature Review

4.2.1 Sustainability in Accounting Education

There are many definitions that can be applied to sustainability (Gray, 2013); however, the most commonly accepted definition is associated with the "Brundtland report," which states that sustainable development is "development that meets the needs of the present without

compromising the ability of future generations to meet their own needs" (WECD, 1987, p. 8). In this regard, sustainability refers to multiple dimensions (economy, environment, and society) and their dynamic relationships (Bebbington, 1997).

Sustainability accounting education has been confronted with various barriers. Faculty and professional bodies have strongly driven accounting curricula that are seen to be "too narrow and often outdated" (Albrecht and Sack, 2000; Jackling and Lange, 2009), with an overemphasis on the technical aspects of accounting data, task completion, and memorization (Boyce *et al.*, 2012). Moreover, governmental funding is restricted to educational reforms towards sustainability in accounting courses at universities (Boulianne *et al.*, 2018) while the complex interdisciplinary nature of sustainability is another barrier to incorporating sustainability in accounting education (Marx and van der Watt, 2013).

As an effect of these barriers, the integration of sustainability concepts into accounting curricula is lacking (Al-Hazaima *et al.*, 2021; Boulianne and Keddie, 2018; Contrafatto, 2013). For example, Botes *et al.* (2014) concluded that "the integration is not wide enough and the sustainability education is not in sufficient depth" in New Zealand universities, while Boulianne *et al.* (2018) emphasized that there is little evidence of the inclusion of sustainability in accounting education programs in France. A key reason appears to be that sustainability in accounting education is based on individual initiatives rather than on any systematic development (Bebbington, 1997; Cho *et al.*, 2020; Humphrey *et al.*, 1996). This is reflected in the coverage of sustainability accounting in 'selective' sustainability courses, with a low level of student uptake (Bebbington, 1997; Khan, 2013).

In response to these barriers and their effects, there is significant academic support for implementing sustainability in accounting education (Boyce *et al.*, 2012; Gray and Collison, 2002; Cho and Mäkelä, 2019). Some studies have reflected *what is taught and integrated* in sustainability accounting courses, such as ethics perspectives (Gray *et al.*, 1994), environmental performance (Wynder *et al.*, 2013), or sociological perspectives (Boyce *et al.*, 2019), through exploring students' (Sharma and Kelly, 2014) and stakeholders' perceptions (Al-Hazaima *et al.*, 2021). However, the visible learning outcomes of educating accounting for sustainability (as educational results including both knowledge and professional skills) are still limited. To fill this gap, Wyness and Dalton (2018) found evidence of students' development of employability-related skills, such as collaboration, conflict management, and leadership, in terms of sustainability in an undergraduate accounting course. Following this contribution, it is essential to show more evidence on learning outcomes when integrating sustainability in (postgraduate) accounting courses in which student characteristics can be diverse and learning objectives can be varied (Shephard, 2008).

Other studies have explored *how material is taught*, which is a pedagogic approach, in sustainability accounting, such as transformative (Saravanamuthu, 2015), dialogic (Bebbington *et al.*, 2007; Wong *et al.*, 2021; Thomson and Bebbington, 2004), and problem-based learning (Wyness and Dalton, 2018). These studies have attempted to search for pedagogies that facilitate learning in accounting for sustainability. Thus far, these approaches have been examined in face-to-face environments. However, there is still room for the exploration of other pedagogies being embedded in blended/online teaching and learning for SDGs (Holmes *et al.*, 2021); for example, blended case-based learning has the potential to contribute to addressing existing challenges in sustainability accounting education.

Considering these issues, this paper examines the research question: *How can students' learning be enhanced towards accounting for sustainability through blended case-based learning?* Next, the blended case-based approach will be explained.

4.2.2 Blended Case-Based Learning

4.2.2.1 The Use of Case Studies in Teaching

A teaching case study is characterized by three fundamental characteristics: a significant business issue or issues, sufficient information on which to base conclusions, and no stated conclusions (Ellet, 2007; Campbell and William, 1991). Accounting educators have increasingly used case studies in accounting courses (Stewart and Dougherty, 1993; Adler *et al.*, 2004; Wynn-Williams *et al.*, 2008; Raschke and Charron, 2021).

The use of case studies by educators relies on the learning objectives, educational level, and course design (Weil *et al.*, 2011; Campbell and William, 1991). Kimmel (1995) posited that case studies are extremely useful as a critical thinking instructional tool, while Milne and McConnell (2001) emphasized the usefulness of cases in the development of problem-solving skills. Stewart and Dougherty (1993) utilized case studies in upper-level undergraduate accounting courses, while Weil *et al.* (2004) applied cases in a professional accounting program. Cullen *et al.* (2004) combined six case studies in a whole compulsory module, while Weil *et al.* (2011) used three case studies in an asynchronous discussion mode using the Moodle platform.

When learning objectives involve complex knowledge and skills, educators need to choose appropriate teaching methods to promote active and deep learning (Bonner, 1999). Teaching with cases is an effective method to help students achieve learning outcomes in both knowledge and professional skills towards sustainable development (Prado *et al.*, 2020) because this method immerses students in realistic business situations, including incomplete information, time constraints, and conflicting goals (Anderson and Schiano, 2014). However, the presence of cases does not ensure the successful development of professional skills in accounting courses (Libby, 1991). The ways in which the cases are used and the level of student engagement are crucial (Boyce *et al.*, 2001; Hassall and Milne, 2004; Healy and McCutcheon, 2010). One way to facilitate the use of case studies in accounting education is blended learning.

4.2.2.2 Blended Learning

Garrison and Kanuka (2004, p. 96) defined blended learning as "the thoughtful integration of classroom face-to-face (synchronous) learning experiences with online (asynchronous) learning experiences." In this regard, blended learning offers successful possibilities when creating a cohesive community of inquiry to develop critical thinking and reflection skills (Garrison and Anderson, 2003). The blended approach is powerful in improving student success in accounting education (Prinsloo & van Rooyen, 2007). However, it requires rethinking and redesigning the holistic teaching and learning system to overcome existing challenges in blended accounting courses, such as less engagement, loss of student support, and learning resource access issues (Sangster *et al.*, 2020; Jones and Chen, 2008). In doing so, three elements of blended learning are important to be considered, including student characteristics, educator roles, and design features.

4.2.2.2.1 Student Characteristics

Students have different characteristics, such as levels of motivation, attitudes about learning, and responses to specific classroom environments (Felder and Brent, 2005). These individual differences can affect their learning outcomes (Krasodomska and Godawska, 2021; Kintu *et al.*, 2017; Osgerby, 2013; Paechter *et al.*, 2010). Kintu *et al.* (2017) added that student attitudes towards blended learning and self-regulation have a positive effect on their satisfaction as an outcome. Krasodomska and Godawska (2021) concluded that there is a relationship between students' nationality and their engagement in e-learning performance, while gender has no impact on the results of accounting learning. Osgerby (2013) raised concerns about students'

expectations, competence, and engagement in a blended accounting course. Paechter *et al.* (2010) demonstrated that students' goals in e-learning are related to their learning achievements and course satisfaction.

4.2.2.2.2 Educator Roles

Gerbic (2011) conceptualized four roles of educators concerning the blended approach. These roles are pedagogical, social, technological, and managerial. The pedagogical role has a direct effect on course design, requiring educators to choose appropriate teaching methods and become more facilitative towards learner-centered and technology-mediated learning. The social role of educators refers to their ability to build relationships with students through online discussions and email and create social commitments. In this regard, educators should pay attention to social presence and use blended technologies to avoid losing the connection with their students in face-to-face classes (Hanson, 2009). The technological role represents the technological skills and confidence of educators in both asynchronous and synchronous environments; however, this role is given little attention. The managerial role involves the organization and evaluation of learning activities, requiring a clear structure and active cohort to organize learning activities and learning materials.

4.2.2.2.3 Design Features

Kintu *et al.* (2017) found that design features are significant predictors for student learning outcomes in blended learning. They emphasized the importance of interactions, technology, face-to-face support, learning management system tools and resources. Although blended learning has the potential to achieve learning objectives and student satisfaction due to convenience, flexibility, and access to learning at any place and time (Hiralaal, 2012), it creates daunting challenges in the design process. The blended approach refers to the use of a variety of technologies, as well as pedagogies and delivery modes, to create a strategic mix that will increase student success (Prinsloo and van Rooyen, 2007). Thus, blended courses need to ensure that both asynchronous and synchronous activities are complementary in a quality learning environment (Garrison and Kanuka, 2004; Weil *et al.*, 2014; Smith, 2012).

4.2.2.3 Blended Case-Based Learning in Accounting Education

Previous studies on accounting education have significantly shown the effectiveness of various pedagogies to address problems in teaching and learning practices (Fortin *et al.*, 2019; Weil *et al.*, 2014). However, the vast majority of these studies have focused on either case-based (Boyce *et al.*, 2001; Campbell and William, 1991; Raschke and Charron, 2021) or blended learning (Russo *et al.*, 2021; Weil *et al.*, 2014; Smith, 2012).

There is a lack of evidence on the effectiveness of combining blended learning and case-based learning in accounting courses, except for very few studies (Weil *et al.*, 2011; Parsons *et al.*, 2020) in the light of quantitative studies. For example, Weil *et al.* (2011) found that asynchronous discussion forums allowed for the social construction of knowledge and the facilitation of learning with case studies in an intermediate financial accounting course in New Zealand. Parsons *et al.* (2020) emphasized the effectiveness of learning tools and curriculum design in terms of blended case-based learning in the context of a professional program in South Africa. However, no previous studies have explored the use of a blended case-based learning approach in sustainability accounting courses. Hence, the present study sought to address this gap in the accounting education literature by examining student characteristics, educator roles, and design features.

4.3 Research Method

4.3.1 Case Study Setting

A qualitative case method was applied as it is helpful to deal with "how" questions to provide insights into research participants' understanding and opinions in a natural environment (Yin, 2009). This paper used the case of a course concerning material flow cost accounting (MFCA) to address the following research question: *how can students' learning be enhanced towards accounting for sustainability through blended case-based learning?*

The course was designed to teach 17 international master's students at the University of Kassel, Germany. For the first time, blending case-based learning was applied. The accounting course focused on the application of MFCA, which promotes "increased transparency of material use practices through the development of a material flow model that traces and quantifies the flows and stocks of materials within an organization in physical and monetary units" (APO, 2014, p. 1). MFCA, which has been diffused in both developed and developing countries, helps companies to enhance both economic and environmental performance (Herzig *et al.*, 2012; Sahu *et al.*, 2021; Christ and Burritt, 2015).

The blended case-based course included asynchronous and synchronous activities. In terms of asynchronous activities, students did self-learning activities by watching various videos. Additionally, they acquired new knowledge through reading books and articles. Following these activities, students engaged in writing learning journals and taking quizzes. Synchronous activities involved team discussions, presentations, and games in online sessions. Students were divided into three teams to work on the same (ten) questions embedded in four parts of the teaching case on MFCA application in the VietGreen mineral water company (Tran and Herzig, 2022).

4.3.2 Data Collection

Data triangulation, which involves using a wide range of data sources, such as documentary evidence, audio and visual materials, and interviews within a single study, was applied because it utilizes the strengths of different data types and validates the data based on the method of collection (Hopper and Hoque, 2006; Yin, 2009). In our study, data were collected from three sources: learning journals, a recording from the last online session of the course, and in-depth interviews. These data types were significant in enhancing the quality of evidence and generating a rich source of data with internal checks on its validity (Gittings *et al.*, 2020; Flick, 2004; Creswell, 2012).

Learning journals are useful in reflecting student learning experiences (Bisman, 2011) and encouraging higher order learning outcomes (Bell *et al.*, 2011). During the course, each student was required to write three learning journals with specific questions (**Appendix 4.1**). Two journals were designed to facilitate self-learning from asynchronous activities. The third journal focused on their reflections on the whole course concerning blended case-based learning. As a result, a total of 51 learning journals from 17 students were submitted to the course's Moodle system. These journals gave insights into what students learned and how they had learned during different sessions.

A video recording was conducted to collect data about learning outcomes through all students' direct reflections. Each student had a chance to express their emotions and opinions with others about the most interesting point they learned from the course. This recording, transcribed in English, was necessary to confirm the information provided in learning journals or add information that students did not mention in their learning journals to provide a fuller picture.

To understand insights into educator roles, students' blended case-based learning, and the effect of our course on learning in their subsequent courses and career paths, six in-depth interviews were conducted, recorded, and transcribed in English. Interviewees were purposely chosen based on country of origin (six students from five countries and three regions: Europe, Asia, and Africa) and from three teams of the course. The semi-structured interview questions

addressed two topics: learning outcomes and student learning (**Appendix 4.2**). A total of six interviews were conducted in April and June 2021 using Zoom until data saturation was reached (Fusch and Ness, 2015; O'Reilly and Parker, 2013). The average length of these interviews was 75 minutes, ranging from 61 to 97 minutes.

4.3.3 Coding and Analytical Framework

All learning journals and transcripts were imported into MaxQDA 2020. Various files were grouped into three types, namely learning journals (LJ1, LJ2, LJ3), a transcript of the last online session (ON1), and interview transcripts (IN1, IN2, IN3, IN4, IN5, IN6), which were useful for managing the source of the data and cross-checking it. In addition, 17 students were numbered (ST1 to ST17) to identify the person providing data.

Then, three steps of thematic coding were conducted. In the first step, raw codes were implemented to capture the key content of sentence(s). Then, the raw codes were synthesized into themes. Finally, these themes were grouped into clusters based on the similarities between the themes. To facilitate the process of presenting the results, an analytical framework was applied. First, students' learning outcomes (knowledge and professional skills) were presented. Next, three elements of blended case-based learning (student characteristics, educator roles, and design features) were analyzed to explain how students' learning of accounting for sustainability can be enhanced.

4.4 Analysis of Findings

4.4.1 Learning Outcomes

Learning objectives are important to measure students' learning outcomes (Rebele and St. Pierre, 2019). The findings revealed that students enhanced their MFCA knowledge and professional skills, such as critical thinking, teamwork, and communication skills, to promote sustainable production.

4.4.1.1 MFCA Knowledge

The objective of 'applying' knowledge relates to the ability of learners to apply their knowledge in a familiar or new task (Kidwell *et al.*, 2013). Over one-third of the 17 students participating in the course were motivated to apply the MFCA approach in their career paths (ST4-IN4, ST5-LJ3, ST6-IN2, ST7-LJ3, ST8-IN5, ST13-ON1, ST16-ON1, ST17-LJ1). Two of these students shared that:

> *I am able to apply MFCA in corporate practice. I have also adopted MFCA in my personal finance. I have a spreadsheet where I write my income and spending, while looking for how I'm wasting my resources and how to mitigate the waste (ST7-LJ3).*
>
> *MFCA is a new topic in Nigeria […] I have contacted the company I worked at before to promote MFCA and develop software-based environmental performance indicators (ST6-IN2).*

To be able to apply MFCA, students were given the VietGreen case study, which focused on physical information (including flowcharts), monetary information (including hidden costs), and a monetary environmental investment appraisal (including the net present value). The students revealed that:

> *What I found most helpful was the development of the flowchart because it was very easy to identify the optimization of the entire process and make recommendations for action (ST8-LJ3).*
>
> *The most interesting point I learned from the case study was the process of identifying the hidden cost, which the company did not know (ST16-LJ3).*

I really learned net present value […] and applied it in the case study (ST17-ON1).

In addition, students recognized the importance of MFCA in supporting managerial decision-making and sustainable production. They commented that:

I have realized that MFCA is a powerful tool to lower the environmental impact. It enables managers to make informed decisions regarding the adoption of cleaner production processes and technologies to ensure future sustainability (ST10-LJ3).

I initially thought recycling was the best approach, but now I understand that the reduction of waste generation and resource consumption is what we should pay more attention to (ST3-LJ3).

4.4.1.2 Critical Thinking, Teamwork, Communication Skills

Critical thinking skills relate to the processes of analysis (the selection of relevant information), synthesis (the connection of information among different components), and evaluation (the conclusions based on logical evidence for a given purpose) (Reinstein and Bayou, 1997). The findings revealed that students enhanced this skill, as demonstrated in the following student quotes:

I was challenged with the units. If I didn't think critically to see that figures were not the same unit, I would have to do that exercise again […] Cost allocation required critical thinking to be able to know where to allocate. I felt difficult. I needed to think really deeply to be able to get that (ST6-IN2).

Before I came to a conclusion, I actually had to understand the context. So, if I don't understand the information and connect other parts, I am not able to make decisions (ST11-ON1).

Teamwork skills are characterized by three elements: synergy among team members, their commitment and accountability to the team's goals, and a complementary talent pool (Bryant and Albring, 2006). Our findings showed that members of a team made efforts to motivate each other, share work with each other, support and learn together. Several students emphasized this skill:

The teamwork was incomparable. We motivated each other without ceasing. The course lifted my teamwork spirit. I became calmer and always ready to listen to people's opinions. I had a very good attitude (ST1-LJ3).

We tried adjusting with patience and sharing work with each other. If one was not available one time, then someone else would do it and vice-versa. Even when I had trouble understanding, I was able to ask others about the meaning […]. I was able to see us maturing (ST15-LJ3).

I was not much of a team player before, but with the help of this course, I have found myself looking forward to every Tuesday where we would meet in our teams (ST7-LJ3).

Communication skills are associated with the ability to write and/or speak effectively (Rebele and St. Pierre, 2019). Our course focused on oral communication skills, in which students discussed among their team and presented their discussion results in a PowerPoint format in a limited time. Students had the chance to reduce their apprehension about speaking in public and develop their presentation skills. Two of these students shared:

I have overcome my fear of public speaking. I surprised myself because of my courage to speak up. It doesn't always come to me easily. I am so glad it turned out this way (ST15-LJ3).

I was able to apply the communication skills acquired in this course to two other courses (ST14-IN1).

Generally, the course brought the students positive feelings, such as "the most interesting course," "satisfactory," "happy," "woo," "long-lasting value," and "enjoyable" (ST1,2,3,4,6,8,10,11,14,15,16-LJ3). When it comes to learning outcomes, one student shared that "learning objectives were 100% achieved, despite not having any background in accounting" (ST5-LJ3); this statement was supported by other students from different teams (ST8-LJ3, ST12-LJ3). These findings showed that students enhanced both knowledge and professional skills towards accounting for sustainability. In doing so, a blended case-based learning approach will be discovered next.

4.4.2 Blended Case-based Learning towards Accounting for Sustainability

Drawing from students' perspectives, there were three enablers for their learning outcomes. These include student characteristics, educator roles, and design features.

4.4.2.1 Student Characteristics

4.4.2.1.1 Diversity of Countries

Students were from eight countries, namely Nigeria (with the highest number of students: 7/17), Germany, Ghana, Nepal, Turkey, Bangladesh, India, and Pakistan. The diversity of international students made it advantageous to develop intercultural communication and exchange critical thinking from various countries. One student explained how the team (including a member from Germany) came up with solutions to waste reduction:

The company had various inputs, including cartons for the packaging stage. We talked about inputs and waste (non-outputs) reduction connected with inputs in the VietGreen case […] We thought of mineral water bottles in Germany, without using cartons […] We discussed the costs of cartons, which the company could save or use for something better (ST6-IN2).

However, the diversity of nationalities challenged all teams. Given the interview data, students struggled with understanding the opinions of members due to miscommunication or linguistic problems (ST4,6,8,12,14). Such challenges helped them develop oral communication and teamwork skills. One of the students shared that:

I remember on the first week's task, I could hardly follow the conversation. We were a group […] with some Asian and African English accents, which I was not really familiar with before […] On the third or fourth week, I realized that I could understand better than before […] Because we had to do the teamwork and the case study at the end, so I learned to be patient, listen to others, and find a solution to complete the task (ST4-IN4).

4.4.2.1.2 Diversity of Background

The course was chosen by students with diverse backgrounds from three master's programs: International Food Business Industry (76%), Sustainable Economics (18%), and Sustainable International Agriculture (6%). The diversity of students' background and experiences enriched their learning. Some students had no practical experience, while others had many experiences in different fields, such as marketing, sustainability, and quality control, through internships and practical jobs. While most students had no background in business (mainly in food, nutrition, and microbiology), only a few students learned business knowledge at the undergraduate or postgraduate levels. As illustrations, the students shared that:

I found working on the case with a team of extremely diverse people with different backgrounds and exchanging opinions on it particularly interesting for learning together (ST11-LJ3).

Our members helped together in teamwork […] If a member is not able to understand during the class, he or she can ask other members. I really asked her (a [Student] from Germany) for one calculation when I was not sure if the results were right or wrong. I was lucky to have a team that were all super cool […] They helped me grow my personal competence (ST14-IN1).

4.4.2.1.3 Positive Learning Attitudes

Our findings revealed that there were many existing challenges to conducting the tasks during the course, such as connection problems, a diversity of accents and opinions, and a lack of technological skills. These are very common in online teaching and learning in the field of accounting (Sangster *et al.*, 2020; Malan, 2020). However, such challenges cultivated the learning conditions for students, in which they enhanced their knowledge and skills, maintained positive energy, and became more active and adaptable to uncertain situations. Three of the students shared that:

Although it is not always that easy to deal with deadlines and pressure, I believe keeping a positive outlook will go a long way toward making each challenge a bit less daunting (ST3-LJ3).

I am a master's, not a bachelor student. I am not here for a grade […]. I would like to learn to develop my skills (ST4-IN4).

At first, it was a bit difficult to cope with this whole online study method. But gradually I got acquainted with the process of e-learning and self-learning. I am optimistic about this method (ST2-LJ1).

4.4.2.2 Educator Roles

The findings provided evidence on four roles for educators in enhancing students' learning: pedagogical, social, technical, and managerial roles.

4.4.2.2.1 Pedagogical Role

Teaching with cases is an effective method to help students achieve learning outcomes in both knowledge and professional skills (Prado *et al.*, 2020; Stewart and Dougherty, 1993). This method does require professional competence and the thorough preparation of educators to adapt to an unprecedented learning environment (Butler *et al.*, 2019). According to Berge (1995), this role is related to an educational facilitator using questions and probes for student responses during their discussions. Two students shared that:

You gave us directions on how to move. You contributed to this kind of interaction among the students […] When somebody asked you a question […], you did not answer directly. You just told them something that helped them get the answer by themselves. So, I think that is a good thing because instead of giving somebody fish, you taught the person how to fish (ST12-IN3).

There were some questions if we missed the wastewater bottle and cap cleaning process […] you told us that we needed to think it over. You tried to raise questions when students were not discussing them. The questions really helped us to think (ST14-IN1).

4.4.2.2.2 Social Role

There were high social interactions among students and lecturers, as well as between students and students in the same blended case-based course. Given the interview data, these interactions were made by the students' commitment to turning on their cameras during online sessions (ST4,14,15). One student highlighted that:

> *Students were required to turn on their cameras [...] At first, it was difficult for me, but later I got used to it […] It really helped me open up […] Everyone was seeing what I was doing. In the discussion part, I concentrated 100% of my energy on thinking, listening, and responding to questions (ST15-IN6).*

Students confirmed that encouragement was necessary to make the learning environment comfortable and safe for them to learn and express their opinions. One of them emphasized:

> *I will point out the impact of the lecturer in solving most of the challenges I encountered. I could remember saying most times—it is fine to struggle at first but think about this, think about that. Those words encouraged me and gave me paths to consider in most cases (ST13-LJ3).*

Additionally, feedback was essential to establish a close relationship between students and educators outside and inside classrooms. Four students asked us via email to arrange various appointments to give them feedback about their learning. In the online sessions, students expected educators' feedback to improve their presentation. One student recalled:

> *I remember you told us to […] use pictures or illustrations that we may need to develop. The feedback was helpful (ST12-IN3).*

4.4.2.2.3 Technological Role

When it comes to online teaching, technological knowledge and skills play a vital role in supporting students' learning (OECD, 2016). Various technologies were effectively used to organize the course: Moodle to deliver learning materials and activities, Zoom tools to teach online sessions, Panopto to record videos, Powtoon to create animated videos, Mentimeter and Google Drive to collect students' information, Miro to reflect the learning outcomes, and Kahoot to run a learning game. Moreover, partnering with technology was very important in supporting students' learning activities and dealing with technological problems. Three students commented that:

> *I could see the effort of the lecturers behind the videos. They were easier to understand (ST9-LJ3).*

> *Previously, I tried to write everything in my notes […] Right now, I just use Miro and some other technologies […] You helped me in terms of technology (ST14-IN1).*

> *Many times, I had connection problems. You helped me get back to my team discussions (ST16-ON1).*

4.4.2.2.4 Managerial Role

The course was structured in two complementary parts: asynchronous and synchronous. These parts were designed to encourage students to engage in learning through the blended case-based approach. Three students emphasized:

> *I enjoyed how each topic was divided into weekly tasks. I learned new things every week (ST10-LJ3).*

> *If this course is without you (educator), there will be nothing […] You were the one who organised all online sessions. You contributed to this kind of interaction among the*

students. You made us feel very comfortable talking and interacting. So, it really helped everybody learn (ST12-IN3).

You were more active than us. Because you knew the topic, you were teaching it, observing the discussion, and commenting […] You were doing this for three groups. So, it was not actually as easy as maybe some others think (ST4-IN4).

The managerial role not only involves the organization of learning activities but also the evaluation of students' learning outcomes (Dickfos *et al.*, 2014). In this regard, two students commented:

There were one or two students who were not talking or doing anything, but I still remember you told us that we would be graded. So, I think that really helped our team […]. Step by step, we communicated well and discussed together. In evaluating, you pointed out […] straight points (ST14-IN1).

I liked the presentation format with five presentations for a maximum of 15 minutes each, as this meant that only the most important things could be mentioned (ST8-LJ3).

4.4.2.3 Design Features

4.4.2.3.1 Asynchronous and Synchronous Activities

Our findings revealed that asynchronous learning activities facilitated positive learning feelings for students, such as being comfortable, enjoyable, reflective, and delightful. They shared that:

I think I did love how to read a case study. I learned how to understand a case study deeply (ST5-LJ3).

I was in my comfort zone and enjoyed watching videos and reading course materials. I also enjoyed writing learning journals. It helped me evaluate myself and reflect on my learning experience […] I was excited, grateful, and happy to have been able to experience this opportunity (ST10-LJ1&3).

The quiz aspect of self-learning was delightful (ST12-LJ3).

All asynchronous learning activities provided major knowledge for working within a team to address questions in the case study. One student commented that:

When I was unable to read through the case before the online session, I noticed trying to keep up with the subject matter of discussions was a bit difficult since I had no idea what was really going on. Thus, I realized that assessing prior knowledge enabled both the instructor and student to allocate their time and energies to be most productive during class sessions. I tried my best to always ensure I read materials before the scheduled online sessions (ST17-LJ3).

When it comes to synchronous activities, students confirmed that discussions in online sessions were very interactive and exciting. Two of them revealed:

I enjoyed the interactive discussions in the online class and particularly in the break-out rooms, where we had to brainstorm to come up with viable solutions (ST12-LJ3).

There were very exciting discussions about the different parts and tasks that we had to work on, which opened up new perspectives for us. I found that it was particularly interesting when it came to hidden costs (ST11-LJ3).

In addition, the five presentations and a game created a playful learning environment since students had many opportunities to learn from each other (ST2,4,6,7,10,14,15). The students expressed that:

> *I always liked the presentations. It helped me to understand other people's thought processes and the steps they took or methods used to solve the questions. It also gave me other ideas and insights that I would not have thought of (ST6-LJ3).*

> *The Kahoot game was very fun and competitive (ST15-ON1).*

After online classes, students were active in discussing and learning together. One student shared:

> *All I did to overcome some of the challenges was to build connections with my teammates outside the virtual class […] We usually met on the weekend to explain and discuss the case and the assignment in a relaxed atmosphere on Zoom or Whatsapp (ST13-LJ3).*

4.4.2.3.2 Learning Materials

Learning materials are vital for facilitating students' learning. It is necessary to create and choose the appropriate and structural materials, including the case study, videos, and reading texts, to achieve learning objectives. One of the students commented that:

> *The materials were definitely very structured (ST9-LJ3).*

VietGreen Case Study

When it comes to teaching with case studies, it is important to choose a good case to cultivate students' learning (Adler *et al.*, 2004; Wynn-Williams *et al.*, 2008). We found that students learned knowledge and skills, especially critical thinking skills, as they were involved in different parts of the VietGreen case study (Tran and Herzig, 2022), which were connected (ST5,7,15-LJ3).

> *The four parts of the case are connected. They told a story of how the company introduced MFCA and identified where the losses come from. It also explained how they all work towards achieving the company's objectives (ST5-LJ3).*

> *I felt that each stage has an effect on all other stages (ST15-LJ3).*

The case peaked the students' interest and curiosity, but they also found it challenging (ST9,13,14-LJ3, ST12-ON1) because it was written to describe a significant business issue of the company, with sufficient information on which to base conclusions. Three of the students stated:

> *The case was very interesting […] I liked learning with the case that was a "step-by-step" process and I was not overwhelmed with the whole case at once (ST9-LJ3).*

> *The case made me really curious about what will happen in the next parts […] and how to persuade the Chief Executive Officer of the company (ST14-LJ3).*

The case was challenging […] It improved my critical thinking. Initially, when we started, it was hard to bring useful information from a pile of words […] But as we did more, it was easier to understand […] Through the case, I was able to know the importance of MFCA at the corporate level and how it helped managerial decisions (ST12-ON1).

Supplementary Materials (Videos and Reading Texts)

In the past, we mainly used the case study without further illustrative videos. Students absorbed new knowledge from our lectures in the face-to-face classroom. However, due to circumstances

surrounding the Covid-19 pandemic, we were motivated to use innovative learning materials in the blended course. Six animated videos and five lecture videos were created by us to provide additional knowledge. Additionally, nine YouTube videos were selected. Given data from interviews and learning journals, students confirmed that the videos were understandable, knowledgeable, engaging, excellent, appropriate full-length, appealing, and clear (ST9,10,11,12,13,14,15). Three students commented:

> *What I liked about the videos was the length of each video. Every sub-chapter was divided into different videos. This took away the pressure to sit in front of a two-hour lecture (ST9-LJ1).*
>
> *The animated videos were nice. It is an efficient way of engaging and sustaining interest for me (ST12-LJ3 and IN3).*
>
> *I found the videos very interesting and also perceived the shortness of the videos as positive. This made it possible to watch one after the other and then review it without getting too much information at once. I also found the layout of the videos very appealing and was able to concentrate on the topic (ST11-LJ1).*

In addition to the academic articles that were closely connected with animated videos, two main books were integrated into the course as major supplementary material (Herzig *et al.*, 2012; Ellet, 2007). These were characterized by a wealth of knowledge, reflection, and inspiration. Three students emphasized:

> *The case study handbook has helped on how to prepare myself for the next online sessions. It accurately summarised the feelings I had been feeling regarding the case discussion, but now I can say that I was well prepared (ST10-LJ2).*
>
> *The Environmental Management Accounting (EMA) book with the case studies in South-East Asian companies […] I would really suggest. Not only the chapters you mentioned or in general […] but all cases were helpful and even to get an understanding of what the topic is about (ST8-IN5).*
>
> *The motivation of my MFCA project came to my mind when I was reading the case of the JBC company in the EMA textbook (ST6-IN2).*

4.5 Discussion

4.5.1 The Necessity of Understanding Student Characteristics

Our study found that student characteristics, including nationality, background, and learning attitudes, affected learning outcomes. Given an international learning environment, nationality played a vital role in students' engagement and performance in the e-learning process, as shown before by Krasodomska and Godawska (2021) in a quantitative study. Our study complemented their findings by providing additional insights into how nationality impacts students' learning and how domestic students (e.g., German students) can help international students during the process of learning, for example, when defining solutions to waste reduction. Furthermore, our study showed the linguistic challenges of international students in relation to working in a diverse team; this result was complementary to previous quantitative studies on the effect of language proficiency on learning performance (Jackling and Anderson, 1998; Bobe and Cooper, 2019).

To facilitate a blended case-based approach, we collected student information, such as nationality, background, expectation, interests, age, and living place, before starting the course. This information was important to design and adjust learning activities, create a safe learning environment, and enhance social interactions. Since blended case-based learning relates to the learner-centred approach, we agreed that instructors should not ignore student characteristics,

such as their prior experience/backgrounds (Koh and Koh, 1999), learning attitudes (Felder and Brent, 2005; Kintu *et al.*, 2017), and students' mental health during the Covid-19 pandemic (Humphrey and Forbes-Mewett, 2021).

4.5.2 Adopting Different Educator Roles

Our findings revealed that educator roles—pedagogical, social, technological, and managerial roles—make vital contributions to helping students achieve learning outcomes. Given the emerging importance of educator attributes in implementing blended learning (Bruggeman *et al.*, 2021; Gerbic, 2011), we argue that these four roles have been neglected in studies on (sustainability) accounting education.

Some studies on accounting education have mainly focused on the benefits of adopting blended learning (Dickfos *et al.*, 2014), student's choice (Fortin *et al.*, 2019; Liu and Zainuddin, 2021), and student engagement (Weil *et al.*, 2014) in the absence of considering the roles of educators. Similarly, some studies on educating for sustainability accounting also fail to explicitly define educator roles. For example, Wyness and Dalton (2018) mainly examined a pedagogy for enhancing students' learning, with a focus on students' perceptions of the importance of learning sustainability in their accounting program and the value of problem-based learning. Wong *et al.* (2021) implicitly indicated two of four roles (e.g., pedagogical and managerial roles) when the authors reflected on how the dialogic approach permeated the course design and the assessments of essays, reflective journals, and presentations.

Although each educator has different teaching styles, specific educator roles should be identified and adopted (Boyce *et al.*, 2001). Our study is a rare case, explicitly defining a set of roles that an educator should adapt for blended case-based learning in sustainability accounting education. Given the challenges for student engagement in accounting education (Sangster *et al.*, 2020), the social role is of vital importance due to the ability to enable students to engage in interactive learning (Redmond *et al.*, 2018). Additionally, given the increasing need to integrate online/blended learning into higher education (Alammary *et al.*, 2014), accounting educators should develop technological skills to adapt to this style of learning. Such skills can enhance the technological role in assisting student learning, solving technical problems, creating a playful learning environment, and creating innovative materials (Duncan *et al.*, 2012; Hall *et al.*, 2004; Paechter *et al.*, 2010). In this regard, we agree that accounting educators should "commit to a continual process of professional development" to become "competent in the use of technology in the classroom" (Bryant and Hunton, 2000, p. 150).

4.5.3 Innovations in Course Design

Our findings showed that innovations in course design created positive learning feelings for students and enhanced their learning outcomes. Specifically, students highly appreciated the complementation and interactions of learning activities, including both asynchronous and synchronous sessions that are strongly supported by the literature (Smith, 2012; Garrison and Kanuka, 2004) and strongly engaged in a wide range of learning materials.

While Weil *et al.* (2011) emphasized the effectiveness of asynchronous/online discussion forums when learning with cases, our paper added evidence of the success of adopting quizzes and writing learning journals, which are essential in motivating students to stay engaged and think critically (Dickfos *et al.*, 2014; Weil *et al.*, 2014). Furthermore, the use of a Kahoot game in synchronous activities was highly recommended by students due to its effect on their playful and interactive learning in our course. This finding is consistent with some studies on the influence of Kahoot games on classroom dynamics, motivation, and students' learning process (Licorish *et al.*, 2018; Wang and Tahir, 2020). Noticeably, students engaged in team discussions in break-out rooms, which are helpful for them to share their opinions and prepare for their synchronous presentations. This result added new perspectives in designing blended courses on

sustainability accounting, which may be different from team discussions in physical classes (Wyness and Dalton, 2018).

In addition, students enjoyed learning materials, including the teaching case study, animated videos, lecture videos, YouTube videos, and textbooks, which were creative, structured, and engaging. Despite resistance to the use of technology in accounting teaching (Watty *et al.*, 2016), there has been increasing interest among accounting educators in creating innovations in teaching materials. Holtzblatt and Tschakert (2011) found that online video clips, student video projects, and online video lecture recordings are enormously beneficial for accounting education. Additionally, D'Aquila *et al.* (2019) emphasized that the generated YouTube videos, including lecture and information videos, improved student performance. Innovations in creating animated videos, podcasts, and digital storytelling are of vital importance in accounting education (Copley, 2007; Suwardy *et al.*, 2013).

Overall, our findings showed that the comprehensive innovation in course design (both learning activities and materials) enormously contributed to students' learning outcomes. To foster innovative teaching, accounting educators should thoroughly consider blended course design (Alammary *et al.*, 2014) to adopt different innovative teaching strategies according to the diverse needs of the students (Naz and Murad, 2017; Kintu *et al.*, 2017; Martin and Martin, 2015), which are supported by academics, accounting associations, and professional bodies (Aston Business School, 2021; European Accounting Association, 2021; Calderon, 2019; Institute of Chartered Accountants of Scotland, 2021).

4.6 Conclusions

This study aimed to explore how a blended case-based learning approach can enhance students' learning towards accounting for sustainability. The research question—*how can students' learning be enhanced towards accounting for sustainability through blended case-based learning?*—was addressed by the analysis of learning outcomes and the insightful exploration of blended case-based learning.

Our findings showed that students enhanced the application of MFCA knowledge with a high level of cognitive objectives according to Bloom's taxonomy (Gray *et al.*, 1994; Kidwell *et al.*, 2013). Based on recognizing the importance of MFCA in making decisions towards eco-efficiency and sustainable production, over one-third of the students want to apply this tool in their career paths. This result gives reason to believe that the course's educational quality and approach can encourage the next generation to contribute to solving global challenges. While sustainability education and institutional factors are barriers to MFCA diffusion in developing countries, such as Nigeria and South Africa (Jalaludin *et al.*, 2011; Olalekan and Jumoke, 2017), international students who pursue their learning in developed countries may have the potential to transfer their sustainability knowledge into practice to deal with global problems (Bebbington *et al.*, 2019; Gray *et al.*, 1994).

Along with MFCA knowledge, our results emphasized that students can enhance their critical thinking, teamwork, and communication skills through blended case-based learning. These skills must be equipped for graduates to be successful in their future jobs and lifelong learning (AICPA, 2018; ILO, 2018; Villiers, 2010). Critical thinking skills are essential to accomplish relevant job functions (Wolcott and Sargent, 2021). With this skill, graduates meet requirements from professional bodies and have more career opportunities (AICPA, 2018; Bui and Porter, 2010; Rebele and St. Pierre, 2019) because employers require them to adapt to uncertain and complicated environments, as well as contribute to solving global challenges as reflected in the SDG agenda by transformative actions (Cho and Mäkelä, 2019).

Overall, our study shows that blended learning with a case study can be an enjoyable journey for students when diving into real practice. Using this approach had a wide variety of benefits,

ranging from acquiring knowledge to gaining professional skills, such as critical thinking, teamwork, and communication skills. In this study, three key elements in blended case-based learning were discovered and analyzed, including student characteristics, educator roles, and design features (learning activities and materials).

4.6.1 Theoretical Contributions

These findings made theoretical contributions in two key aspects. First, the paper contributes to addressing the knowledge and skill gap raised in accounting education literature, such as sustainability knowledge (Al-Hazaima *et al.*, 2021), critical thinking skills (Wolcott & Sargent, 2021), communication, and teamwork skills (Jackling & de Lange, 2009). Given the lack of evidence on learning outcomes in relation to accounting for sustainability, this study specifically showed that sustainability knowledge is acquired and professional skills are enhanced in the context of blended case-based learning environment. As a result, this study provided valuable evidence on contributing to achieving the target SDG 4.7 which focuses on educating for sustainable development.

Second, our findings contribute to pedagogical approaches in accounting education when complementing a blended case-based learning approach, which is rarely mentioned in previous studies (Weil *et al.*, 2011; Parsons *et al.*, 2020; Apostolou *et al.*, 2021). Noticeably, this study was the first to apply this approach in sustainability accounting education, in addition to other educational pedagogies, such as transformative learning, dialogic learning, and problem-based learning (Wyness and Dalton, 2018; Saravanamuthu, 2015; Wong *et al.*, 2021). In particular, this study provided confirmatory evidence for the effectiveness of applying the blended case-based approach, which was reflected by the comments of international students that very few studies focus on this perspective (Wong *et al.*, 2021). More importantly, this study can be regarded as a successful showcase of blended learning connecting with a high-impact blend. This blend refers to the consideration of the whole course objectives with students' needs in mind, which is still challenging for educators in terms of course design (Alammary *et al.*, 2014).

4.6.2 Practical Contributions

From a practical perspective, these findings offer three implications: the necessity of understanding student characteristics, the adoption of various educator roles, and innovation in course design. Although this study focuses on accounting education, educators in other disciplines may benefit from our paper.

First, student diversity is an important asset for engagement and enjoyment in the classroom, as they have different opinions and perspectives. In this regard, Felder and Brent (2005, p. 57) stated that "the more thoroughly instructors understand the differences, the better chance they have of meeting the diverse learning needs of all of their students".

Second, given that educator roles, defined here as pedagogical, social, technological, and managerial roles, are often neglected in studies on e-learning (Paechter *et al.*, 2010). We think that these roles should be thoroughly and explicitly reflected in the context of blended/online teaching and learning, especially the technological role. If the technological role is not strengthened, students can find it hard to adapt to the practical business environment (Ahadiat, 2008; Bryant and Hunton, 2000; Webb and Chaffer, 2016; IFAC, 2019). It has been argued that the ways technologies are used are more important than knowing about many technologies (Gerard *et al.*, 2016; Spraakman *et al.*, 2015).

Third, educators can face various personal challenges in teaching practices in relation to the use of case studies, as well as blended learning. Although teaching with cases has been increasingly used in accounting education (Cullen *et al.*, 2004; Wynn-Williams *et al.*, 2008; Raschke and Charron, 2021), accounting educators have misused and underused the case method in their

teaching activities for a long time (Adler *et al.*, 2004; Adler *et al.*, 2000; Libby, 1991). If educators want to pursue case-based teaching, they need to be trained or willing to learn this method to adopt flexible roles through practicing or observing experience from experts in case-based teaching (Milne and McConnell, 2001; Boyce *et al.*, 2001). Additionally, when sustainability cases are not available or suitable for their educational goals, it could be essential that accounting educators think forward to writing their own cases using partnerships with practical corporations or students to create significant cases towards business model innovations (Baron and McNeal, 2019; Bouten and Hoozée, 2015).

When it comes to blended/online teaching with cases, new challenges, such as workload and technological problems, have been considerably raised and shared by 282 educators from 56 countries through a survey in 2021 (Case Centre, 2021). Preparation for teaching in an online format is more time-consuming than teaching in a face-to-face format (Butler *et al.*, 2019; Schiano and Andersen, 2017). However, given evidence on the success confirmed by students' learning reflections, we recommend that practical stories of teaching with case studies, especially in online platforms, should be encouraged and shared in the educator community. As Kreber (2001) noted:

> When faculty reflect on both existing educational research on the use of case studies and their personal experience using case studies with students and disseminate their findings, they contribute to an aspect of academic work that has received little attention to date: the scholarship of teaching (p. 227).

4.7 Appendix

Appendix 4.1 Learning Journals

First and second learning journals

- What did you learn?
- How did you learn?

Third learning journals

- Could you please specifically describe interesting points that you liked while learning about the case?
- Could you please specifically describe the challenges you faced during the process of learning about the case? What did/will you do to overcome these challenges?
- What could you take away from the case as a personal learning document in terms of Material Flow Cost Accounting (MFCA)?
- How are various parts of the case linked together?
- How could MFCA be helpful in making decisions?
- How do you evaluate your learning outcomes?
- Why could you (not) achieve these learning outcomes?
- How has the course influenced your thoughts (knowledge, skills, attitude)?

Appendix 4.2 Interview Questions

Learning outcomes

- What did you learn from the course?
- You mentioned (A). Is there anything that you learned from the course?
- Could you explain (B) in more detail?
- Why do you think that you learned (C)?

Students' learning

- How did you learn?
- Why did you learn (D)?
- How could you describe the roles of educators (E) when it comes to the course?
- How do you evaluate the case study (F)?
- Which learning activities/learning materials (G) did you like the most? And why?
- How did (H) affect your learning?
- Do you mean the presentation (I)?
- Why do you think that (J) is very interesting?
- If I ask you who contributed a lot to your team, what would you say?
- After the course, did you apply (K)? If yes, why?
- Do you want to apply material flow cost accounting in the future? If yes, why?
- How did the course change your thinking?
- Did you change your behaviour or your attitude after the course? If yes, could you please give me an example?
- Before ending the interview, is there anything you want to add or you want to say?

4.8 References

Adler, R.W., Milne, M.J. and Stringer, C.P. (2000), "Identifying and overcoming obstacles to learner-centred approaches in tertiary accounting education: a field study and survey of accounting educators' perceptions", *Accounting Education*, Vol. 9 No. 2, pp. 113–134.

Adler, R.W., Whiting, R.H. and Wynn-Williams, K. (2004), "Student-led and teacher-led case presentations: empirical evidence about learning styles in an accounting course", *Accounting Education*, Vol. 13 No. 2, pp. 213–229.

Ahadiat, N. (2008), "Technologies used in accounting education: A study of frequency of use among faculty", *Journal of Education for Business*, Vol. 83 No. 3, pp. 123–134.

AICPA (2018), "AICPA Pre-Certification Core Competency Framework", available at: http://www.aicpa.org/interestareas/accountingeducation/resources/pages/corecompetency.aspx (accessed 2 May 2021).

Alammary, A., Sheard, J. and Carbone, A. (2014), "Blended learning in higher education: three different design approaches", *Australasian Journal of Educational Technology*, Vol. 30 No. 4, pp. 440–454.

Albrecht, W.S. and Sack, R.J. (2000), *Accounting education: Charting the course through a perilous future*, American Accounting Association, USA.

Al-Hazaima, H., Low, M. and Sharma, U. (2021), "Perceptions of salient stakeholders on the integration of sustainability education into the accounting curriculum: a Jordanian study", *Meditari Accountancy Research*, Vol. 29 No. 2, pp. 371–402.

Anderson, E. and Schiano, B. (2014), *Teaching with cases: A practical guide*, Harvard Business Press.

APO (2014), *Manual on Material Flow Cost Accounting: ISO 14051*, Asian Prodcutivity Organization, Japan.

Apostolou, B., Dorminey, J.W. and Hassell, J.M. (2021), "Accounting education literature review (2020)", *Journal of Accounting Education*, Vol. 55, p. 100725.

Aston Business School (2021), "Games and simulations in accounting and finance education conference", available at: https://www.aston.ac.uk/research/events/gsafe-conference (accessed 1 August 2021).

Baron, A. and McNeal, K. (2019), *Case Study Methodology in Higher Education*, IGI Global.

Bebbington, J. (1997), "Engagement, education and sustainability", *Accounting Auditing & Accountability Journal*, Vol. 10 No. 3, pp. 365–381.

Bebbington, J., Brown, J., Frame, B. and Thomson, I. (2007), "Theorizing engagement: the potential of a critical dialogic approach", *Accounting Auditing & Accountability Journal*, Vol. 20 No. 3, pp. 356–381.

Bebbington, J., Österblom, H., Crona, B., Jouffray, J.-B., Larrinaga, C., Russell, S. and Scholtens, B. (2019), "Accounting and accountability in the Anthropocene", *Accounting, Auditing & Accountability Journal*, Vol. 33 No. 1, pp. 152–177.

Bebbington, J., Russell, S. and Thomson, I. (2017), "Accounting and sustainable development: Reflections and propositions", *Crititcal Perspectives on Accounting*, Vol. 48, pp. 21–34.

Bell, A., Kelton, J., McDonagh, N., Mladenovic, R. and Morrison, K. (2011), "A critical evaluation of the usefulness of a coding scheme to categorise levels of reflective thinking", *Assessment & Evaluation in Higher Education*, Vol. 36 No. 7, pp. 797–815.

Berge, Z.L. (1995), "The role of the online instructor/facilitator", *Educational Technology*, Vol. 35 No. 1, pp. 22–30.

Bisman, J. (2011), "Engaged pedagogy: a study of the use of reflective journals in accounting education", *Assessment & Evaluation in Higher Education*, Vol. 36 No. 3, pp. 315–330.

Bobe, B.J. and Cooper, B.J. (2019), "The effect of language proficiency on approaches to learning and satisfaction of undergraduate accounting students", *Accounting Education*, Vol. 28 No. 2, pp. 149–171.

Bonner, S.E. (1999), "Choosing teaching methods based on learning objectives: An integrative framework.", *Issues in Accounting Education*, Vol. 14 No. 1, pp. 11–15.

Botes, V., Low, M. and Chapman, J. (2014), "Is accounting education sufficiently sustainable?", *Sustainability Accounting, Management and Policy Journal*, Vol. 5 No. 1, pp. 95–124.

Boulianne, E., Keddie, L.S. and Postaire, M. (2018), "(Non) coverage of sustainability within the French professional accounting education program", *Sustainability Accounting, Management and Policy Journal*, Vol. 9 No. 3, pp. 313–335.

Boulianne, E. and Keddie, S.L. (2018), "Where is sustainability within the Canadian CPA education program?", in Belal, A. and Cooper, S. (Eds.), *Sustainability Accounting*, *Advances in Environmental Accounting & Management*, Vol. 7, Emerald Publishing Limited, pp. 71–112.

Bouten, L. and Hoozée, S. (2015), "Challenges in sustainability and integrated reporting", *Issues in Accounting Education Teaching Notes*, Vol. 30 No. 4, pp. 83–93.

Boyce, G. (2004), "Critical accounting education: teaching and learning outside the circle", *Critical Perspectives on Accounting*, Vol. 15 No. 4-5, pp. 565–586.

Boyce, G., Greer, S., Blair, B. and Davids, C. (2012), "Expanding the horizons of accounting education: incorporating social and critical perspectives", *Accounting Education*, Vol. 21 No. 1, pp. 47–74.

Boyce, G., Narayanan, V., Greer, S. and Blair, B. (2019), "Taking the pulse of accounting education reform: liberal education, sociological perspectives, and exploring ways forward", *Accounting Education*, Vol. 28 No. 3, pp. 274–303.

Boyce, G., Williams, S., Kelly, A. and Yee, H. (2001), "Fostering deep and elaborative learning and generic (soft) skill development: the strategic use of case studies in accounting education", *Accounting Education*, Vol. 10 No. 1, pp. 37–60.

Bruggeman, B., Tondeur, J., Struyven, K., Pynoo, B., Garone, A. and Vanslambrouck, S. (2021), "Experts speaking: Crucial teacher attributes for implementing blended learning in higher education", *The Internet and Higher Education*, Vol. 48, p. 100772.

Bryant, S.M. and Albring, S.M. (2006), "Effective team building: Guidance for accounting educators", *Issues in Accounting Education*, Vol. 21 No. 3, pp. 241–265.

Bryant, S.M. and Hunton, J.E. (2000), "The use of technology in the delivery of instruction: Implications for accounting educators and education researchers", *Issues in Accounting Education*, Vol. 15 No. 1, pp. 129–162.

Bui, B. and Porter, B. (2010), "The expectation-performance gap in accounting education: An exploratory study", *Accounting Education*, Vol. 19 No. 1-2, pp. 23–50.

Butler, M.G., Church, K.S. and Spencer, A.W. (2019), "Do, reflect, think, apply: Experiential education in accounting", *Journal of Accounting Education*, Vol. 48, pp. 12–21.

Calderon, T.G. (2019), *Advances in accounting education: Teaching and curriculum innovations*, Emerald Publishing Limited.

Campbell, J.E. and William, F.L. (1991), "Using cases in accounting classes", *Issues in Accounting Education*, Vol. 6 No. 2, pp. 276–283.

Case Centre (2021), "Online case teaching survey 2021: the results", available at: https://www.thecasecentre.org/caseMethod/features/CTsurvey2021results (accessed 11 January 2022).

Cho, C.H., Kim, A., Rodrigue, M. and Schneider, T. (2020), "Towards a better understanding of sustainability accounting and management research and teaching in North America: a look at the community", *Sustainability Accounting, Management and Policy Journal*, Vol. 11 No. 6, pp. 985–1007.

Cho, C.H. and Mäkelä, H. (2019), "Can accountants save the world? Incorporating sustainability in accounting courses and curricula", available at: https://arc.eaa-online.org/blog/can-accountants-save-world-incorporating-sustainability-accounting-courses-and-curricula (accessed 25 May 2021).

Christ, K.L. and Burritt, R.L. (2015), "Material flow cost accounting: a review and agenda for future research", *Journal of Cleaner Production*, Vol. 108, pp. 1378–1389.

Contrafatto, M. (2013), "'Utopia' and 'Passion': A commentary on 'Sustainability and accounting education: The elephant in the classroom'", *Accounting Education*, Vol. 22 No. 4, pp. 336–339.

Copley, J. (2007), "Audio and video podcasts of lectures for campus-based students: production and evaluation of student use", *Innovations in Education and Teaching International*, Vol. 44 No. 4, pp. 387–399.

Creswell, J.W. (2012), *Educational Research Planning, Conducting, and Evaluating Quantitative and Qualitative Research,* 4th ed., Pearson, Boston.

Cullen, J., Richardson, S. and O'Brien, R. (2004), "Exploring the teaching potential of empirically-based case studies", *Accounting Education*, Vol. 13 No. 2, pp. 251–266.

D'Aquila, J.M., Wang, D. and Mattia, A. (2019), "Are instructor generated YouTube videos effective in accounting classes? A study of student performance, engagement, motivation, and perception", *Journal of Accounting Education*, Vol. 47, pp. 63–74.

Dickfos, J., Cameron, C. and Hodgson, C. (2014), "Blended learning: making an impact on assessment and self-reflection in accounting education", *Education + Training*, Vol. 56 No. 2/3, pp. 190–207.

Duncan, K., Kenworthy, A. and McNamara, R. (2012), "The effect of synchronous and asynchronous participation on students' performance in online accounting courses", *Accounting Education*, Vol. 21 No. 4, pp. 431–449.

Ellet, W. (2007), *The Case Study Handbook: How to Read, Discuss, and Write Persuasively about Cases*, Harvard Business Press, Boston, MA.

European Accounting Association (2021), "Experiential pedagogy in accounting: using virtual reality case teaching", available at: https://arc.eaa-online.org/portfolio/experiential-pedagogy-accounting-using-virtual-reality-case-teaching (accessed 3 August 2021).

Felder, R.M. and Brent, R. (2005), "Understanding student differences", *Journal of Engineering Education*, Vol. 94 No. 1, pp. 57–72.

Flick, U. (2004), "Triangulation in qualitative research", in Flick, U., Kardoff, E. von and Steinke, I. (Eds.), *A Companion to Qualitative Research*, Sage, London, UK, pp. 178–183.

Fortin, A., Viger, C., Deslandes, M., Callimaci, A. and Desforges, P. (2019), "Accounting students' choice of blended learning format and its impact on performance and satisfaction", *Accounting Education*, Vol. 28 No. 4, pp. 353–383.

Fusch, P.I. and Ness, N.R. (2015), "Are we there yet? Data saturation in qualitative research", *The Qualitative Report*, Vol. 20 No. 9, pp. 1408–1416.

Garrison, D.R. and Anderson, T. (2003), *E-learning in the 21st Century: A Framework for Research and Practice*, Routledge/Falmer, London.

Garrison, D.R. and Kanuka, H. (2004), "Blended learning: uncovering its transformative potential in higher education", *The Internet and Higher Education*, Vol. 7 No. 2, pp. 95–105.

Gerard, L., Matuk, C. and Linn, M.C. (2016), "Technology as inquiry teaching partner", *Journal of Science Teacher Education*, Vol. 27 No. 1, pp. 1–9.

Gerbic, P. (2011), "Teaching using a blended approach – what does the literature tell us?", *Educational Media International*, Vol. 48 No. 3, pp. 221–234.

Gittings, L., Taplin, R. and Kerr, R. (2020), "Experiential learning activities in university accounting education: A systematic literature review", *Journal of Accounting Education*, Vol. 52, p. 100680.

Gray, R. (2013), "Sustainability + Accounting Education: The Elephant in the Classroom", *Accounting Education*, Vol. 22 No. 4, pp. 308–332.

Gray, R. (2019), "Sustainability accounting and education: conflicts and possibilities", in Amaeshi, K., Muthuri, J.N. and Ogbechie, C. (Eds.), *Incorporating Sustainability in Management Education*, Springer International Publishing, Cham, pp. 33–54.

Gray, R., Bebbington, J. and McPhail, K. (1994), "Teaching ethics in accounting and the ethics of accounting teaching: educating for immorality and a possible case for social and environmental accounting education", *Accounting Education*, Vol. 3 No. 1, pp. 51–75.

Gray, R. and Collison, D. (2002), "Can't see the wood for the trees, can't see the trees for the numbers? Accounting education, sustainability and the Public Interest", *Critical Perspectives on Accounting*, Vol. 13 No. 5-6, pp. 797–836.

Hall, M., Ramsay, A. and Raven, J. (2004), "Changing the learning environment to promote deep learning approaches in first-year accounting students", *Accounting Education*, Vol. 13 No. 4, pp. 489–505.

Hanson, J. (2009), "Displaced but not replaced: the impact of e-learning on academic identities in higher education", *Teaching in Higher Education*, Vol. 14 No. 5, pp. 553–564.

Hassall, T. and Milne, M.J. (2004), "Using case studies in accounting education", *Accounting Education*, Vol. 13 No. 2, pp. 135–138.

Healy, M. and McCutcheon, M. (2010), "Teaching with case studies: An empirical investigation of accounting lecturers' experiences", *Accounting Education*, Vol. 19 No. 6, pp. 555–567.

Herzig, C., Viere, T., Schaltegger, S. and Burritt, R.L. (Eds.) (2012), *Environmental Management Accounting: Case Studies of South-East Asian Companies*, Routledge, London.

Hiralaal, A. (2012), "Students' experiences of blended learning in accounting education at the Durban University of Technology", *South African Journal of Higher Education*, Vol. 26 No. 2, pp. 316–328.

Holmes, J., Moraes, O.R., Rickards, L., Steele, W., Hotker, M. and Richardson, A. (2021), "Online learning and teaching for the SDGs – exploring emerging university strategies", *International Journal of Sustainability in Higher Education*, ahead-of-print ahead-of-print.

Holtzblatt, M. and Tschakert, N. (2011), "Expanding your accounting classroom with digital video technology", *Journal of Accounting Education*, Vol. 29 2-3, pp. 100–121.

Hopper, T. and Hoque, Z. (2006), "Triangulation approaches to accounting research", in Hoque, Z. (Ed.), *Methodological Issues in Accounting Research: Theories and Methods*, Spiramus Press, London, UK, pp. 477–486.

Humphrey, A. and Forbes-Mewett, H. (2021), "Social value systems and the mental health of international students during the COVID-19 pandemic", *Journal of International Students*, Vol. 11 S2, pp. 2162–3104.

Humphrey, C., Lewis, L. and Owen, D. (1996), "Still too distant voices? Conversations and reflections on the social relevance of accounting education", *Critical Perspectives on Accounting*, Vol. 7 No. 1, pp. 77–99.

IFAC (2019), *Handbook of International Education Pronouncements*, International Federation of Accountants, New York, USA.

ILO (2018), "ILO Toolkit for Quality Apprenticeships", *International Labour Organization,* 2018, available at: https://iloskillskspstorage.blob.core.windows.net/development/resources/1094/edmsp1_263233.pdf (accessed 2 May, 2021).

Institute of Chartered Accountants of Scotland (2021), "Discover the fantastic opportunities available for CAs to work with ICAS", available at: https://www.icas.com/news/ca-opportunities-at-icas (accessed 8 September 2021).

Jackling, B. and Anderson, A. (1998), "Study mode, general ability and performance in accounting: a research note", *Accounting Education*, Vol. 7 No. 1, pp. 65–73.

Jackling, B. and Lange, P. de (2009), "Do accounting graduates' skills meet the expectations of employers? A matter of convergence or divergence", *Accounting Education*, Vol. 18 No. 4-5, pp. 369–385.

Jalaludin, D., Sulaiman, M. and Nazli Nik Ahmad, N. (2011), "Understanding environmental management accounting (EMA) adoption: a new institutional sociology perspective", *Social Responsibility Journal*, Vol. 7 No. 4, pp. 540–557.

Jones, K.T. and Chen, C.C. (2008), "Blended-learning in a graduate accounting course: Student satisfaction and course design", *The Accounting Educators' Journal*, Vol. 18, pp. 15–28.

Khan, T. (2013), "Sustainability accounting courses, Talloires Declaration and academic research", *International Journal of Sustainability in Higher Education*, Vol. 14 No. 1, pp. 42–55.

Kidwell, L.A., Fisher, D.G., Braun, R.L. and Swanson, D.L. (2013), "Developing learning objectives for accounting ethics using Bloom's taxonomy", *Accounting Education*, Vol. 22 No. 1, pp. 44–65.

Kimmel, P. (1995), "A framework for incorporating critical thinking into accounting education", *Journal of Accounting Education*, Vol. 13 No. 3, pp. 299–318.

Kintu, M.J., Zhu, C. and Kagambe, E. (2017), "Blended learning effectiveness: the relationship between student characteristics, design features and outcomes", *International Journal of Educational Technology in Higher Education*, Vol. 14 No. 1, pp. 1–20.

Koh, M.Y. and Koh, H.C. (1999), "The determinants of performance in an accountancy degree programme", *Accounting Education*, Vol. 8 No. 1, pp. 13–29.

Krasodomska, J. and Godawska, J. (2021), "E-learning in accounting education: the influence of students' characteristics on their engagement and performance", *Accounting Education*, Vol. 30 No. 1, pp. 22–41.

Kreber, C. (2001), "Learning experientially through case studies? A conceptual analysis", *Teaching in Higher Education*, Vol. 6 No. 2, pp. 217–228.

Libby, P.A. (1991), "Barriers to using cases in accounting education. Issues in Accounting Education", Vol. 6 No. 2, pp. 193–213.

Licorish, S.A., Owen, H.E., Daniel, B. and George, J.L. (2018), "Students' perception of Kahoot!'s influence on teaching and learning", *Research and Practice in Technology Enhanced Learning*, Vol. 13 No. 9, pp. 1–23.

Liu, T. and Zainuddin, S. (2021), "Extrinsic and intrinsic motivation towards the online component of blended learning in accounting education: evidence from a Malaysian public university", *Quality Assurance in Education*, Vol. 29 No. 2/3, pp. 293–310.

Malan, M. (2020), "Engaging students in a fully online accounting degree: an action research study", *Accounting Education*, Vol. 29 No. 4, pp. 321–339.

Martin, N.A. and Martin, R. (2015), "Would you watch It? Creating effective and engaging video tutorials", *Journal of Library & Information Services in Distance Learning*, Vol. 9 1-2, pp. 40–56.

Marx, B. and van der Watt, A. (2013), "Sustainability in accounting education: An analysis of the teaching thereof at accredited South African universities", *South African Journal of Accounting Research*, Vol. 27 No. 1, pp. 59–86.

Milne, M.J. and McConnell, P.J. (2001), "Problem-based learning: a pedagogy for using case material in accounting education", *Accounting Education*, Vol. 10 No. 1, pp. 61–82.

Naz, F. and Murad, H.S. (2017), "Innovative teaching has a positive impact on the performance of diverse Students", *SAGE Open*, Vol. 7 No. 4, 215824401773402.

O'Reilly, M. and Parker, N. (2013), "'Unsatisfactory Saturation': a critical exploration of the notion of saturated sample sizes in qualitative research", *Qualitative Research*, Vol. 13 No. 2, pp. 190–197.

OECD (2016), *Innovating Education and Educating for Innovation: The Power of Digital Technologies and Skills*, OECD Publishing, Paris.

Olalekan, I.O. and Jumoke, O.O. (2017), "Identifying barriers to environmental management accounting practices: a comparative study of Nigeria and South Africa", *The Business and Management Review*, Vol. 9 No. 1, pp. 168–179.

Osgerby, J. (2013), "Students' perceptions of the introduction of a blended learning environment: an exploratory case study", *Accounting Education*, Vol. 22 No. 1, pp. 85–99.

Paechter, M., Maier, B. and Macher, D. (2010), "Students' expectations of, and experiences in e-learning: their relation to learning achievements and course satisfaction", *Computers & Education*, Vol. 54 No. 1, pp. 222–229.

Parsons, S., Davidowitz, B. and Maughan, P. (2020), "Developing professional competence in accounting graduates: An action research study", *South African Journal of Accounting Research*, Vol. 34 No. 2, pp. 161–181.

Prado, A.M., Arce, R., Lopez, L.E., García, J. and Pearson, A.A. (2020), "Simulations versus case studies: Effectively teaching the premises of sustainable development in the classroom", *Journal of Business Ethics*, Vol. 161 No. 2, pp. 303–327.

Prinsloo, P. and van Rooyen, A.A. (2007), "Exploring a blended learning approach to improving student success in the teaching of second year accounting", *Meditari Accountancy Research*, Vol. 15 No. 1, pp. 51–69.

Raschke, R.L. and Charron, K.F. (2021), "Review of data analytic teaching cases, have we covered enough?", *Journal of Emerging Technologies in Accounting*, Vol. 18 No. 2, pp. 247–255.

Rebele, J.E. and St. Pierre, E.K. (2019), "A commentary on learning objectives for accounting education programs: The importance of soft skills and technical knowledge", *Journal of Accounting Education*, Vol. 48, pp. 71–79.

Redmond, P., Heffernan, A., Abawi, L., Brown, A. and Henderson, R. (2018), "An Online Engagement Framework for Higher Education", *Online Learning*, Vol. 22 No. 1, pp. 183–204.

Reinstein, A. and Bayou, M.E. (1997), "Critical thinking in accounting education: processes, skills and applications", *Managerial Auditing Journal*, Vol. 12 No. 7, pp. 336–342.

Russo, A., Warren, L., Neri, L., Herdan, A. and Brickman, K. (2021), "Enhancing accounting and finance students' awareness of transferable skills in an integrated blended learning environment", *Accounting Education*, pp. 1–25.

Sahu, A.K., Padhy, R.K., Das, D. and Gautam, A. (2021), "Improving financial and environmental performance through MFCA: A SME case study", *Journal of Cleaner Production*, Vol. 279, p. 123751.

Sangster, A., Stoner, G. and Flood, B. (2020), "Insights into accounting education in a COVID-19 world", *Accounting Education*, Vol. 29 No. 5, pp. 431–562.

Saravanamuthu, K. (2015), "Instilling a sustainability ethos in accounting education through the Transformative Learning pedagogy: A case-study", *Crititcal Perspectives on Accounting*, Vol. 32, pp. 1–36.

Schiano, B. and Andersen, E. (2017), "Teaching with Cases Online", available at: https://s3.amazonaws.com/he-product-images/docs/Article_Teaching_With_Cases_Online.pdf (accessed 15 May 2021).

Sharma, U. and Kelly, M. (2014), "Students' perceptions of education for sustainable development in the accounting and business curriculum at a business school in New Zealand", *Meditari Accountancy Research*, Vol. 22 No. 2, pp. 130–148.

Shephard, K. (2008), "Higher education for sustainability: seeking affective learning outcomes", *International Journal of Sustainability in Higher Education*, Vol. 9 No. 1, pp. 87–98.

Smith, G. (2012), "Designing and instructing managerial and cost accounting courses consisting of students in a combined classroom and online environment", *The Journal of International Management Studies*, Vol. 7 No. 1, pp. 70–79.

Spraakman, G., O'Grady, W., Askarany, D. and Akroyd, C. (2015), "Employers' perceptions of information technology competency requirements for management accounting graduates", *Accounting Education*, Vol. 24 No. 5, pp. 403–422.

Stewart, J.P. and Dougherty, T.W. (1993), "Using case studies in teaching accounting: a quasi-experimental study", *Accounting Education*, Vol. 2 No. 1, pp. 1–10.

Suwardy, T., Pan, G. and Seow, P.-S. (2013), "Using digital storytelling to engage student learning", *Accounting Education*, Vol. 22 No. 2, pp. 109–124.

Thomson, I. and Bebbington, J. (2004), "It doesn't matter what you teach?", *Critical Perspectives on Accounting*, Vol. 15, pp. 609–628.

Tran, T.T. and Herzig, C. (2022), "Improving decision-making through Material Flow Cost Accounting: the case of VietGreen bottled mineral water company", *International Food and Agribusiness Management Review*, Vol. 25 No. 1, 37-48.

Villiers, R. de (2010), "The incorporation of soft skills into accounting curricula: preparing accounting graduates for their unpredictable futures", *Meditari Accountancy Research*, Vol. 18 No. 2, pp. 1–22.

Wang, A.I. and Tahir, R. (2020), "The effect of using Kahoot! for learning – A literature review", *Computers & Education*, Vol. 149, p. 103818.

Watty, K., McKay, J. and Ngo, L. (2016), "Innovators or inhibitors? Accounting faculty resistance to new educational technologies in higher education", *Journal of Accounting Education*, Vol. 36, pp. 1–15.

Webb, J. and Chaffer, C. (2016), "The expectation performance gap in accounting education: a review of generic skills development in UK accounting degrees", *Accounting Education*, Vol. 25 No. 4, pp. 349–367.

WECD (1987), *Our Common Future: Report of the World Commission on Environment and Development*, United Nations, New York.

Weil, S., McGuigan, N. and Kern, T. (2011), "The usage of an online discussion forum for the facilitation of case-based learning in an intermediate accounting course: a New Zealand case", *Open Learning*, Vol. 26 No. 3, pp. 237–251.

Weil, S., Oyelere, P. and Rainsbury, E. (2004), "The usefulness of case studies in developing core competencies in a professional accounting programme: a New Zealand study", *Accounting Education*, Vol. 13 No. 2, pp. 139–169.

Weil, S., Silva, T.-A. de and Ward, M. (2014), "Blended learning in accounting: a New Zealand case", *Meditari Accountancy Research*, Vol. 22 No. 2, pp. 224–244.

Wolcott, S.K. and Sargent, M.J. (2021), "Critical thinking in accounting education: status and call to action", *Journal of Accounting Education*, Vol. 56, p. 100731.

Wong, A., George, S. and Tanima, F.A. (2021), "Operationalising dialogic accounting education through praxis and social and environmental accounting: exploring student perspectives", *Accounting Education*, Vol. 30 No. 5, pp. 1–26.

Wynder, M., Wellner, K.-U. and Reinhard, K. (2013), "Rhetoric or Reality? Do accounting education and experience increase weighting on environmental performance in a balanced scorecard?", *Accounting Education*, Vol. 22 No. 4, pp. 366–381.

Wyness, L. and Dalton, F. (2018), "The value of problem-based learning in learning for sustainability: undergraduate accounting student perspectives", *Journal of Accounting Education*, Vol. 45, pp. 1–19.

Wynn-Williams, K., Whiting, R.H. and Adler, R.W. (2008), "The influence of business case studies on learning styles: An empirical investigation", *Accounting Education*, Vol. 17 No. 2, pp. 113–128.

Yin, R.K. (2009), *Case Study Research: Design and Methods,* fourth ed, Sage Publications, Thousand Oaks, CA.