



**THE DIFFUSION OF MATERIAL FLOW COST
ACCOUNTING (MFCA) IN A SMALL AND MEDIUM-
SIZED ENTERPRISE (SME) AUTOMOTIVE VENDOR
IN MALAYSIA**

BY

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ABSTRACT

Material Flow Cost Accounting (MFCA) has attracted growing interest particularly after its ISO 14051 issuance in September 2011. Its evident simultaneous achievement of environmental and economic goals had also appealed to Malaysia through a pilot project with five model SMEs, coordinated by Malaysia Productivity Corporation (MPC). The significant presence of SMEs in Malaysia of 97%, their commonly-held traditionalist views, and their potential to adversely affect the natural environment has stimulated a need to obtain deeper understanding of the MFCA case. Employing a qualitative inquiry, this explanatory case study sought to explain the drivers and innovation-diffusion process of MFCA within the context of one of the model companies, Alpha, an SME automotive vendor. Principally framed by the diffusion of innovation (DOI) theory and supplemented by new institutional sociology (NIS), the study covered periods both during and after the project, and found that Alpha continued its MFCA activities, extending it to several other areas. MFCA in Alpha went through a pseudo-reinvention and was eventually routinised as part of Alpha's continuous improvement activities. Primarily driven towards MFCA by competitive isomorphism to meet cost reduction and competitive pricing criteria, an environment-driven criterion was only secondary for Alpha. Furthermore, institutional pressures were also found in terms of indirect coercive and normative isomorphism from MPC. Various enablers and barriers also contributed to the routinisation of MFCA in Alpha. These include innovation attributes of MFCA, data availability and unavailability, communication via change agencies and champions, team composition, ineffective performance measurement system (PMS) and inadequate human resource training. The study largely contributes to addressing environmental issues by providing insights to potential adopters among SMEs which are in similar contexts to Alpha, and insights to potential change agencies of MFCA. In particular, it provides further evidence to support the revisionist view that performing environmental initiatives can improve economic performance. The study also enriches the literature on MFCA and sustainability management in SMEs with its theoretically-informed empirical research covering both pre- and post-intervention periods. Finally, it also adds value to diffusion research by combining both DOI and NIS of explanations on innovation motivation. The theoretical underpinning was able to explain the pseudo-reinvention and routinisation of MFCA in Alpha. This routinisation also provided insights related to design issues for future research and future MFCA communication programmes.

ملخص البحث

حظيت محاسبة تكلفة تدفق المواد على أهمية خاصة بعد إصدار معيار ISO 14051 في شهر سبتمبر من عام 2011. كما أن الإنجازات الواضحة للأهداف البيئية والاقتصادية ظهرت في ماليزيا من خلال مشروع تجريبي مع خمس شركات صغرى ومتوسطة الحجم، بالتنسيق مع شركة ماليزيا للإنتاج (MPC). وقد أدى الحضور المميز للمشاريع الصغيرة ومتوسطة الحجم في ماليزيا والذي يقدر بنسبة 97% ضمن أرائهم التقليدية الشائعة وقدرتهم على التأثير سلباً في بيئتنا الطبيعية قد خلق حاجة أكبر للحصول على فهم أوسع لمحاسبة تكلفة تدفق المواد (MFCA). سعت دراسة الحالة باستخدام أسلوب التحقق النوعي لتوضيح وشرح خطوات الابتكار لمحاسبة تكلفة تدفق المواد في ضوء مثال واحد من إحدى الشركات الأنموذجية والتي هي شركة (ألفا) والتي تعمل بوصفها مورداً لقطع السيارات. وقد تناولت الدراسة بشكل أساس نظرية نشر الابتكار (DOI) واستكملت من خلال علم الاجتماع المؤسسي الجديد (NIS). وقد شملت الدراسة فترة المشروع وما بعده. وقد خلصت الدراسة إلى أن (ألفا) كانت تواصل نشاطات محاسبة تكلفة تدفق المواد، وتوسعها لمناطق أخرى جديدة. حيث مرت محاسبة تكلفة تدفق المواد في (ألفا) بعملية إعادة تجديد فاشلة ولكن تم في نهاية المطاف جعلها بوصفها روتيناً وجزءاً من أنشطة التحسين المستمر لشركة ألفا. كانت المعايير الموجهة والقائمة على حماية البيئة شيئاً ثانوياً بالنسبة لشركة ألفا، مدعومة بشكل رئيس باتجاه محاسبة تكلفة تدفق المواد بسبب تشابه عملية التنافس لتلبية معايير تخفيض التكاليف ومعايير الأسعار التنافسية. وعلاوة على ذلك، فقد كانت هناك ضغوط مؤسسية أيضاً من حيث إكراه الغير المباشر وتمائل المعايير من محاسبة تكلفة تدفق المواد. وساهمت العوامل التمكينية والعوائق المختلفة أيضاً في جعل محاسبة تكلفة تدفق المواد عملية روتينية في شركة ألفا. وتشمل هذه العوامل صفات الابتكار لمحاسبة تكلفة تدفق المواد، توفر وعدم توفر البيانات، التواصل عبر العملاء والوكالات الكبرى، مسألة تكوين الفريق، نظام قياس الأداء غير الفعال، بالإضافة إلى عدم كفاية تدريب الموارد البشرية. ساهمت الدراسة في معالجة القضايا البيئية إلى حد كبير من خلال تقديم أفكار للجهات التي تنبئ الشركات والمشاريع الصغيرة والمتوسطة والتي هي ضمن سياق شركة ألفا، بالإضافة إلى تقديم وجهات نظر إلى الوكالات المحتملة التغيير وفق محاسبة تكلفة تدفق المواد. ويقدم البحث بشكل محدد دليلاً آخر لدعم الرأي القائل بأنه يمكن للمبادرات البيئية أن تحسن من الأداء الاقتصادي. كما ساهمت الدراسة في إثراء الأبحاث حول موضوع محاسبة تكلفة تدفق المواد والإدارة المستدامة في المؤسسات الصغرى ومتوسطة الحجم بوجود أبحاثها التجريبية والنظرية والتي تغطي فترات ما قبل التدخل وبعده. وأخيراً وبالإضافة إلى ماسبق، فإن البحث يضيف قيمة إلى البحوث الأخرى من خلال الدمج بين نظرية نشر الابتكار (DOI) وعلم الاجتماع المؤسسي الجديد (NIS) للحصول على تفسيرات حول وجود الدافع للابتكار. وقد كان الأساس النظري قادراً على شرح عملية إعادة التجديد الزائفة وكيف تم جعل محاسبة تكلفة تدفق المواد عملية روتينية في ألفا. يقدم هذا الروتين أفكاراً ذات صلة بمسائل إيجاد بحوث مستقبلية حول محاسبة وبرامج تكلفة تدفق المواد في المستقبل القريب.

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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TABLE OF CONTENTS

Abstract	ii
Abstract in Arabic.....	iii
Approval Page	iv
Declaration	v
Copyright Page.....	vi
Acknowledgements	vi
List of Tables.....	xi
List of Figures	xii
List of Abbreviations	xiv
CHAPTER ONE: INTRODUCTION	1
1.1 Introduction	1
1.2 Background and Research Problem	1
1.3 Purpose of Study and Research Questions	7
1.4 Theoretical Framework.....	8
1.5 Research Methodology.....	12
1.6 Contributions of the Study	15
1.7 Organisation of the Thesis.....	18
CHAPTER TWO: MATERIAL FLOW COST ACCOUNTING (MFCA).....	20
2.1 Introduction	20
2.2 Material Flow Cost Accounting (MFCA)	20
2.2.1 MFCA versus Conventional Cost Accounting.....	23
2.3 MFCA Development.....	28
2.4 MFCA, Environmental Costs (EC) and Environmental Management accounting (EMA)	33
2.4.1 Exposing the Underside of the Environmental Cost Iceberg	33
2.4.2 MFCA as an EMA Tool	35
2.5 Research in MFCA	44
2.5.1 Recent Growth in MFCA Literature and the Study	44
2.5.2 Current Status.....	45
2.5.3 MFCA Research Issues.....	47
2.6 Relevance of MFCA to SMEs in Malaysia	55
2.7 MFCA and the Theoretical Literature.....	63
2.7.1 Theories Used in EMA Research	65
2.7.2 Other Potential Theories	83
2.8 Summary	104
CHAPTER THREE: THE THEORETICAL FRAMEWORK	106
3.1 Introduction	106
3.2 The Intra-Organisation Innovation Process for MFCA Diffusion in Alpha	106
3.2.1 The Initiation Phase (Stages of Agenda-Setting, Matching and Decision)	113

3.2.2 The Implementation Phase (Stages of Redefining, Clarifying and Routinising).....	114
3.2.3 Enablers and Barriers throughout the Innovation Process.....	115
3.3 Isomorphic Pressures Driving the Adoption of MFCA	119
3.4 Summary	121
CHAPTER FOUR: RESEARCH METHODOLOGY	123
4.1 Introduction	123
4.2 Rationale for a Qualitative Inquiry	123
4.3 Research Design – Explanatory Case Study	127
4.3.1 Key Players and Company Selection	129
4.4 Data Collection and Data Analysis	132
4.4.1 Pilot Study and Main Study	133
4.4.2 Interviews.....	135
4.4.3 Documentary Sources and Informal Observations.....	141
4.4.4 Analysing the Data	141
4.5 Trustworthiness and Reflexivity	146
4.6 Summary	150
CHAPTER FIVE: MATERIAL FLOW COST ACCOUNTING (MFCA) IN ALPHA	151
5.1 Introduction	151
5.2 Alpha, an SME Vendor in the Automotive Industry in Malaysia	151
5.3 Alpha and MFCA – The Beginnings	155
5.3.1 Offer for MFCA Project Participation.....	155
5.3.2 Adoption of MFCA in Alpha during the MPC-MFCA Project.....	158
5.3.3 The Finale of the MPC-MFCA Project in Malaysia	168
5.4 Alpha and MFCA – The Progression.....	169
5.4.1 MFCA under Development Activities.....	172
5.4.2 MFCA under Improvement Activities.....	173
5.4.3 Different Perceptions Regarding MFCA in Alpha.....	181
5.4.4 The Roles of Non-Company Members after the MPC-MFCA Project.....	183
5.5 Summary	186
CHAPTER SIX: THE INNOVATION DIFFUSION PROCESS OF MFCA IN ALPHA	187
6.1 Introduction	187
6.2 The Intra-Organisation Innovation Process in Alpha	188
6.3 MFCA Initiation Phase in Alpha	190
6.4 Isomorphic Pressures Motivating Alpha to Adopt MFCA.....	193
6.5 MFCA Implementation Phase in Alpha.....	203
6.5.1 Redefining Stage	204
6.5.2 Clarifying Stage.....	209
6.5.3 Routinising Stage	217
6.6 Enablers For the Routinisation of MFCA	218
6.6.1 Innovation Attributes	218
6.6.2 Communication Channels and Change Agency Efforts	223

6.6.3 Nature of Social System	229
6.6.4 Type of Innovation-Decision	231
6.7 Barriers Against the Routinisation of MFCA.....	232
6.7.1 Data Unavailability (Innovation Attribute – Compatibility)	233
6.7.2 Inadequate Training and Knowledge Management System (Communication)	234
6.7.3 Ineffective Performance Measurement System (PMS) (Nature of Social System)	238
6.7.4 Vendor Constraints (Nature of Social System).....	243
6.7.5 Barriers Related to Social Construction	244
6.8 Summary	250

CHAPTER SEVEN: CONCLUSION, CONTRIBUTIONS AND FUTURE

RESEARCH.....	252
7.1 Introduction	252
7.2 Summary of the Study and its Main Findings	252
7.3 Research Contributions	255
7.4 Limitations and Suggestions for Future Research	268
7.5 The Adjournment.....	272

REFERENCES	274
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LIST OF PUBLICATIONS.....	289
----------------------------------	------------

APPENDIX I LINKING RESEARCH QUESTIONS AND DATA SOURCES	290
APPENDIX II JOURNAL PUBLICATION OF MFCA PILOT STUDY	293
APPENDIX III SUMMARISED THEMES FOR INTERVIEW GUIDE AND CATEGORIES FOR INTERVIEW CUE CARDS	295
APPENDIX IV LIST OF INTERVIEW SESSIONS	298
APPENDIX V LIST OF DOCUMENTS AND INFORMAL OBSERVATIONS	302

LIST OF TABLES

Table 2.1	Integrative framework of EMA (<i>numbering added by researcher</i>)	41
Table 2.2	MFCA Framework for Decision-making	43
Table 2.3	A Natural Resource Based View Conceptual Framework	87
Table 2.4	A Natural Resource Based View (NRBV): Fifteen Years After	88
Table 5.1	Technical visits for overall project in general	161
Table 5.2	Technical visits attended by Alpha	162

LIST OF FIGURES

Figure 1.1	Transparent and Hidden Environmental Costs Related to Waste Flows	4
Figure 1.2	<i>Intra</i> -Organisation Innovation Process for MFCA Diffusion in Alpha	10
Figure 2.1	Basic Concept of MFCA	21
Figure 2.2	Material Balance Concept	22
Figure 2.3	Material Flow Model Example	23
Figure 2.4	Conventional Cost Accounting Example	24
Figure 2.5	MFCA Cost Calculation	25
Figure 2.6	Transparent and Hidden Costs Related to Waste Flows	34
Figure 2.7	MFCA's Position in Relation to Sustainability	35
Figure 2.8	Traditionalist View	72
Figure 2.9	Revisionist View	72
Figure 2.10	Synthesis of Traditionalist and Revisionist View	73
Figure 2.11	Barney's (1991) Framework for the Resource Based View (RBV) Interrelationships	85
Figure 2.12	Askarany's (2003) General Model of Influencing Factors and Diffusion Process	92
Figure 3.1	MFCA Adopters in Malaysia through MPC Consultation	107
Figure 3.2	<i>Inter</i> -Organisation Innovation-Decision Process (Reproduced from Rogers, 2003)	108
Figure 3.3	<i>Intra</i> -Organisation Innovation Process for MFCA Diffusion in Alpha	110
Figure 3.4	Five Stage Innovation Process in an Organisation (Reproduced from Rogers, 2003, p. 356)	112
Figure 3.5	Model for Rate of Adoption	116
Figure 4.1	Alpha Organisation Chart as at December 2014	137

Figure 4.2	Steps in Analyses Employing Thematic Networks (Reproduced from Attride-Stirling, 2001)	142
Figure 5.1	General Material Flow Model of Alpha's Small Press Stamping process	165
Figure 5.2	Material Flow for Product A before Improvement Activity	167
Figure 5.3	Material Flow for Product A after Improvement Activity	167
Figure 5.4	Summary of material analysis calculation for Product A	167
Figure 5.5	Reduction in Material Loss Percentage for Product A	168
Figure 6.1	The Intra-Organisation Innovation Process Model for Alpha (Reproduced from Chapter Three)	188
Figure 6.2	Innovation Communication Flow via Change Agent and Champion	224

LIST OF ABBREVIATIONS

ABC	Activity-Based-Costing
ACCA	Association of Chartered Certified Accountants
AFTA	Asean Trade Free Agreement
AGV	Automated Guided Vehicles
ANT	Actor-Network-Theory
APO	Asian Productivity Organization
BAU	Business As Usual
BoP	Base of the Pyramid
CBDO	Chief Business Development Officer
COO	Chief Operations Officer
CSRn	Corporate Social Responsibility
CSRp	Corporate Social Reporting
DOE	Department of Environment (Malaysia)
DOI	Diffusion of Innovations
DOS	Department of Statistics (Malaysia)
EA	Environmental Accounting
EC	Environmental Costs
ECA	Environmental Cost Accounting
EEV	Energy Efficient Vehicles
EFA	Environmental Financial Accounting
EMA	Environmental Management Accounting
EMAN	Environmental and Sustainability Management Accounting Network
EMS	Environmental Management System
ENA	Environmental National Accounting
EPU	Economic Planning Unit (Malaysia)
EQR	Environmental Quality Report
ERP	Enterprise Resource Planning
FC	Financial Controller
FCA	Full Cost Accounting
GM	General Manager
GM R&D	General Manager of Research and Development
GP	Green Productivity
HOD	Head Of Department
HOD HR	Head Of Department of Human Resources
IDP	Innovation-Decision Process
IFAC	The International Federation of Accountants
IMP3	Third Industrial Master Plan
ISO	International Organization of Standardization
JCP	<i>Journal of Cleaner Production</i>
JPC	Japan Productivity Center
KeTTHA	Ministry of Energy, Green Technology and Water (Malaysia)
KPI	Key Performance Indicators
LPS	Lean Production System
LSS	Lean Six Sigma
MA	Management Accounting

MAA	Malaysian Automotive Association
MAI	Malaysia Automotive Institute
MAJAICO	Malaysia-Japan Automotive Industry Cooperation
MAS	Management Accounting Systems
MaSRA	Malaysia Sustainability Reporting Awards
MCS	Material Cost Savings
MCSP	Member Country Support Program
MD	Managing Director
MEMA	Monetary Environmental Management Accounting
METI	Ministry of Economy, Trade and Industry (Japan)
MFCA	Material Flow Cost Accounting
MITI	Ministry of International Trade and Industry (Malaysia)
MOSTI	Ministry of Science, Technology and Innovation (Malaysia)
MOU	Memorandum of Understanding
MPC	Malaysia Productivity Corporation
MPC-MFCA	MPC-MFCA Project with 5 Pilot Companies
NAP	National Automotive Policy
NIE	New Institutional Economics
NIS	New Institutional Sociology
NRA	Natural Resource Accounting
NRBV	Natural Resource Based View
NRE	Ministry of Natural Resources and Environment (Malaysia)
OC	Organisational Controls
OIE	Old Institutional Economics
PDCA	Plan, Do, Check and Act
PEMA	Physical Environmental Management Accounting
PMS	Performance Measurement System
PPC	Production, Planning and Control
QDA	Qualitative Data Analysis
QNC	Quantity Centres
RBV	Resource Based View
RMK	Rancangan Malaysia Ke-
SA	Sustainability Accounting
SD	Sustainable Development
SHE	Safety, Health and Environment
SILC	Social Issue Life Cycle
SME	Small and Medium-sized Enterprise
SMP	Small and Medium Practices
SOP	Standard Operating Procedure
TEFMA	Tertiary Education Facilities Management Association (Australia)
TIV	Total Industry Volume
TQM	Total Quality Management
UNSD	United Nations Division for Sustainable Development
VRIN	Valuable, Rare, Imperfectly imitable and Non-substitutable

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

This chapter discusses the background of the study and research problem, objectives and questions. It also briefly describes the theoretical framework, research methodology and contributions of the study. It begins with the background of the study leading to the research problem, followed by the purpose of the study and research questions. Following that are brief explanations of the theoretical framework used and research methodology employed. The chapter ends with the major contributions of this study to academia and to practice.

1.2 BACKGROUND AND RESEARCH PROBLEM

Where environmental initiatives are concerned, the view that they are related to reduced profits is typically held in the business community in Malaysia, particularly in small and medium-sized enterprises (SMEs). Wagner et al. (2001) call this the traditionalist view. This view is apparent from studies on Malaysian SMEs in which it was found that cost reduction programmes have been prioritised over environmental activities (Wooi & Zailani, 2010). Malaysia-owned companies show lower participation in green supply chain initiatives compared to MNCs (Eltayeb & Zailani, 2009), and environmental awareness of companies for green products and processes in Malaysia is still in its infancy stage (Yacob & Moorthy, 2012). Given Malaysia's deteriorating environmental quality (DOE, 2010, 2011, 2012, 2013, 2015), compounded by the fact that SMEs comprise 97.3% of total business establishments in Malaysia (DOS, 2011), collectively their impact on the environment may be strong. This is reinforced by a study in Europe

reporting that 64% of total European industrial pollution is contributed by its SMEs (Constantinos et al., 2010). Although a similar study in the Malaysian context is not yet available in published literature, the situation for Malaysia may be very similar if not worse since SMEs in developing countries appear to have lesser awareness of environmental impacts (Hillary, 2000). As such, evidence is needed to help shift the traditionalist mindset of SMEs in Malaysia, and this can clearly play a significant role towards sustaining our natural environment.

The most recent environmental quality report (EQR) produced by Malaysia's Department of Environment (DOE) shows that there was an overall increase in air pollutant emissions, water pollution and scheduled waste (DOE, 2013). More specifically on waste, total scheduled waste in 2013 was 2.96 million metric tonnes compared to 2.85 million metric tonnes in 2012 (DOE, 2013). These figures clearly show that there is an increasing volume of scheduled waste generated by industries. To address environmental issues, the government in its Tenth and Eleventh Malaysian Plans (RMK10 and RMK11) and its annual budgets have continuously demonstrated its commitment to ensure the sustainability of environmental resources (EPU, 2010, 2015). For example, this commitment is evident from one of its ten main premises in the Tenth Malaysian Plan: "Valuing our environmental endowments" (EPU, 2010, p. 26). This is then continued in the Eleventh Malaysian Plan, with one of its strategic thrusts being "Pursuing green growth for sustainability and resilience" (EPU, 2015, pp. 6-1). Bringing it closer to MFCA, the government's commitment on sustainable development is reflected, for instance, by adopting the green productivity concept introduced by APO (Asian Productivity Organization). This adoption is made by Malaysia through MPC. Furthermore, the Malaysian government continues to implement its national green technology policy, which is governed under the Ministry of Energy, Green Technology

and Water (KeTTHA). Essentially, the policy statement asserts that “green technology shall be a driver to accelerate the national economy and promote sustainable development” (KeTTHA, 2009, p. 5). Additionally, the focus moving towards greener production processes is also one of the Eleventh Malaysian Plan’s game changers, which aims to “embark on green growth to shift the paradigm of sustainability from a narrow focus on natural assets, to include consumption and production processes in all sectors and households” (EPU, 2015, pp. 1-8).

Considering the above efforts to meet environmental objectives of the country, there is a need to further encourage the business community to embark on environmental initiatives without perceiving that these will jeopardise their financial or economic position. Material flow cost accounting (MFCA), regarding which an ISO 14051 was issued in September 2011, is an environmental management accounting (EMA) tool that has the potential to change the traditionalist view towards environmental initiatives.

Traditionally, environmental costs have mostly been hidden under overhead expenditure (UNSD, 2001; Jasch, 2003, 2009; IFAC, 2005; Sulaiman and Nik Ahmad, 2006; GIZ, 2008). GIZ (2008) depicts it clearly through an iceberg diagram in Figure 1.1, where typically only the waste incineration costs are transparent to the management and the other related costs of waste are hidden in overheads. Consequently, as these costs are less transparent to the management, they are likely to be neither measured nor managed appropriately, leading to higher operating expenditure at the aggregate level.



Figure 1.1 Transparent and Hidden Environmental Costs Related to Waste Flows (GIZ, 2008)

Material flow cost accounting (MFCA) is an environmental management accounting (EMA) tool that specifically addresses hidden environmental costs. What MFCA does is in line with the famous quote by Peter Drucker, “What gets measured, gets managed”. Having its own international standard, ISO 14051 issued in September 2011, MFCA allows companies to focus on how waste should be managed by increasing the visibility of these hidden environmental costs (UNSD, 2001; Kokubu et al., 2009; Kokubu & Tachikawa, 2013). This is primarily achieved by identifying and calculating the costs attached to the waste (also referred to as material losses, negative products or non-product output). Further detail on the mechanism of MFCA is explained in Chapter Two.

In addition, MFCA is a tool that has the potential to shift the traditionalist view on environmental initiatives towards that of a revisionist one. A revisionist view sees

the relationship between environmental performance and economic performance as uniformly positive where high environmental performance corresponds to high economic performance (Wagner et al., 2001). In other words, environmental initiatives can potentially improve a company's bottom-line. From MFCA case examples, the portion of waste or material loss has usually been significant to the companies, if not alarmingly high (METI, 2011; MPC, 2013), with an average across all cases, of approximately 40% of the total product cost. As management's attention is drawn to these eye-catching, previously hidden costs, only then are they encouraged to initiate improvement activities to reduce the waste. Subsequently, as these activities are conducted, the cost savings are realised, profits are improved, and ultimately, environmental impact is reduced. This is the beauty of MFCA; where both environmental performance and profits are achieved simultaneously, even though the original intention is perhaps only to reduce costs. It is with this concurrent goal feature of MFCA that the business community, especially SMEs which have limited financial resources, is expected to be driven to use MFCA for managing their waste.

MFCA has its origins in Germany in the 1990s and then has been expanded by Japan since 2000. METI's MFCA case example book showcases a number of MFCA from various sectors including non-manufacturing (METI, 2011). The ISO 14051 itself also presents case examples as a guide to those interested (ISO, 2011). Literature on MFCA has shown that MFCA has also been implemented in countries such as Vietnam, the Philippines, South Africa, Greece, Czech Republic and Thailand (see Jasch, 2009; Hyslova et al., 2011; ISO, 2011; METI, 2011; Herzig et al., 2012; Papaspyropoulos et al., 2012; Fakoya and van der Poll, 2013; Chompu-inwai et al., 2015; Kasemset et al., 2015; Wagner, 2015). However, since MFCA is a relatively new tool for countries other

than Germany and Japan, there is a need for additional empirical studies published in English to further expand MFCA literature and research globally.

MFCA was introduced to Malaysia in 2010 to five pilot companies under a Member Country Support Program (MCSP) jointly organised by Asian Productivity Organisation (APO), Japan Productivity Center (JPC) and Malaysia Productivity Corporation (MPC). The objective of this program was mainly to introduce MFCA to the five companies, and MPC was appointed as the secretariat for this MCSP in Malaysia. Thus, the program shall be referred to as the MPC-MFCA project hereafter. The project duration was from September 2010 until March 2012. The outcomes were very favourable, resulting in significant cost savings and waste reduction for all five companies. A final seminar on 7th March 2012 revealed an aggregate cost savings of RM1.6 million. After the project term, the companies continued on their own and MPC was left with a responsibility to promote MFCA to other companies in Malaysia. Following the success stories of the five pilot companies, another 19 companies have been introduced to MFCA in consultation with MPC.

Based on all of the above, the activities of SMEs in Malaysia may have a profound impact on Malaysia's natural environment, but with evidence of MFCA practices and benefits, there is great potential for MFCA to contribute in addressing environmental issues in Malaysia, while at the same time increasing economic gains for these SME companies. As for academia, there is indeed space for learning and research on the Malaysian context of MFCA implementation, especially in the field of accounting. This is because most research studies for the Malaysian context are at their beginning stages since MFCA has only recently been introduced into Malaysia. Furthermore, as most MFCA research has been done mainly through action-based case studies or normative literature case studies (see Chompu-inwai et al., 2015; Hyrslova et

al., 2011; Kasemset et al., 2015; Kokubu & Kitada, 2014; METI, 2011; Nakajima, 2004, 2006). Christ and Burritt (2015, p. 1387) highlight, “thus far theoretically informed research is virtually non-existent within the MFCA literature” and highly recommends it for future research. Should this potential benefit from MFCA and recommended research be ignored, the existing traditionalist view of Malaysian SME business community may further deteriorate the natural environment. Therefore there is a need to study MFCA implemented within the context of Malaysia in greater depth to gain better understanding of its implementation, and provide further insights for future practice. Informed by a theoretical framework to help explain the MFCA phenomenon in greater depth, this study intends to provide this necessary understanding, by examining MFCA in the context of one of the pilot companies, Alpha, from the MPC-MFCA project.

1.3 PURPOSE OF STUDY AND RESEARCH QUESTIONS

In addressing the necessity for further research on MFCA in Malaysia, this study aims to explain the drivers and the innovation diffusion process of MFCA in the context of an SME automotive vendor in Malaysia. The main research questions are why MFCA is being adopted and how is MFCA being routinised within this context? More specifically, this study seeks answers to the following questions:

- 1) What isomorphic pressures have motivated the company to adopt MFCA as a sustainability management tool?
- 2) How has the intra-organisation innovation process framed the diffusion of MFCA in the company?
 - a) What are the phases of MFCA diffusion in the company?

- b) How have enablers and barriers brought about routinisation of MFCA to the company?

The research questions above were developed primarily based on the literature on MFCA, and in the areas of environmental management accounting (EMA), environmental accounting (EA), sustainability and general management. In addition, these questions were also compiled using literature on the association between SMEs and the natural environment. The research questions are theoretically-driven, with diffusion of innovations (DOI) as the main theoretical framework, supplemented by the isomorphism perspectives under new institutional sociology (NIS). The theoretical framework is briefly described next.

1.4 THEORETICAL FRAMEWORK

In the absence of a theoretically-informed study on MFCA (Christ & Burritt, 2015), the present study had to seek theories applied in EMA and EA studies, as well as from those outside of accounting, that matched the requirements of the research problem and research questions. These were eventually found in the diffusion of innovations (DOI) theory by Rogers (2003) and the new institutional sociology (NIS) strand of institutional theory, particularly on the isomorphism perspectives by DiMaggio and Powell (1983) and Hannan and Freeman (1977). These theories were used to frame the whole study from the development of research questions, to constructing interview questions and finally to the analysis and discussion of the findings towards a further contribution to the field of knowledge.

DOI theory covers a broad range of research areas. For this study, two models within DOI theory were applied, forming the overall theoretical framework for the study. First, Rogers' (2003) *intra*-organisation innovation process model was adapted

to Alpha's context to explain the innovation processes *within* Alpha. The second is Rogers' (2003) model of variables influencing the rate of adoption to help explain the enablers and barriers permeating the whole innovation process in Alpha. The original forms of these two models are presented and explained further in Chapter Three. The adaptation of these models to the context of Alpha and the MPC-MFCA project is built into the following theoretical framework, Figure 1.2 which is employed in this study.