NEGOTIATING THE MULTI-NATIONAL SUSTAINABLE FOOD SUPPLY CHAIN: A CONCEPTUAL ROADMAP

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ABSTRACT

As global wealth and prosperity shifts, Food Chief Supply Chain Officers (CSCO) and Chief Sustainability officers (CSO) must become even closer global partners in order to survive. For instance, according the World Health Organization (WHO) estimated that at least three million lives are lost annually due to carbon emission. Several known sources including utility plants, organic food matter, and other industrial supply chain (combustion engines) sources. This life expectancy number creates a sense of urgency for growing multi-national food companies (MNFCs). The implications are clear, failure to develop and implement effective supply chain CO 2 strategies in the Paris Climate Agreement and China Carbon Trading era could lead to further humans, animals, and businesses losses. In contrast, MNFCs must grow in developing markets or face a difficult future.

This research study offers an innovative MNFC sustainable supply roadmap and technology innovations to address future sales growth and lower greenhouse gas emissions. First, this paper engages leading international subject matter experts (SME) whom influence the world's largest multi-national food companies. The paper's SME's provide a high-level Food MNCs Supply Chain roadmap. Second, this paper reveals emerging MNFC technologies which could help fill two (new product development and strategic sourcing) of six global food sustainable supply chain research gaps suggested by this research paper's SME's. MNFC gaps such as blockchain, machine learning and internet of things (IoT) are integrated into this paper's findings and MNFC sustainable supply chain conceptual roadmap. Although this paper is narrowly focused on the global food exporters yet many aspects of this paper apply to many global consumer products companies. Collectively this paper could to useful to researchers, government and industry leaders.

Keywords: Sustainable Supply Chain, Food Supply Chain, Block Chain, Machine Learning, Internet of Things (IoT), Smart Contracts

1. Introduction

As global populations surpass eight billion citizens multi-national food companies must address two opposing forces; grow sales revenues and meet consumer demands for lower greenhouse gas emissions. The roles of Industry 4.0 technologies and digital innovation could enable and accelerate crucial business growth (Shankar & Hanson, 2013) and lower supply chain emissions Samuri & Rahim (2018). As multi-national sustainable food supply chains evolve humans (consumers), livestock, and food sources are at continued risk (Diehl & Spinler, 2013). Given this landscape, this paper offers a conceptional sustainable supply chain roadmap to help multi-national food companies (MNFC) reduce their impact on the environment and continue their growth path.

This research is focused on transforming the sustainability topic from a regulatory risk and environmental compliance subject matter to a business growth directive. While this study focused on the niche food sustainable supply chain industry, many aspects of this body of knowledge apply across various manufacturing companies seeking a new business growth roadmap focused on business growth and lower greenhouse gas (GHG) emissions.

1.1 Background & Rationale

Today's business climate creates an opportunity to link two sustainable food supply chain challenges; (greenhouse gas emissions) with often a hidden MNFC obstacle, addressing MNFC activist investor (supply chain innovation funding) growth mandate.

Challenge Number One – According to Choi and Ng (2011), consumer life expectancy and mortality rates are key factors in future business growth for MNFCs. The World Health Organization (WHO) estimated that at least three million lives are lost annually due to greenhouse gas emissions from known supply chain sources including utility plants, MNFC logistics operations (combustion engines) as well as food organic matter (WHO, 2014a). This startling life expectancy statistic creates significant sustainability and business growth concerns for MNFC in emerging markets. A new MNFC sustainable supply chain must address consumers demand for future lower GHG emissions.

Challenge Number Two - Global activists, investors or shareholders such as Carl Icahn of Icahn Enterprises have yielded tremendous influence with the board of directors, bond investors, and senior executives (Goranova & Ryan, 2013) across the food industry. In the past, MNFC CEOs tasked senior executives to balance sales revenues, operational costs and profits. Today, numerous MNFCs have successfully mitigated greenhouse gas emissions into daily operations. For nearly 20 years, the financial sector has scored and reported the most effective sustainable MNFCs utilizing the annual Corporate Sustainability Assessment (CSA) report (Durand, Paugam, Stolowy, 2019). MNFCs could meet activist investor requirements by building on existing frameworks and constructing a roadmap focused on growth and lower GHG emissions.

1.2 Research Context

This paper examines 75 leading MNFCs sustainable supply chain empirical evidence (innovations) and constructs a MNFC roadmap (phased approach) which could lower future greenhouse gas (GHG) emissions and enables future global business growth. Many researchers have attempted to solve the complex supply chain GHG emissions challenges with two common frameworks: (a) the product view (Seuring & Mueller, 2008) and (b) the operational view (Pagell & Wu, 2009). However, research emphasis is focused on two MNFC research themes (new product development and strategic sourcing) across three MNFC categories; nutrition, nutrition

and beverage, and tobacco and 21 countries (emerging and developed markets). Lastly, this study guided was by two research questions:
RQ1. Which sustainable supply chain practices most supports MNFC business growth and lower greenhouse gas emissions?
RQ2. Which sustainable supply chain Industry 4.0 technologies most supports MNFC business growth and lower greenhouse gas emissions?

2. Literature Review

2.1 Background

This paper's literature review followed a four-step, sequential literature review process. The first step in the four-step literature search process was an exploratory search. An exploratory search began with identifying initial key words, databases and sources. Researchers Schlagenhaufer and Amberg (2015) described the second step, descriptive literature review, which identifies the potential gaps in the literature, classifying material, and creating linkages across the literature (Lyman-Hager, 2000). The third step in this study's literature review process was explanatory; sustainable supply chain researcher, Seuring (4,005 citations), characterized "explanatory" as refining research questions and seeking to understand patterns and trends. The last step in this study's literature review process is titled predictive. According to Pagell & Wu (2009) supply chain researchers may replicate this step by categorizing the literature, organizing it by research themes, and creating new theories (roadmaps).

2.2 Product Framework Overview. In 2008, Seuring and Mueller published one of the most comprehensive sustainable supply chain management papers to date (Seuring & Mueller, 2008). The authors reviewed more than 191 papers from 1994-2007, organizing their research into two segments: supply chain management products and supply chain management risk. Seuring and Mueller's exhaustive literature review was significant as it provides valuable sustainable supply chain insight from the 2000s until today.

2.3 Product Framework Gaps. Despite the consumer connection, Product Framework has two MNFC sustainable supply chain gaps (product development and engagement). The first, the new product time-to-market challenge (Palmié, Zeschky, Winterhalter, & Sauter, 2016). New product development takes months to years, an obvious disadvantage for competitive MNFC companies. Second, engaging consumers in today's digital marketplace requires a different approach in emerging markets. Homburg, Vollmayr, and Hahn (2014) affirmed that MNFCs must build brand trust before gaining market share in developing markets. Overcoming these challenges are important for business growth, optimizing supply chain resources, and reducing greenhouse gas emissions.

2.4 Operations Supply Chain Framework Overview. Another important sustainable supply chain research framework that influenced this study was the Pagell and Wu operations framework (2009). Pagell and Wu analyzed case studies to develop a sustainable supply chain that focused on the operational business improvement principles of lean and total quality management. The Pagell and Wu operations framework is an obvious pillar for an improved MNFC roadmap focused on business growth and lower GHG emissions.

2.5 Operations Supply Chain Framework Gaps. The operations framework has distant gaps (integration, and planning). Today's complex supply chain requires companies to adapt and react to consumer requirements quickly or risk losing market share and business growth opportunities (Goranova & Ryan, 2013). Phase One of Pagell & Wu's Operational Framework (integration) presents a challenge for MNFC companies because lean and total quality management initiatives are time consuming programs (Beer, 2003). In addition, the Pagell and Wu framework addresses supply chain execution yet does not address common supply or transportation research themes. A future MNFC sustainable supply chain must address the above themes.

3. Research Methodology

This paper's Delphi study engaged a panel of MNFC subject matter experts in a two round Delphi method near the Silicon Valley (US). In order to create a baseline rating, the researcher asked two interview questions during round one; corresponding numerical ratings are presented in this study findings. As discussed, round two's interview questions were intended to establish agreement among the panelists. Delphi study interview questions:

Round One:
1. Which sustainable supply chain practice most enables MNFC business growth?
2. Which sustainable supply chain practice most supports consumer demands for lower MNFC supply chain greenhouse gas emissions?

Round Two interview questions:
1. Which sustainable supply chain practice most enables MNFC business growth?
2. Which sustainable supply chain practice most supports consumer demands for lower MNFC supply chain greenhouse gas emissions?
3. Is business growth important to the MNFC company shareholder, stakeholder, and investors?
4. Regarding question three, if so, why. If not, why not.

3.1 Delphi Study Expert Population

This research's expert Delphi panelists included a Chief Sustainability Officer and three influential MNFC investment community executives with more than 15 years industry MNFC research experience. Global food company executive investment portfolios ranged from $100 million (USD) to $2 billion (USD) during this study.

3.2 Reliability & Validity

For the purposes of this research study, content, criterion, and construct validity were increased and risk was reduced by applying exploratory and explanatory research procedures. According to Guion, Diehl, and McDonald (2011), establishing stable and quality research data is important when creating reliability and validity in a qualitative study. Creswell (2014) argued that qualitative reliability is present when the researcher mirrors consistency of different investigators and projects. This study followed sustainable supply chain researchers such as Hsu, Lee, Kreng, (2010) who utilized case study and Delphi research in their studies. Khan (2014) maintained that qualitative validity is indicated when the researcher confirms findings by applying specific research procedures.

4. Research Findings

The study's objective is to construct a MNFC sustainable supply chain conceptual roadmap (overview) based on known gaps revealed in the study's literature review and MNFC subject matter experts. Findings are organized by research questions.

RQ1. This Delphi Study revealed four important trends (table 1) that could lead to lower greenhouse gas emissions as well as business growth. First, the expert panel strongly agreed that research and development and strategic sourcing themes are the most important execution priorities in a MNFC roadmap. Second, engaging consumers is the secondary research importance. Third, marketing and manufacturing management are third tier research status. Lastly, the logistics research theme is the least important theme in a future MNFC conceptual roadmap which lowers emissions and grows the business

Table 1: RQ1 Delphi Study Panelist Summary Findings

Which sustainable supply chain practice most enables MNFC business growth and lower greenhouse gas emissions?	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Mean
Marketing	2	2	2	2	2.0
Research & Development	1	1	1	1	1.0
Manufacturing	2	2	2	1	1.8
Strategic Sourcing	2	1	1	1	1.3
Logistics	3	3	3	3	3.0
Consumer Engagement	1	1	1	3	1.5

RQ2. This study's literature review revealed six Industry 4.0 sustainable supply chain technologies which could help grow sales and lower future GHG emissions. Table 2 reflects innovations (empirical evidence) which helps answers this paper's RQ2. MNFC Industry 4.0 technology revealed in this study are categorized by nutrition, nutrition & beverage, beverage, and tobacco.

Table 2: RQ2 Delphi Study Panelist Summary Findings

Research Theme	Subtheme	MNFC Category	MNFC Country	MNFC Innovation
Research & Development	New Product Development	Nutrition	US	Blogging/ML
Research & Development	Market Segmentation	Nutrition	US	Digital Journey/ML
Research & Development	Consumer Profiling	Nutrition	Canada	360-degree Portal/ML
Strategic Sourcing	Consumer Insights	Tobacco	US	Internet of Things
Strategic Sourcing	Transportation Planning	Beverage	Australia	Intelligent Vending/ML
Strategic Sourcing	Supply Planning	Beverage	Asia Pacific	Block Chain/ML

5. Conceptual Roadmap

5.1 Overview

This research contributed to the MNFC sustainable supply chain body of knowledge by constructing a roadmap which helps MNFCs lower future supply chain greenhouse gas emissions and grow sales revenues in developing markets. First this paper established a solid foundation by discussing existing sustainable supply chain benefits and limitations; product development, consumer engagement, supply chain integration and supply chain planning. Next, this study revealed two sustainable supply chain research gaps (research and development and strategic sourcing) across and nutrition, beverage, and tobacco (MNFC) industry subthemes and several

global economies. Lastly, as illustrated in Figure 1 this research creates a MNFC sustainable supply chain roadmap focused on business growth and lower greenhouse gas emissions.

5.2 Insights

This phased approach conceptual roadmap's (Bellwether Sustainable Supply Chain Business Growth Roadmap (BBGR) foundation includes Industry 4.0 MNFC empirical evidence (innovations) revealed during this paper's literature review. The BBGR is organized along two themes, six subthemes, six existing technology innovations and four potential implementation phases. Based on this research study's empirical evidence, the following MNFC innovations are strictly narrowly focused on future sales growth and lower GHG emissions; new product development, market segmentation, consumer profiling, transportation planning. Nutrition and beverage companies operating throughout Australia and United States. According the body of knowledge beverage and tobacco companies operating in the Asia-Pacific region as well as the United States have implemented consumer insight and supply planning innovations.

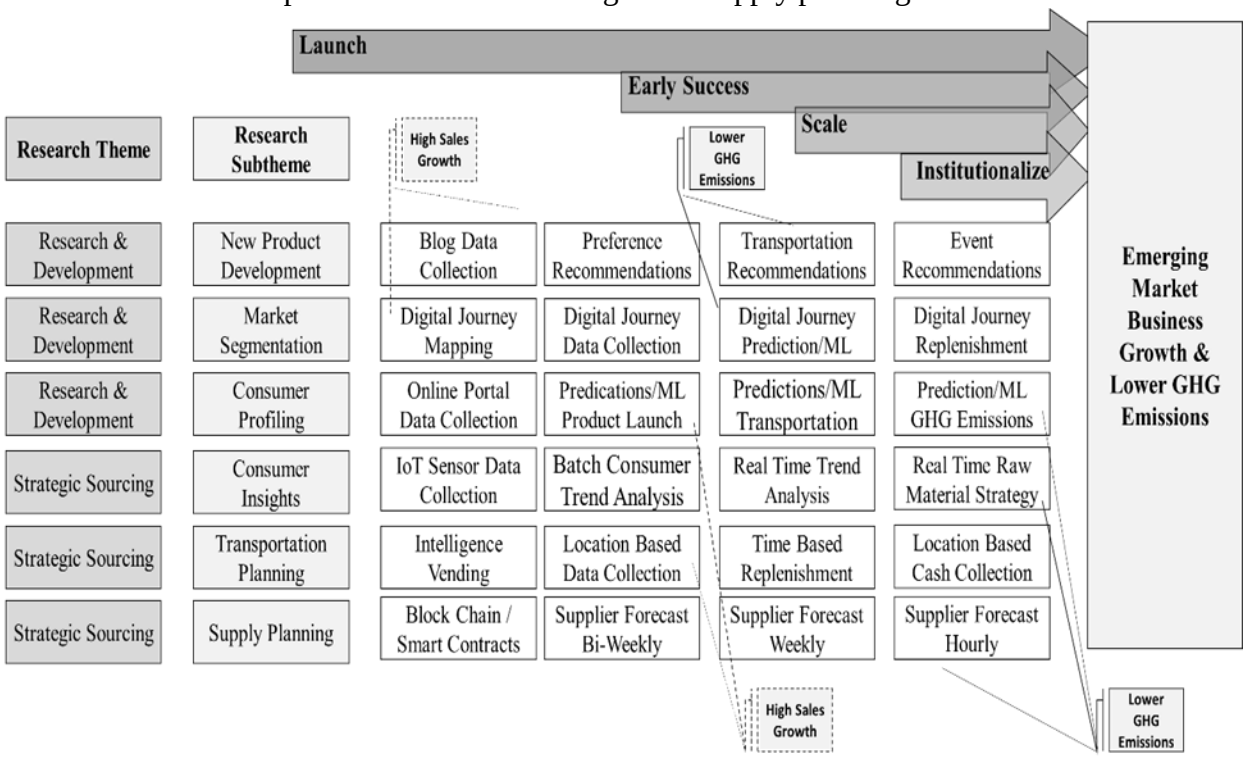

Figure 1. Bellwether Sustainable Supply Chain Business Growth Roadmap (BBGR)

6. Conclusion

This study expands the MNFC body of knowledge by constructing a sustainable supply chain roadmap by answering two research questions; RQ1, which sustainable supply chain practice most enables MNFC business growth and lower greenhouse gas emissions, and RQ2, which sustainable supply chain Industry 4.0 technologies most supports MNFC business growth and lower greenhouse gas emissions? This paper's data analysis builds on four existing MNFC sustainable supply chain gaps (product development, consumer engagement, supply chain integration and planning). Indirectly, this research contributes to the contemporary MNFC body of knowledge by addressing sustainable supply chain innovation funding obstacles which could

incumber global sustainable supply chain innovation. Lastly, this modern study's sustainable supply chain roadmap, once adopted, could help saves lives by reducing unplanned combustion engine (GHG emissions) and therefore air pollution related respiratory and cardiac disorders (WHO, 2014b).

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