

Article

Exploring Environmental Supply Chain Innovation in M&A

Pavan Manocha * and Jagjit Singh Srail

Department of Engineering, University of Cambridge, Cambridge CB3 0FS, UK; jss46@cam.ac.uk

* Correspondence: pm532@cam.ac.uk

Received: 1 November 2020; Accepted: 27 November 2020; Published: 3 December 2020



Abstract: Organisations are challenged with executing innovation for sustainable development within the context of their operations and value networks—networks which are increasingly fuelled by mergers and acquisitions (M&As), and which accounted for USD 4 trillion in global deal value in 2019. While outcomes from M&As may produce mixed results, merger synergies fundamentally change the environmental, social and governance (ESG) footprint of an organisation and its product-supply chain. These compounding challenges of innovation for sustainability and ESG product-supply chain due diligence are not adequately explored in the operations management literature or practically considered during M&As. In this article, we consider those factors that determine “how innovative is the deal?” and explore how environmental supply chain innovation for sustainability might inform M&As. A case study approach is adopted, drawing upon an exemplar deal within the global food product-supply chain for ingredient production, where high M&A deal-interest and ESG sustainability considerations exist. The theoretical lens is the resource-based view (RBV) of the firm. A deal analysis framework, integrating key concepts from strategic environmental supply chain management and the M&A process literature, is defined. These findings suggest that product design and technology selection factors represent sources of M&A value creation when exploring an innovation for sustainability deal thesis. The implication for firms with ambitious environmental agendas or motives is that the M&A process needs to be reconfigured, such that product design and technology selection, currently secondary factors, are considered primary drivers. Together, these drivers form substantive strategic considerations and new merger motives of both theoretical and practical relevance, informing a new perspective of operations sustainability targeted M&A.

Keywords: M&A; mergers and acquisitions; sustainable supply chain management; sustainability; operations management; operations

1. Introduction

At the United Nations (UN) Sustainable Development Summit on 25 September 2015, world leaders endorsed the 2030 Agenda for Sustainable Development. Two months later, at the Paris climate conference (COP21), 195 countries adopted the first-ever universal, legally binding global climate agreement. This agreement defines 17 inter-connected Sustainable Development Goals (SDGs) and 169 individual targets; the goals range from climate action to responsible consumption and production. SDG 12 specifically addresses the need to reduce our ecological footprint by changing the way we produce and consume goods.

Today, international organisations face the challenge of implementing this transformation to net-zero emissions within the context of their operations and value networks. Networks that are both linked at their most fundamental levels to issues such as water scarcity and air pollution [1], and increasingly fuelled by mergers and acquisitions (M&As), which in 2019 hit a record USD 4 trillion in deal value [2]. M&A continues to be a highly popular form of corporate development [3], as evidenced

in 2016 by Pfizer & Allergan in their attempted USD 148.57 billion pharmaceutical merger, Dell's USD 63.4 billion acquisition of EMC, Kraft & Heinz's USD 40 billion merger and Unilever's acquisition of eco-conscious brand Seventh Generation. Other sectors experiencing high M&A activity in 2018-19 were technology, energy and specialty chemicals.

While M&As may produce mixed results, they can fundamentally change the environmental, social and governance (ESG) footprint of an organisation and its product-supply chain. M&As may change activities that span across the supply chain, including material sourcing, manufacturing, distribution and delivery. Supply chain management under M&A continues to be widely studied as a source of operations synergy [4]. In fact, enhanced supply chain performance represents the greatest cost reduction benefits case, particularly in the context of horizontal mergers [5–7]. These compounding challenges of operations sustainability, particularly ESG performance during product-supply chain merger due diligence, are not adequately explored in the operations management literature or practically considered during the M&A process [8].

In this paper, we explore the relationship between environmental supply chain innovation for sustainability and M&As by considering the factors that determine “how innovative is the deal?” We make the argument that due diligence of environmental supply chain innovation capabilities for sustainability is an under-explored source of M&A value, and a substantive merger motive of both theoretical and practical relevance. Using the resource-based view (RBV) of the firm [9] as the theoretical lens, this complication was tested in an exploratory case study, using an analytical framework developed by integrating key concepts from strategic environmental supply chain management and the M&A process literature. It is within this context that the research question (RQ) was defined: how environmental supply chain innovation for sustainability might inform M&As?

This article is organized as follows. Section 2 defines the theoretical lens and arguments which link environmental supply chain management and the M&A execution-process to innovative leadership for sustainable development. Section 3 presents the research design, data collection and analysis framework. Section 4 presents the qualitative case study details and results. Section 5 presents an analysis of the findings. Section 6 describes the theoretical and practical implications and identifies a novel area for future sustainability transition research.

2. Theoretical Foundation

Firms which successfully identify and respond to opportunities in the natural environment may benefit from sustainable development and competitive gains [10]. Sustainable development is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [11]. Sustainable development, then, occurs at the intersection of three general principles: environmental integrity, social equity and economic development. The triple bottom line [12] is one of several theoretical lenses that have emerged to frame how environmentally orientated resources and capabilities might deliver sustainable sources of competitive advantage. Others include the Natural Step, Ecological Footprint, the Five Capitals framework and the Resource-Based Theory of the Firm [9,13,14].

While each lens has its advantages and disadvantages, the resource-based view (RBV) of the firm is preferred for its examination of how certain assets and capabilities establish a foundation for competitive advantage and superior performance [9], thereby linking environmental supply chain innovation to strategic management and M&A. Besides the active research, very few papers integrate these fields.

To explore this research gap further, the following three bodies of literature are considered pertinent to the aim of this article: (1) sustainable supply chain management, (2) merger motives and (3) M&A process (an operations management perspective).

2.1. Sustainable Supply Chain Management Literature

Sustainable supply chain management (SSCM) is characterized by the explicit integration of environmental or social objectives [15]. Research suggests that the environmental regime and regulatory considerations are of increasing interest in cross-border M&A [6]. Carter and Rogers [16] suggested four pillars at the intersection of SSCM research, namely, strategy, organisational culture, transparency, and risk management. In the context of this article, our focus is on exploring the strategic factors relevant during environmental supply chain innovation, for sustainable operations.

The literature contains many frameworks [12,15,16] through which to examine strategic and operational firm/value network considerations; the factors advanced by Tang and Zhou [17] are considered most relevant within the context of innovation given its environmental supply chain focus on product design and technology selection. Assessing product design facilitates the recovery of components and materials, and new product and service enhancement considerations (Table 1), while technology selection factors might enable improved SSCM performance through business model innovation and energy efficiency.

Table 1. Sustainable environmental supply chain (SC) considerations (adapted [15,17]).

Strategic Factors	Sustainable Environmental SC Considerations	References
Product Design	Innovation for environmental sustainability	[18–20]
	New product and service design optimization	
	Specification/customer insights	
	Network product and service enhancement	
Technology Selection	Business/operating model innovation performance	[18,19,21]
	Energy efficiency and effectiveness	

2.2. Merger Motives Literature

Traditional finance theory informs us that an organisation's sole mandate is to maximize shareholder value. However, today, there is significant pressure being placed on firms to improve their corporate social performance (CSP), and integrate sustainability, sometimes defined as environmental, social and governance (ESG) factors, into their business practices [22]. Most theories and constructs used in prior research and practice to evaluate the effectiveness of M&As are entrenched in the old, manufacturing-dominated competitive environments. It has been suggested that in high-technology M&As, the integration of science and technology capabilities may serve as a more useful indicator of deal synergy, than assessing relatedness in terms of firms' market and product portfolios [23].

Strategic management literature indicates that the rationale for mergers has been organised around four different "competitive efforts" or merger motives: improving competitive positioning, extending product portfolios, leveraging economies of scale or re-defining scope and industry [24,25]. From an operations management perspective, identifying and delivering synergies from network access or network efficiency, while acquiring capabilities, such as innovative product or technology Research and Development (R&D), are also cited as being key M&A objectives [26].

The following (Table 2) was developed from the literature and suggests exploratory questions relevant when assessing product or technology innovation capabilities during an M&A.

2.3. M&A Process (An Operations Management Perspective)

The view of an M&A transaction as a distinct process with several varying and integrated tasks is gaining ground in both academic and practice literature. Table 3 sets out some of the theoretical process models reported in the literature. The workstream model's perspective of an M&A process can be summarised as consisting of three phases, including (1) preparation, (2) transaction and (3) integration [27]. Each perspective consists of a set of key activities and deliverables. In practice as in theory, the process is not sequential, but rather iterative, and depends on the perspective taken.

Table 2. Product design and technology selection for environmental sustainability. SSCM: sustainable supply chain management.

Strategic Factors	Sustainable Environmental SC Considerations	Merger Motives Exploratory Questions	References
Product Design	Innovation for environmental sustainability	What clean-tech patents and license research/R&D capabilities exist?	[18]
	New product and service design optimization	What processes, tools, education and metrics govern how sustainability is embedded into the development processes for new products and services?	[19,20]
	Specification/customer insights	How are the target customers' sustainability needs treated by the product design team?	[20]
	Network product and service enhancement	Does a network understanding of customers' requirements and target-firm leadership for implementation and co-development exist?	[19]
Technology Selection	Business/operating model innovation performance	To what extent is business model innovation for SSCM a strategic and established capability?	[18,21]
	Energy efficiency and effectiveness	What management systems for energy, material and natural resources exist, and to what extent are they optimised?	[18,19]

Table 3. Merger and acquisition (M&A) process models reported in the academic literature.

Perspective	Phases Reported	References
Strategy/Market intelligence	Strategy, formulation, investigation and selection, negotiation and integration	[28,29]
	Strategy, analysing target, integration strategy	
Workstream models	Planning, implementation and integration	[27,30,31]
	Planning, execution and implementation	
Acquiring perspectives	Preparation, transaction and integration Policy responsibilities, acquisition planning, acquisition criteria, acquisition candidates, acquirer contact, due diligence, negotiated terms, harvesting the benefits	[32]
Selling perspective	Several models discuss the process of disposal but in broad terms only	Various
Contractual and legal frameworks	Strategic and financial perspective, transaction stage, transition stage, integration stage and evaluation	[33]
Stakeholder perspective	Mapping stakeholders, managing stakeholders and measuring acquisition outcomes	[34]
Manufacturing operations perspective	Identify value creation drivers, initial operations assessment, develop operations strategy and value delivery	[35,36]

The methodological framework for international M&A value creation advanced by Srari et al. [35] was used to advance the research question given its manufacturing operations perspective. The four strategic considerations were: (1) identification of value creation drivers, (2) initial operations assessment, (3) develop operations strategy and (4) value delivery (Figure 1).

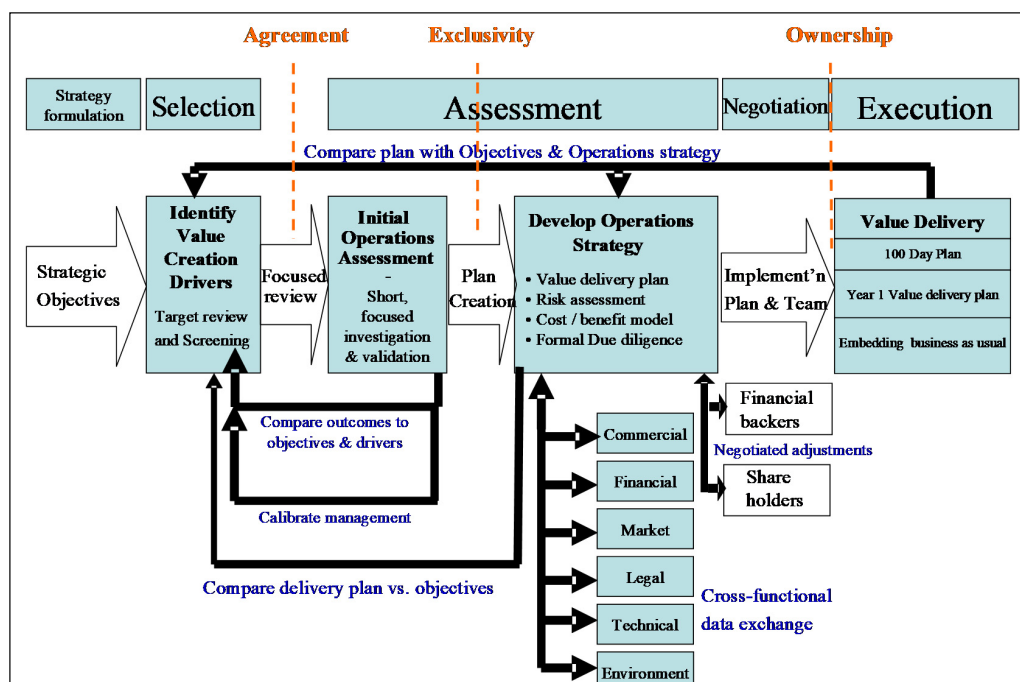


Figure 1. The M&A process: a manufacturing operations perspective [35].

3. Material and Methods

3.1. Research Design

The case study method was used to explore the phenomenon of environmental supply chain innovation in M&A and to answer the question “How environmental supply chain innovation for sustainability might inform M&As?” This type of research question is consistent with the conditions outlined by Yin [37] as appropriate for a case-study-based research methodology. The case selection was determined based on deal and product-supply chain characteristics. The unit of analysis was a product-supply chain acquisition in the global food industry for ingredient production. The global food industry was selected as the focal product-supply chain, given its large environmental footprint and the industry’s strategic pressure to adapt to the evolving consumer health and taste preferences through innovation, such as plant-based proteins and natural sugar substitutes.

Accordingly, the research strategy and purpose were empirical and exploratory, respectively, with primarily inductive utilisation of case study data to test and develop relationships to suggest new theory [37,38]. Furthermore, the research design and approach included the following four steps: (1) analyse the selected merger transaction as an exploratory case study using primary and secondary data to establish the strategic context; (2) collect primary data via semi-structured interviews to explore the relationship between the M&A process and environmental supply chain innovation; (3) collect primary data via semi-structured interviews to further explore the strategic environmental factors of product design and technology selection as sources of M&A value creation; and (4) summarize the results using the maturity-model-based analytical framework (Appendix A).

3.2. Case Study Organisation

The product-supply chain case study transaction was the acquisition by a global ingredient solutions provider to the food, beverage, brewing and pharmaceutical industries, of a controlling stake in the producer and innovator of great-tasting plant-based sweeteners for the global beverage and food industry. The target organisation has a proven track record of product and technology innovation as evidenced by its market leadership position in the global natural sugar growing and processing supply chain. Furthermore, it has invested in research and development and holds over 214 stevia-related

patents, with more than 300 applied for patents pending. The manufacturer's stevia sweeteners and flavour modifiers are supported by full vertical integration from a global network of agricultural partners. The company leverages a system of "advanced plant breeding" to extract the optimal tasting components of the stevia leaf. The company works with farmers in Asia, Africa, Latin America and North America to grow and source its proprietary stevia plants. The merger deal thesis was to support the acquiring firm's mission of encouraging healthy diets around the world and being the preferred supplier of high-purity stevia ingredients for the global food and beverage industry.

3.3. Data Collection and Analysis

A deal analysis framework, utilizing maturity model elements to integrate key concepts from SSCM, merger motives and the M&A process literature, was applied and tested [39,40]. A semi-structured interview consisting of sixteen leading questions was defined to gain preliminary insight into the respondent and organisational profile, strategic context, M&A process analysis and deal analysis. The interviews typically lasted ninety minutes and were recorded, transcribed and coded using NVIVO. Respondents included CEOs, Chief Sustainability Officers, VP Supply Chain, Managers of Strategic Planning, Merger Integration Leaders, Consultants/Advisors, Subject Matter Experts and people with similar roles. Particular attention was given to ensuring each phase of the M&A process was adequately explored (Table 4).

Table 4. Case study interviews by M&A process phase.

Case Study Interviews	Identification of Value Creation Drivers	Initial Operations Assessment	Develop Operations Strategy	Value Delivery
COO	✓			✓
Chief Sustainability Officer	✓	✓		✓
VP Supply Chain			✓	✓
Integration Manager		✓	✓	✓

4. Results

4.1. Strategic Context

Five questions were explored with each respondent to establish the strategic context of the deal. The objective was to establish perspectives on the organisation's strategy, sustainability goals, M&A experience, SSCM experience and transaction details. The results are summarised in Table 5.

Table 5. Case study interviews for strategic context.

Case Study Data Collection	Results (Selected)
Strategy	<ul style="list-style-type: none"> • Strategy is informed by consumer behaviour • Consumer behaviour and sustainability increasingly intersecting (GMO foods, plant-based proteins)
Sustainability Goals	<ul style="list-style-type: none"> • Cost control, risk mitigation and brand enhancement • Climate change, water access, human rights
M&A Experience	<ul style="list-style-type: none"> • Serial acquirer, three deals within last five years • Primary focus is to grow market share

Table 5. Cont.

Case Study Data Collection	Results (Selected)
SSCM Experience	<ul style="list-style-type: none"> The VP of Sustainability reporting relationship is to the Chief Commercial Officer (since 2018) to ensure sustainability programs drive commercial value
Transaction Details	<ul style="list-style-type: none"> Target organisation was a close commercial partner Both acquirer and target participate in Sustainable Agriculture Initiative (SAI)

4.2. M&A Process Analysis

Five questions were explored with each respondent to understand the M&A process. The exploratory questions were defined to establish an understanding of the merger motives, and key outcomes from each phase of the M&A process. The results are summarised in Table 6.

Table 6. Case study interviews by M&A process phase.

Case Study Data Collection	Results (Selected)
Merger Motives	<ul style="list-style-type: none"> Network efficiency Grow capability in natural low caloric sweeteners
Identify Value Drivers	<ul style="list-style-type: none"> Operational synergies, eliminating processing facilities, access to Intellectual Property/Research & Development (IP/R&D) cited as a merger prizes
Perform Operations Assessment	<ul style="list-style-type: none"> Assess supply mechanisms, review contracts, sustainable sourcing for agriculture certifications
Develop Operations Strategy	<ul style="list-style-type: none"> Integration team did not include sustainability directly, rely on questionnaire (emission targets)
Value Delivery and Post Merger Integration (PMI)	<ul style="list-style-type: none"> NGO alert relating to prison labour in supply chain Over a year long, streamlining headcount Detailed synergy targets being developed and reviewed against pre-deal assumptions

4.3. Deal Analysis

The deal analysis respondent feedback was summarised using the maturity model framework (Figure 2) below. Table 7 highlights these key respondent statements and their relevance to the appropriate M&A process phase when assessing product design and technology innovation for environmental sustainability.

Table 7. Case study respondent statements.

Exploratory Questions	Identification of Value Creation Drivers	Initial Operations Assessment	Develop Operations Strategy	Value Delivery
What clean-tech patents and license research/R&D capabilities exist?	"IP (for stevia concentrate formulation) was definitely a factor in the acquisition"			
What processes, tools, education, and metrics govern how sustainability is embedded into the development processes for new products and services?	"... good alignment with Sustainable agriculture initiative (SAI)"	"reliance on pre-merger survey feedback to guide the scope and types assessment teams established"	"Extra consideration needed to be given to the Rep Risk search as the target had prison labour accusations, that potentially eroded some value delivery, opportunity missed to get ahead of the customer messaging"	
How are the target customers' sustainability needs treated by the product design team?	"very seriously as customers are looking for no or low caloric sweeteners"			
Does a network understanding of customers' requirements and target-firm leadership for implementation and co-development exist?	"pre-acquisition it's usually just which country the product is sourced from, don't get to a more granular level until day-1"		"... don't want to expand into these new customers at the expense of cutting out the old ones"	"trick will be integrating the operations into our business without messing things up"
To what extent is business model innovation for SSCM a strategic and established capability?	"eliminate operations and transportation costs by closing Brazil production and consolidate raw material growing and Stevia production in one region (China)"	"evaluation of waste streams, particularly leaf extracts [...] day-1 discussion, revenue generation opportunity assessment"		
What management systems for energy, material and natural resources exist, and to what extent are they optimised?		"product sustainability customer value comes at a higher environmental footprint"	"Integration lead responsible for capturing what they think are the potential synergies"	

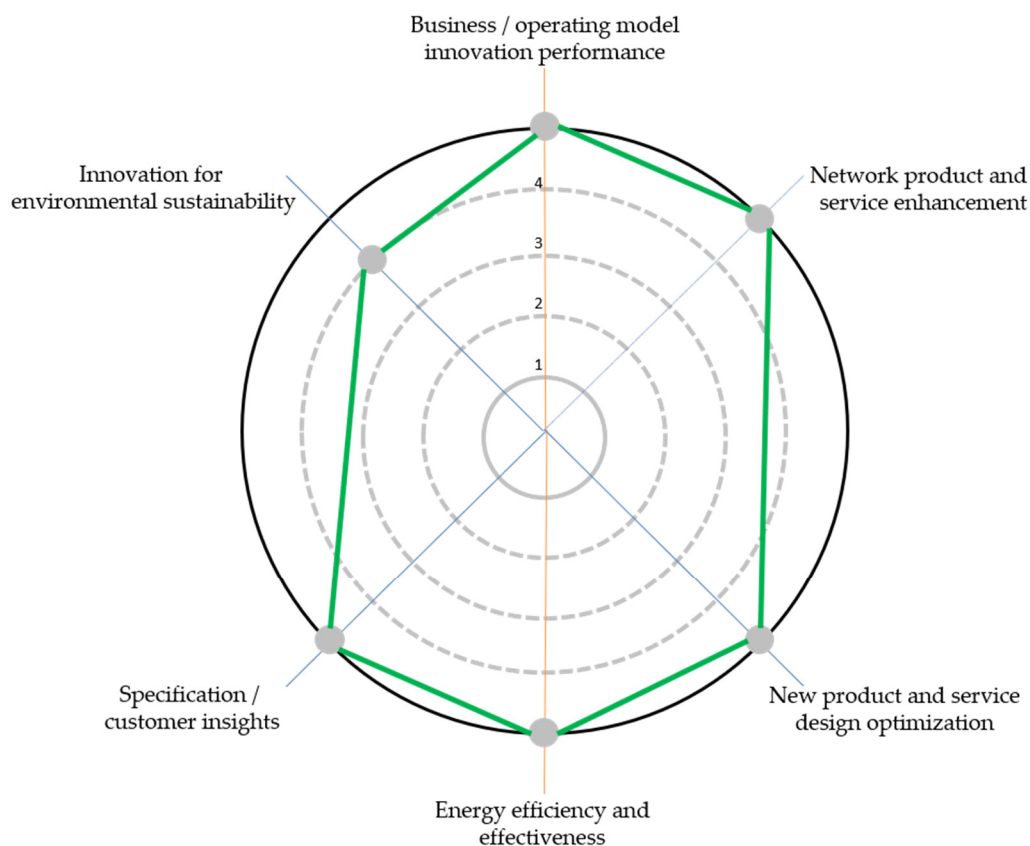


Figure 2. Deal analysis (SSCM in M&A).

5. Discussion

The purpose of this article is to explore how environmental supply chain innovation for sustainability might inform M&As. Strategic factors and exploratory questions identified from SSCM, merger motives and M&A process literature were assessed using a product-supply chain deal case study and the findings summarized using a maturity model framework (Appendix A).

5.1. How Innovative Is the Deal?

Case study findings suggest that this deal was strategically favourable from the perspective of product design and technology selection considerations. In terms of assessing maturity against the six dimensions on a scale of (1) Initial to (5) Optimised, only Innovation for Environmental Sustainability was “Managed” vs. the “Optimised” maturity defined for each of the other five dimensions. It may be appropriate to revisit the case as a longitudinal study, as the assessment could be influenced by the period in which the combined entity is operating in the value delivery phase. In this case, our analysis was approximately three months post-day-1 operations. Given additional time, we would expect an increasing focus on executing against these medium-to-longer-term product synergies, including further value capture in the area of innovation for environmental sustainability.

Product and technology innovation were identified as a merger motive; the acquiring firm was operating in a marketplace being shaped by changing consumer product preferences for low caloric sweeteners. The target firm had the technology and intellectual property (IP) in the form of concentrate formulation; their sustainability performance could be benchmarked and easily integrated post-merger, given that both the acquiring and target firms had good alignment and reported against the Sustainable Agriculture Initiative (SIA).

Several challenges for effective post-merger value delivery were identified, which included (1) not eroding the target firm’s innovation advantages during assimilation, and (2) evaluating the trade-off

between higher environmental production (of stevia when compared to high-fructose corn syrup) vs. consumption impacts (benefits of lowering sugar in diet). This highlights the systemic nature of sustainable development and is an argument to explore other dimensions beyond product and technology innovation.

5.2. Towards a New M&A Process Perspective for Operations Sustainability

While this article builds upon the operations management M&A process perspective, our findings suggest that environmental sustainability considerations can materially inform M&A and that specific considerations should be given to environmental product and technology value as merger motives. Furthermore, findings suggest that initial operations assessment, operations strategy development, and value delivery should include elements of production waste, product cannibalization and technology risk assessment, respectively, and that the case for a new M&A process perspective for operations sustainability can be suggested.

The case study provides insight into the relevancy of the exploratory questions by M&A process phase (Table 7). For instance, within the context of product design, understanding the scope of clean-tech patents and license research were the only factors that were relevant during target selection. Likewise, not all factors were relevant during the assessment and negotiation phases. The opportunity to explore the relationship between these environmental SSCM factors and traditional M&A process outcomes, such as target selection and deal valuation, is a gap of practical and theoretical relevance. Furthermore, while the focus of this paper was on the environmental dimension of sustainability, there is evidence that the social dimension, particularly as it relates to farm/migrant labour practices, needs to be integrated to provide a holistic evaluation of the deal.

Finally, the strategic SCM pillar and its relevant considerations of product design and technology selection should be broadened to include other considerations relevant in the areas of organisational culture, transparency, and risk management. The case study identified instances of environmental supply chain management tension for innovation, between water, energy and food, thereby underscoring this opportunity for a holistic evaluation of the trade-offs and a systems perspective to the question “how innovative is the deal?”

6. Conclusions

Our case study analysis and discussion provide the context from which key theoretical arguments and overall conclusions can be drawn relative to the research question “How environmental supply chain innovation for sustainability might inform M&As?”

The findings suggest that product design and technology selection factors represent sources of M&A value creation when exploring an innovation for a sustainable SCM deal thesis (Figure 2). The implication for firms with ambitious environmental agendas or motives is that the M&A process needs to be reconfigured such that product design and technology selection, currently secondary factors, are considered primary drivers. Together these form substantive strategic considerations and new merger motives of both theoretical and practical relevance, informing a new perspective of operations sustainability targeted M&A.

6.1. Additional Considerations

A reconfigured M&A process-execution model that integrates sustainable supply chain management factors is a gap of practical relevance. With the increasing emphasis on firms to deliver enhanced ESG performance and deliver against their net-zero emission targets, this deal within the global food product-supply chain for ingredient production provides evidence of strategic M&A as a mechanism to acquire capabilities that enhance environmental innovation.

6.2. Research Limitations

The ability to generalize and establish a new theory is limited due to the single detailed case study method. The research is limited to a single industry, geography and time period. To reach data saturation, the case selection should consider multiple industry/deal combinations as the unit of analysis of both domestic and international scope. Furthermore, it may be informative given the milestone events of 2015, namely the ratification of the UN Sustainable Development Goals and the Paris climate accord (COP 21), to study M&A merger motives and deal outcomes pre and post-2015.

6.3. Future Research

Opportunities for future research include broadening the scope from environmental sustainability to include social considerations. In addition, the strategic SCM pillar and its relevant considerations of product design and technology selection should be broadened to include the SSCM pillars of organisational culture, transparency and risk management. The strategic factors and SSCM considerations of both environmental and social significance relevant to each of these three dimensions should be explored further. Finally, given the inherent tension and trade-offs that need to be evaluated at the intersection of sustainable supply chain management and M&A, a “systems” perspective might provide an alternative theoretical lens for future sustainability transition research.

Author Contributions: Conceptualisation, P.M.; methodology, P.M.; validation, P.M.; investigation, P.M.; data curation, P.M.; writing—original draft preparation, P.M.; writing—review and editing, P.M. and J.S.S.; visualisation, P.M.; supervision, J.S.S.; project administration, P.M. All authors have read and agreed to the published version of the manuscript

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. M&A deal analysis maturity model – product design.

Focus	Exploratory Questions	1. Initial	2. Repeatable	3. Defined	4. Managed	5. Optimised
Product Design	What clean-tech patents and license research/R&D capabilities exist?	Target has little or no awareness of environmental sustainability-related opportunities	Environmental sustainability-related innovation is typically driven by short-term or near-term priorities and seen as a necessity rather than a profit opportunity	Target is in the early-to-middle stages of embedding systematic and repeatable innovation processes with some projects intentionally connected to advance environmental sustainability	Environmental sustainability implications are important, and thoughtful consideration in most innovation efforts is linked to financial performance	All innovation efforts explicitly incorporate environmental sustainability considerations
	What processes, tools, education and metrics govern how sustainability is embedded into the development processes for new products and services?	Regulatory compliance	Sustainability considered in new product development, for suppliers and in reporting metrics	Sustainability considered in new product development, for suppliers and in reporting metrics	Sustainability included throughout much of the enterprise and used as a competitive advantage in some markets	Sustainability fully integrated throughout enterprise, viewed not as an initiative but rather as the way the company does business
	How are the target customers' sustainability needs treated by the product design team?	Regulatory compliance	Sustainability considered in new product development, for suppliers and in reporting metrics	Sustainability included throughout much of the enterprise	Sustainability included throughout much of the enterprise and used as a competitive advantage in some markets	Sustainability fully integrated throughout enterprise, viewed not as an initiative but rather as the way the company does business
	Does a network understanding of customers' requirements and target-firm leadership for implementation and co-development exist?	No R&D, isolated local processes, strategy for compliance	Opportunities for design for sustainability assessed, awareness and some local implementation of sustainability	Design for sustainability integrated at R&D level. Lean and other appropriate processes in place at all network nodes	Sustainability elements used as initiatives driving new R&D. Knowledge-based scenario management assessed but not implemented across network	Sector leader in sustainable technologies and disruptive sustainable innovation. Network knowledge integration. Industry regulatory roadmaps shaped by target in partnership with regulatory bodies

Table A2. M&A deal analysis maturity model—technology selection.

Focus	Exploratory Questions	1. Initial	2. Repeatable	3. Defined	4. Managed	5. Optimised
Technology Selection	To what extent is business model innovation for SSCM a strategic and established capability?	Innovation is rarely strategic. Tendency is to regard innovation as the price of doing business, rather than as a net contributor to profit	Innovation is evolutionary and driven by external forces. Changes are small and are more “tweaks” than true design changes	Innovation incorporating social and environmental issues that is partly foresight-based is increasingly regarded as an expectation	Innovation processes exists by which the business model is regularly reviewed, with some change being moderate to revolutionary in scale	There is an established, regular and rigorous business model innovation process with change based on substantial foresight
	What management systems for energy, material and natural resources exist, and to what extent is it optimised?	Consumption measurement/local awareness	Energy consumption continuous improvement process implemented at process/plant level	Energy element incorporated into location decision and make/buy decision tools. Product level continuous improvement process for energy use reduction	Network configuration measurement of consumption. Renewable options locally assessed	Network configuration measurement of consumption. Renewable options locally assessed

References

1. Sarni, W. *Corporate Water Strategies*; Earthscan: London, UK, 2011.
2. Barney, J. Firm Resources and Sustained Competitive Advantage. *J. Manag.* **1991**, *17*, 99–120. [\[CrossRef\]](#)
3. Dealogic. M&A Highlights: Full Year 2019. Global M&A Volume on a Decline (Blog). Available online: <https://dealogic.com/insight/ma-highlights-full-year-2019/> (accessed on 31 October 2020).
4. Cartwright, S.; Schoenberg, R. Thirty Years of Mergers and Acquisitions Research: Recent Advances and Future Opportunities. *Br. J. Manag.* **2006**, *17*, S1–S5. [\[CrossRef\]](#)
5. Gupta, S. Mergers and Acquisitions for Enhancing Supply Chain Competitiveness. *J. Mark. Oper. Manag. Res.* **2012**, *2*, 129–147.
6. Inderst, R.; Shaffer, G. Retail Mergers, Buyer Power and Product Variety. *Econ. J.* **2007**, *117*, 45–67. [\[CrossRef\]](#)
7. Cho, S.-H. Horizontal Mergers in Multitier Decentralized Supply Chains. *Manag. Sci.* **2014**, *60*, 356–379. [\[CrossRef\]](#)
8. Manocha, P.; Srail, J.S.; Kumar, M. Understanding the Role of Sustainability in Mergers & Acquisitions from the Perspective of Supply Chain Management—How Green Is the Deal? In Proceedings of the 20th Cambridge International Manufacturing Symposium, Cambridge, UK, 29–30 September 2016.
9. Fumagalli, C.; Motta, M. Upstream mergers, downstream mergers, and secret vertical contracts. *Res. Econ.* **2001**, *55*, 275–289. [\[CrossRef\]](#)
10. Li, D.-Y.; Liu, J. Dynamic capabilities, environmental dynamism, and competitive advantage: Evidence from China. *J. Bus. Res.* **2014**, *67*, 2793–2799. [\[CrossRef\]](#)
11. Brundtland, G. Report of the World Commission on Environment and Development: Our Common Future. 1987. Available online: https://www.are.admin.ch/are/en/home/sustainable-development/international-cooperation/2030agenda/un_-milestones-in-sustainable-development/1987--brundtland-report.html (accessed on 1 November 2020).
12. Elkington, J. Partnerships from cannibals with forks: The triple bottom line of 21st-century business. *Environ. Qual. Manag.* **1998**, *8*, 37–51. [\[CrossRef\]](#)
13. Wackernagel, M.; Rees, W.E. *Our Ecological Footprint: Reducing Human Impact on the Earth*; New Society Publishers: Gabriola Island, BC, USA, 1998.
14. Porritt, J. *Capitalism: As If the World Matters*; Earthscan: London, UK, 2007.
15. Seuring, S.; Müller, P.D.M. From a literature review to a conceptual framework for sustainable supply chain management. *J. Clean. Prod.* **2008**, *16*, 1699–1710. [\[CrossRef\]](#)
16. Carter, C.R.; Rogers, D.S. A framework of sustainable supply chain management: Moving toward new theory. *Int. J. Phys. Distrib. Logist. Manag.* **2008**, *38*, 360–387. [\[CrossRef\]](#)
17. Tang, C.S.; Tang, C.S. Research advances in environmentally and socially sustainable operations. *Eur. J. Oper. Res.* **2012**, *223*, 585–594. [\[CrossRef\]](#)
18. Golinska, P.; Kuebler, F. The Method for Assessment of the Sustainability Maturity in Remanufacturing Companies. *Procedia CIRP* **2014**, *15*, 201–206. [\[CrossRef\]](#)
19. Srail, J.S.; Alinaghian, L.S.; Kirkwood, D.A. Understanding sustainable supply network capabilities of multinationals: A capability maturity model approach. *Proc. Inst. Mech. Eng. Part B J. Eng. Manuf.* **2013**, *227*, 595–615. [\[CrossRef\]](#)
20. Hynds, E.J.; Brandt, V.; Burek, S.; Knox, P.; Parker, J.P.; Zietlow, M.; Schwartz, L.; Taylor, J.; Jäger, W. A Maturity Model for Sustainability in New Product Development. *Res. Manag.* **2014**, *57*, 50–57. [\[CrossRef\]](#)
21. Edgeman, R.; Eskildsen, J. Modeling and Assessing Sustainable Enterprise Excellence. *Bus. Strat. Environ.* **2014**, *23*, 173–187. [\[CrossRef\]](#)
22. González-Torres, T.; Rodríguez-Sánchez, J.-L.; Pelechano-Barahona, E.; García-Muiña, F.E. A Systematic Review of Research on Sustainability in Mergers and Acquisitions. *Sustainability* **2020**, *12*, 513. [\[CrossRef\]](#)
23. Makri, M.; Hitt, M.A.; Lane, P.J. Complementary technologies, knowledge relatedness, and invention outcomes in high technology mergers and acquisitions. *Strat. Manag. J.* **2009**, *31*, 602–628. [\[CrossRef\]](#)
24. Sorensen, D.E. Characteristics of merging firms. *J. Econ. Bus.* **2000**, *52*, 423–433. [\[CrossRef\]](#)
25. Nagurney, A. A system-optimization perspective for supply chain network integration: The horizontal merger case. *Transp. Res. Part E Logist. Transp. Rev.* **2009**, *45*, 1–15. [\[CrossRef\]](#)
26. Langabeer, J.; Seifert, D. Supply chain integration: The key to merger success. *Supply Chain Manag. Rev.* **2003**, *7*, 58–64.

27. Meckl, R. Organising and leading M&A projects. *Int. J. Proj. Manag.* **2004**, *22*, 455–462. [CrossRef]
28. Howell, R.A. Managing by objectives—A three-stage system. *Bus. Horiz.* **1970**, *13*, 41–45. [CrossRef]
29. Finkelstein, S.; Cooper, C.L. *Advances in Mergers and Acquisitions*, 1st ed.; Emerald Group Publishing Limited: Bingley, UK, 2010; Available online: <https://search-ebscohost-com.ezp.lib.cam.ac.uk/login.aspx?direct=true&db=nlebk&AN=355737&site=ehost-live&scope=site> (accessed on 1 November 2020).
30. Picot, G. *Handbook of International Mergers and Acquisitions: Planning, Execution and Integration*; Macmillan: New York, NY, USA, 2002.
31. DiGeorgio, R. Making mergers and acquisitions work: What we know and don't know—Part I. *J. Chang. Manag.* **2002**, *3*, 134–148. [CrossRef]
32. Bibler, R.S. *The Acquisition Process: A Program for Success. The Arthur Young Management Guide to Mergers and Acquisitions*; John Wiley & Sons Inc.: Hoboken, NJ, USA, 1989.
33. Schweiger, D.M. *M&A Integration: A Framework for Executives and Managers*; McGraw Hill: New York, NY, USA, 2002.
34. Meglio, O.; Park, K.M. *Strategic Decisions and Sustainability Choices: Mergers, Acquisitions and Corporate Social Responsibility from a Global Perspective*; Springer: Cham, Switzerland, 2019.
35. Srai, J.S.; Bertonecelj, A.; Fleet, D.; Gregory, M. An operations process framework for international M&A value creation. *Eur. J. Int. Manag.* **2010**, *4*, 3. [CrossRef]
36. Zhang, Y.; Fleet, D.; Shi, Y.; Srai, J.S.; Gregory, M. Network integration for international mergers and acquisitions. *Eur. J. Int. Manag.* **2010**, *4*, 56. [CrossRef]
37. Yin, R.K. *Case Study Research—Design and Methods*, 2nd ed.; Sage Publications: Thousand Oaks, CA, USA, 1994.
38. Eisenhardt, K.M. Building theory from case study research. *Acad. Manag. Rev.* **1989**, *14*, 532–550. [CrossRef]
39. Correia, E.; Carvalho, H.; Azevedo, S.G.; Govindan, K. Maturity Models in Supply Chain Sustainability: A Systematic Literature Review. *Sustainability* **2017**, *9*, 64. [CrossRef]
40. Kurnia, S.; Mahbubur, R.; Samson, D.; Prakash, S. Sustainable Supply Chain Management Capability Maturity: Framework Development and Initial Evaluation. In Proceedings of the European Conference on Information Systems (ECIS), Tel Aviv, Israel, 9–11 June 2014.

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



© 2020 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).