

# Green-field Architecture for Sustainable Supply Chain Strategy Formulation

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**Abstract** - The focus of this paper is on supply chain strategy formulation. A conceptual theory approach is used for investigating and identifying the relationship between multiple elements, dimensions, forces and factors that influence and affect the supply chain strategy formulation in Greenfield context, specific to the slate mining industry. The research study involved secondary data review and series of 20 qualitative interviews, followed by 2 group discussions, one with mining and transportation experts external to the supply chain and one group discussion with supply chain internal experts. Through critical analysis, a number of problems emerge and the process of addressing these problems, results in a new framework for evaluating the relationship between business and supply chain strategy, specific to Greenfield project and integration design context.

**Keywords** - Supply chain strategy, supply chain formulation, supply chain architecture, supply chain design.

## 1. Introduction

A Supply chain represents a networked organization where its performance depends on optimizing and coordinating operations towards a common goal. This definition is the basis for identifying the supply chain paradox explored in this paper. The paradox is created when companies are only interested in strengthening their own competitive advantage at the expense of delivering benefit to the whole supply chain. However, in most scenarios a single company cannot singularly perform all operations in the supply chain and unless all parts are optimized towards a common goal the supply chain cannot be enhanced. Therefore, individual companies in a supply chain are part of a larger conceptual system that has a purpose of its own. Following the same logic, if the supply chain is taken apart individual participants lose their function and so does the supply chain.

To address the above paradox to enhance the supply chain whilst maximizing the benefits to the individual company, a systemic approach was applied to the design of a supply chain strategy based on the principle that a system is not represented as the sum of its parts but as the product of their interaction [1].

In this study, supply chain external elements, forces and factors are defined in accordance with existing literature [2-8] as:

- 1) Element: essential part of abstract concept that cannot be interconverted.
- 2) Force: strength that attribute coercion of action at a distance.
- 3) Factor: circumstance, fact or influence that contributes to a result.

The analysis in this paper is aimed at identifying the elements, factors and forces within the salient dimensions of the supply chain operations. The investigation is aimed at identifying the level of complexity in the salient dimensions and its relevance in designing supply chains. The aim of the investigation is to derive insights into the relationship between that complexity and the business strategy in the process of designing a Greenfield supply chain architecture.

Supply chain architecture is defined as the process of formulating a holistic supply chain strategy, while Greenfield architecture refers to the process of formulating new supply chain strategy, where the supply chain is non-existent until formulated.

## 2. Theory and Literature review

The battle for competitiveness is fought between supply chains and not companies [9] and the real competition is not company against company, but supply chain against supply chain [10]. In that respect 'a supply chain is much like a river, with products and services flowing down it instead of water. Whether anyone recognizes the systemic, strategic implications of managing the water basin, the river still exists.' [10]. Therefore the focus when developing a supply chain strategy is towards integration and collaboration [11-16]. Unfortunately collaboration is often focused on enterprise profitability and not supply chain profitability [4], [5], [7], [17], leading to a focus on local optimization [8], [17], [18]. It is only when companies involved in the supply chain recognize the need to utilize the benefits of the supply chain for its own needs, can these companies be considered to have taken a systemic

strategic supply chain focus [8-10], [17-25]. The supply chain ‘effectiveness’ is only achieved by synchronizing its processes and operations both internally and externally and jointly planning the execution to achieve an optimal supply chain performance for a common goal [17].

**3. Research Method**

To date, very few studies on supply chain strategy formulation have been conducted on the mining industry in North Wales, despite its wide development in other regions. This provides further motivation for the research to seek evidence from the mining industry in North Wales.

In the case study research the conceptual system design was initiated with a detailed review of aspects that influence and affect the supply chain strategy, including elements, factors and forces in each dimension and a review of the steps performed in analyzing these factors.

The effect of driving forces and local factors was investigated by Porter [26] to assess the influences on the industry and understand the context in which companies operate. More recently [7] investigated the ‘influencers’ such as the business and political environment, the business model employed, the company’s desired outcomes, the supply chain life cycle and the ‘design decisions’ such as the social, behavioral, physical and structural design elements that define a supply chain.

The process of setting the scene involved secondary data review of the industry [27-34], and government reports [35-39] and academic reports [40-48], on the state of the mining industry in N.Wales, followed by qualitative interviews and group discussions.

**4. Findings**

The review and analysis of the external elements, factors and forces out of the supply chain control, resulted in a sample of concepts related to the context of business and supply chain strategy formulation. These are articulated with directive and conventional analysis [49] and categorised in accordance to the grounded theory approach [50-52] to investigate the impact they create on business and supply chain strategy. Following recommendation in existing literature [2], [3], [53] the concepts are presented in a causal loop diagram (Figure 1) to investigate the ‘causal mechanisms’ [54]. The interrelated concepts represent the influencers [7] identified in the case study research [55-59].

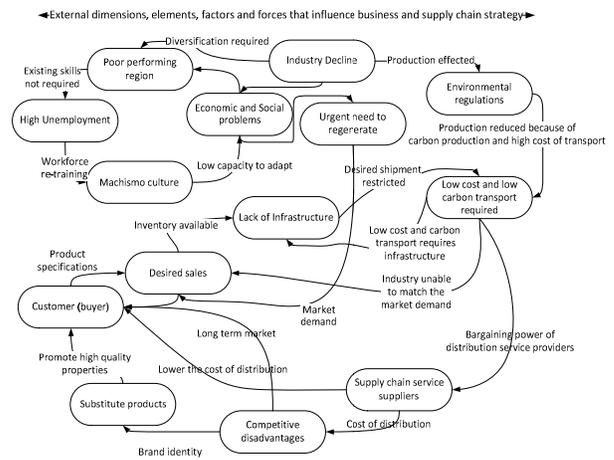


Figure 1: Causal Loop of external elements, factors and forces present in external and salient dimensions.

The causal loop diagram in Figure 1 was presented to the industry participants and the findings confirmed the concepts identified as the key ones that influence their business and supply chain strategies. These findings were then validated through applying summative analysis on the two group discussions. The results of the summative analysis from the first group discussion with external experts were presented and evaluated through a second group discussion with internal experts to interpret the data and evaluate the implications for a supply chain strategy formulation. The outcome of the group discussions resulted in converting the causal loop diagram into a conceptual diagram (Figure 2) that clarifies further the relationship between the articulated concepts and initiates the process of building a conceptual system. The interviews and group discussions process applied validity confirmation principles to the process [25].

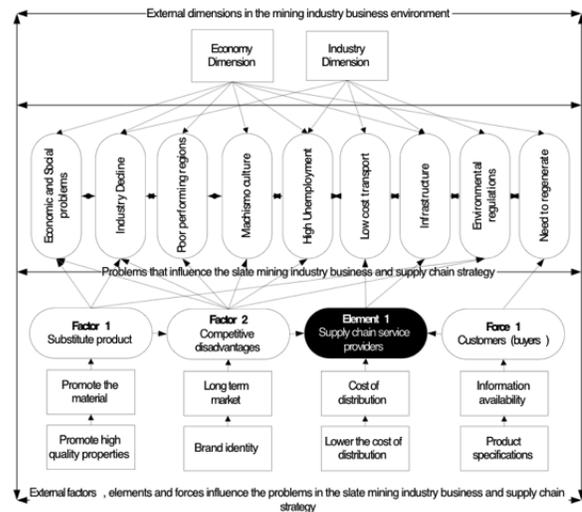


Figure 2: Block diagram of categorizing concepts articulated from the influencers present in the external dimensions.

The process of categorising concepts resulting from the group discussions initiated the design of a framework for business strategy development that anticipates the effect of the external dimensions. However, it must be emphasised that different business environment will differ in the external factors and elements identified.

The investigation identified multiple elements, dimensions and factors that influence and affect the supply chain strategy formulation in a Greenfield context, specific to the industry investigated (Figure 3).

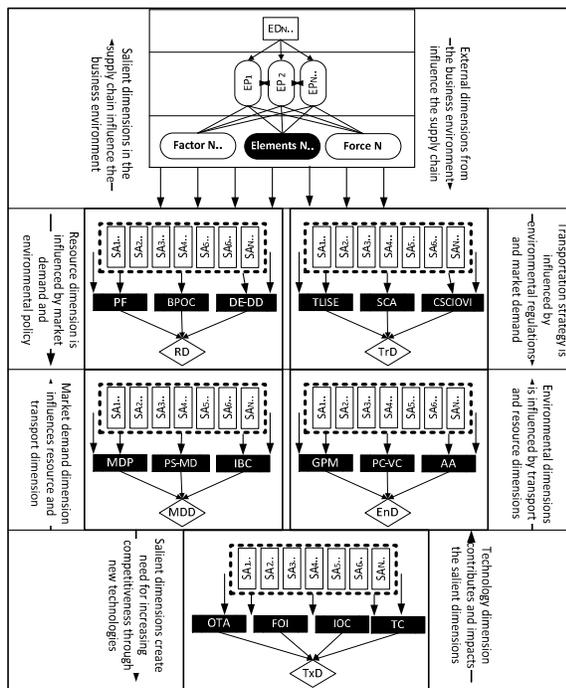


Figure 3: Conceptual system for Greenfield architecture

Where RD= Resource Dimension; TrD= Transportation Dimension; MDD= Market Demand dimension; EnD= Environmental Dimension; TxD= Technology Dimension.

Developed from the conceptual system, a Greenfield architecture was built and validated over five years period of investigation. The architecture provides a conceptual system that enables further research to identify, focus and relate the framework in different business environments. The concepts in Figure 3 are detailed with a framework key in Figure 4.

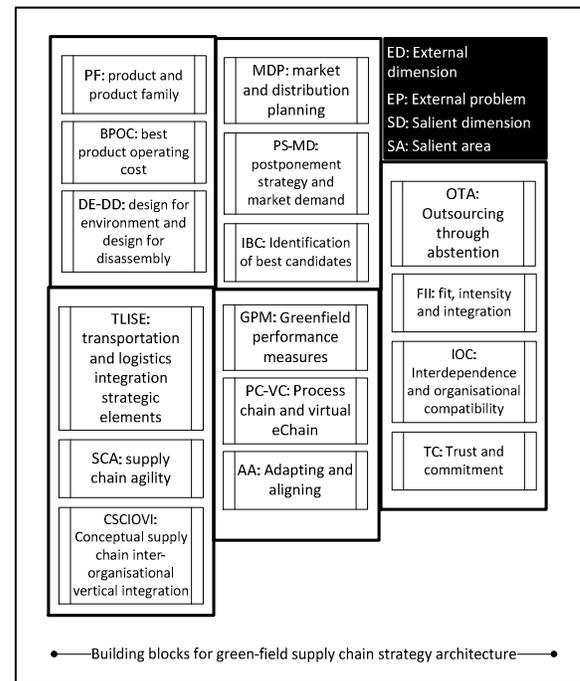


Figure 4: Framework key of the conceptual system

### 5. Conclusions and further work

The investigation in this paper concludes that in a scenario where the supply chain activities consist of a number of choices, there are a number of probable supply chain salient dimensions. These are evaluated with conventional analysis and supported with summative analysis. The measure of credibility applied is the participants' confirmation that the results are validated by the group discussions. However, the case study undertaken does not control the large number of variables, nor can the study guarantee with complete certainty that the most important factors are truly identified.

The analysis in this paper applied directive and conventional analysis to determine the effect of external elements, factors and forces is in the context of five salient dimensions: resource, transport, market demand, technology and environment. The salient dimensions are analyzed to investigate their impact on formulating business and supply chain strategy and grounded theory was applied to build the emerging concepts into categories. The number of salient dimensions emerging from the external dimensions exceeds the ones present in existing literature. Since this paper is focused on business and supply chain strategy formulation, the factor analysis covers only the impact of salient dimensions relevant to the context of Greenfield formulation.

The investigation in this paper concludes that the level of complexity in the salient dimensions must be considered in designing supply chains and that business strategy ar-

chitecture should be considered in the process of designing supply chain architecture. The strategy formulation investigated the relationship between supply chain design, business strategy and business environments, since a strategy should be suitable for a given business environment complexity, and when that complexity is changed, the supply chain design must be changed accordingly.

The resulting framework in this paper is not all-inclusive. Nevertheless, it is developed through comprehensive investigation and was field-tested on an industrial project, resulting in an easy to visualize convincing structure. However, this study involved a single case study and while it is anticipated that the proposed conceptual system is suitable for other sectors, the findings would need to be delimited through further research. Future research challenge emerging from these findings, is to design a conceptual framework for holistic supply chain formulation that would anticipate the effect of external dimensions to the business and supply chain strategies.

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