On Strategic Trade-Offs:

Does the Principle of Energy Conservation Explain the Trade-Offs Law?

Structured Abstract

Purpose: The purpose of this paper is to reaffirm the suggestion that there are at least two distinct types of trade-off law that affect all firms; and in doing so, to contribute towards resolving the persistent trade-off debate in the literature.

Design/methodology/approach: Conceptual; based on implicit deductive reasoning.

Findings: Two types of trade-offs are identified: one ('internal') can be understood following the dictates of the law of diminishing returns, while the other ('external') can be modeled utilizing the principle of energy conservation.

Research implications: New insights are provided by discussing the impact of both trade-off laws on the resource-based view of the firm, on new capabilities such as sustainability and innovativeness, and on strategic choices.

Practical implications: Our study explains why trade-offs occur and outlines contextual factors that determine the 'strength' of trade-offs.

Originality/value: To the best of our knowledge, no previous study has attempted to investigate the topic of strategic trade-offs based on the principle of energy conservation.

Keywords: Strategic trade-offs, cumulative capabilities, external trade-offs, internal trade-offs, performance frontiers.

Article Classification: Conceptual paper

1. INTRODUCTION

This study seeks to contribute to the ongoing discussion in the strategic operations management literature on the applicability of Wickham Skinner's strategic trade-offs law: '…*tradeoffs are inevitable; one system cannot be outstanding enough at meeting all criteria to create competitive advantage*' (Skinner 1996, p.6). We argue that the topic of strategic trade-offs that be better understood if the dynamics implied in Skinner's theory are modeled using the principle of energy conservation (i.e. the first law of thermodynamics). In addition, we contribute to the literature by reaffirming the suggestion that there are at least two distinct types of trade-off laws that affect all firms: one ('internal') can be understood following the dictates of the law of diminishing returns, while the other ('external') can be modeled utilizing the aforementioned principle of energy conservation. To the best of our knowledge, this is the first study that attempts to understand the topic of strategic trade-offs based on the principle of conservation of energy.

Over the years, Skinner's work has generated a broad debate in the manufacturing strategy literature. One of the most important questions resulting from these discussions can be summarized as follows: Do manufacturing firms have to necessarily compromise on one competitive aspect of their operations (e.g. on-time deliveries) in order to favor others (e.g. production cost and/or quality)? This is the essence of the strategic trade-offs debate. Scholars have offered two competing arguments to reconcile this debate. On the one hand, there are proponents of the trade-off model that argue 'yes', i.e. that trade-offs are necessary (e.g. Skinner, 1969; New, 1992; Porter, 1996). By contrast, there are scholars that present evidence and arguments against Skinner's law, including advocates of the cumulative capabilities school of thought that argue 'no', a firm can have it all by pursuing each capability in a sequential manner (e.g. Schonberger, 1990, 2007; Noble, 1995; Rosenzweig & Roth, 2004; Roth, 2006; Rosenzweig & Easton, 2010).

Sarmiento *et al*. (2013) recently demonstrated that the divergence of opinion evident in the literature can be explained by confusion surrounding the concepts of performance improvements (i.e. related to operational, financial, and other performance metrics) and actual competitive position (i.e. related to firm-level competitive capabilities). While the trade-off law applies to the latter – i.e. the actual competitive position of a company compared to other companies – the cumulative capabilities model refers to the process undertaken by each individual firm to gain this competitive position. By highlighting this confusion, Sarmiento *et al.* (2013) provided a

major step towards clarifying strategic trade-offs. However, Sarmiento *et al.* (2013) did not present an explanation for why trade-offs occur. The purpose of our study is to extend the discussion by seeking to provide an explanation for *why* trade-offs actually occur.

Our analysis starts with the assumption that a manufacturing enterprise must obey the first law of thermodynamics. We then proceed by building the argument that it is this law that explains trade-offs in the context of competitive position (i.e., Skinner's law). Acknowledging and reaffirming the existence of two trade-off laws, we further propose that internal changes in performance can be explained using the law of diminishing returns. We argue that this dual-law logic resolves the persistent trade-off debate, and we hope that our proposed novel approach to understanding the topic of strategic trade-offs and related themes can provide new insights for researchers and guidance for managerial decision-making in practice.

The remainder of this paper is organized as follows. Section 2 reviews the literature in order to provide the background to our study. Section 3 then presents our research methodology and the assumptions upon which our analysis is built. We elaborate on our main proposal to model trade-offs using the first law of thermodynamics in Section 4. Section 5 then discusses the implications of our proposal *vis-à-vis* the resource-based view of the firm, new capabilities such as sustainability and innovativeness, and the concept of 'strategic choices'. Finally, conclusions are summarized in Section 6, where managerial implications and future research directions are also outlined.

2. LITERATURE REVIEW - BACKGROUND

Wickham Skinner has been a seminal figure in the field of operations management. Our study focuses on one of his most influential concepts: the strategic trade-offs model. This particular theory was first proposed in Skinner (1969). Meanwhile, in later studies (e.g., 1992, 1996), Skinner refined and defended his proposed model. It appears as if his ideas went unchallenged for many years. Nevertheless, and quite possibly as a result of the advent of philosophies such as Just-in-Time, Total Quality Management, Lean Manufacturing, etc., in the 1980s, researchers in the field of operations management started to question the applicability of the trade-offs model and a broad literature emerged.

Arguably ever since the publication of Ferdows & de Meyer's (1990) seminal paper, any discussion on the topic of strategic trade-offs involves discussing at least one alleged competing

theory. In general, the proponents of rival concepts to Skinner's model view their proposals as legitimate alternatives that could supplant the trade-offs theory. For example, on the basis of their empirical analysis, Ferdows & de Meyer (1990, p.172) wrote that '… *or the trade-off theory itself has to be modified*'. Similarly, Collins *et al*. (1998, p.139) said that '[T]*he results support neither the trade-off nor the sandcone model*' while Roth (2006) affirmed that her proposed 'competitive progression' theory '[D]*efines capability progression in a way that differentiates it from traditional logic of trade-offs*'. Meanwhile, more recent studies have proposed that we need to move beyond the trade-off and cumulative capabilities models in order to give way to alternative models of operations strategy (e.g. Singh *et al*., 2015). While there have been a number of concepts that have attempted to supplant Skinner's model, it could be said that its most famous rival is the so-called 'cumulative capabilities' (or 'sandcone') model proposed by Ferdows & de Meyer (1990). According to Schmenner & Swink (1998), the trade-off and cumulative capability laws can be formulated as follows:

- *The Law of Trade-Offs*: A manufacturing plant cannot simultaneously have the highest levels of product quality, flexibility, and delivery, and the lowest manufacturing costs amongst all competitors.
- *The Law of Cumulative Capabilities*: Improvements in certain manufacturing capabilities (e.g. quality) are basic and enable improvements to be made more easily in other manufacturing capabilities (e.g. flexibility). The sequence that the law of cumulative capabilities is most comfortable with is quality, delivery, cost, and then flexibility.

Most literature has focused on supplanting the trade-offs law. In contrast, a first attempt to reconcile the alleged competing laws was presented by Schmenner & Swink (1998) using the concept of performance frontiers (e.g. Clark, 1996; Hayes & Pisano, 1996; Skinner, 1996). Schmenner & Swink (1998, p.108) explained that, if a company is far away from its performance frontier, many slack resources exist and the law of cumulative capabilities will be in effect, i.e. the company gains through synergy effects between different capabilities. By reducing slack resources, e.g. through the implementation of Lean Manufacturing, a firm approaches its performance frontier. Following the law of diminishing returns, more resources must be expended in order to achieve each additional increment in performance. At this point, trade-offs have to be made and, essentially, the law of trade-offs begins to take effect. While this explanation appears to be valid, we argue that it blurs the important difference between the

concepts of performance improvements and competitive position. When the trade-offs law and the law of cumulative capabilities are placed under greater scrutiny, it can be observed that the first one relates to the competitive position of a firm (i.e. its actual competitive capabilities), while the second relates to performance improvements (Sarmiento *et al*., 2013). Although it may be very easy for a badly performing company to achieve large performance improvements in terms of all competitive capabilities, a more competitive position does not necessarily follow. Improvements may simply close the existing competitive gap – firms are rarely able to "leapfrog" market leaders (e.g. Ferrier *et al*., 1999).

While the definition of the trade-offs law provided by Schmenner & Swink (1998) clearly refers to the competitive position of a firm in the marketplace, the explanation provided appears to address only the topic of internal performance improvement by individual firms. In our understanding, Schmenner & Swink (1998) thought to subsume both trade-offs and cumulative capability law under a single, more general law based on performance frontiers. In other words, as with most of the literature, the authors tried to supplant Skinner's trade-off law. In general, with only a few exceptions (e.g., Sarmiento & Shukla, 2011; Sarmiento *et al*., 2013), the potential existence of at least two types of trade-offs (external and internal) has not been discussed in the literature. In this study, we build on the potential co-existence of two trade-off laws, providing an explanation for (external) trade-offs in competitive position that supplements Schmenner & Swink's (1998) explanation of (internal) trade-offs in performance improvement.

3. METHODOLOGY AND UNDERLYING ASSUMPTIONS

Our study develops an argument based on deductive reasoning. Reasoning involves the relationship between a particular and a universal. Reasoning serves to connect these two levels of experience by articulating the grounds for their relationship (Aram & Salipante, 2003). If we reason from a particular to a universal then we speak about inductive reasoning. On the other hand, if we reason from a universal to a particular, as in our study, then we speak about deductive reasoning.

To the best of our knowledge, there is no methodological account of scientific reasoning, whether it be deductive or inductive. The normative criterion for assessing deductive reasoning is logical coherence within a system of statements (Mantere & Ketokivi, 2013). The best way of achieving this is via the use of formal language, but management theory is often only expressible

in natural language. Mantere & Ketokivi (2013) go so far as to claim that no theory about organizations is logically coherent in a normative sense. Management theory is therefore often based on implicit reasoning, which simply goes from the likeness of one case to another without explaining in what sense the likeness exists. In contrast, explicit reasoning occurs when the mind recognizes the relationship between two experiences and explains the nature of the relationship (Aram & Salipante, 2003).

Since our argument is based on implicit reasoning, we must illuminate the underlying logic instead of relying on formal language (Mantere & Ketokivi, 2013). Any evaluation of the deductive argument then centers on the transparency of the deductive chain of evidence – the creditability and plausibility of the theoretical 'story' presented. It is this narrative paradigm and its associated narrative rationality (Fisher, 1987) that builds the methodological background to our study.

3.1 Underlying Assumption

The assumption underlying our argumentation is that an organization's operational processes follow the first law of thermodynamics (the principle of energy conservation). This assumption is based on the following simple (Barbara) syllogism:

- Major Premise: All physical systems follow the first law of thermodynamics (the principle of energy conservation).
- Minor Premise: An organization's operational processes are physical systems.
- Conclusion: An organization's operational processes follow the first law of thermodynamics (the principle of energy conservation).

It is apparent that our assumption, and consequently the validity of our argumentation for a specific organization in practice, depends on the minor premise. If a company's operational processes are physical systems then our argumentation is valid. However, if a company's operational processes are not physical systems then our argumentation is not valid, since the process is not subject to the first law of thermodynamics. Our explanation of trade-offs is developed in the next section.

4. UNDERSTANDING EXTERNAL AND INTERNAL TRADE-OFFS

Performance frontiers, as proposed and explained by a number of previous authors, are helpful when attempting to understand the dynamics of strategic trade-offs. Yet a fundamental question has, to the best of our knowledge, not been addressed in the literature: What could be the underlying principle(s)/law(s) that define performance frontiers? If there is indeed a link between performance frontiers and trade-offs then posing this question may lead to a better understanding of why trade-offs exist. We propose to model performance frontiers differently. Following Krippendorff (1989), two simple but considerable, generalizable laws apply to the production-consumption cycle of a production system:

$$Energy\ used = work + reusable\ energ \quad + entropy \tag{1}$$

$$Raw\ material = organized\ matter + recycable\ waste + pollution \tag{2}$$

Equation (1) restates the first two laws of thermodynamics. The first law is a form of the principle of energy conservation. It states that the total energy of an isolated system remains constant. In other words, energy can neither be created nor destroyed, it can only be transformed. The second law of thermodynamics subdivides the total of the transformed energy into exergy (which is the maximum useful work) and entropy (which is an energy loss that can never be replaced). Equation (2) is the material analog of the first equation, given that pollution is here defined as a dispersion of matter that is impossible or too costly to reverse.

The first law of thermodynamics states that there is a natural limit on realizable attributes, which are the energy used and raw materials. In other words, one cannot get more out of a system than one puts into it. If there are only 10 hours of capacity, then one cannot have 10 hours of work output whilst also spending one hour on ensuring quality. This is the performance frontier. Meanwhile, work and organized matter represent the useful output of the process. This is the so-called operating frontier. The distance between the two – the performance and operating frontiers – has been considered ‘waste’ in the Toyota Production System (Ohno, 1988; p. 19) and consequently Lean literature. Eliminating this “waste” is the objective of performance improvement initiatives.

The law of cumulative capabilities deals with performance improvements within one organization, where a performance improvement is essentially the reduction of entropy or pollution (i.e. ‘waste’). In other words, a performance improvement can be defined as reducing

the gap between the operating and the performance frontiers. Here, *the law of diminishing returns* applies, which leads to the appearance of trade-offs when entropy is low since the probability of falling back into an unordered state increases with the orderliness of the system (Reichenbach, 1999). Nevertheless, this does not explain the law of trade-offs in terms of competitive position, i.e. across different companies, as put forward by Skinner (1969, 1996) and Schmenner & Swink (1998). This trade-offs law can be restated as: a company cannot have the lowest input (e.g. cost, energy consumption) at the highest output (e.g. quality, quantity, sustainability, responsiveness) across companies. It is apparent that, in an ideal system where at least two companies have no waste, this statement is necessarily true. If input is equal to output then it is logically impossible that one firm has a higher output than the input of the other firm. This is a direct consequence of *the first law of thermodynamics*. Another important point is that this law of trade-offs increases in validity with reduced entropy/pollution (i.e. 'leanness') across companies. Both trade-offs laws are summarized in Table 1 before some major consequences for existing research streams are discussed in the next section.

[Take in Table 1]

5. DISCUSSION

This section elaborates on three important aspects from the broader manufacturing strategy literature that appear to be impacted by our trade-off laws. First, Section 5.1 discusses their relationship with the resource-based view of the firm (see, e.g. Herbane (1997) for a review), extending the study by Vastag (2000). Second, Section 5.2 deals with the capabilities to which trade-offs laws apply, extending the classical set of cost, quality, delivery and flexibility by focusing on sustainability and innovativeness. Third, Section 5.3 addresses the relationship between trade-off laws and the concept of strategic choices, highlighting that trade-offs are a law (and not a choice) that restricts the set of possible choices and thus causes strategic choices. Finally, Section 5.4 summarizes and links the major points raised during our discussion.

5.1 The Resource-based View of the Firm

Vastag (2000) recognized that the focus of Schmenner & Swink's (1998) contribution was at the 'within-firm' level rather than the 'between-firms' context. Yet, the author did not recognize that Schmenner & Swink (1998) actually explained internal trade-offs instead of external trade-offs.

Rather, Vastag (2000) extended the discussion on performance improvements across two firms. More specifically, the author argued that the operating frontier (and not the asset frontier) is the source of sustained competitive advantage since it is often based on intangible resources, which typically demonstrate causal ambiguity making them difficult to imitate and/or substitute (Reed & Fillippi, 1990). Thus, Vastag (2000) integrated the resource-based view of the firm into the theory advanced by Schmenner & Swink (1998) to explain performance improvements. While internal trade-offs are necessary, there is a significant difference between resources that can be acquired through the improvement effort. The focus should be on unique resources. But how does a sustained, superior competitive position interlink with Skinner's trade-off law (i.e. external trade-offs)?

According to Barney (1991, p. 102), a firm has competitive advantage when it implements a value-creating strategy that is not simultaneously implemented by any of its competitors; and it obtains a sustained competitive advantage when the competitors are unable to duplicate and or substitute away the benefits gained from this value-creating strategy. In other words, a unique value-creating resource or bundle of resources *and* sufficient isolating mechanisms to deter or limit imitation, emulation, or substitution are the key to sustained competitive advantage. External trade-offs assume that there are competitors; but this competition is significantly questioned in the context of sustained competitive advantage as defined by Barney (1991). In fact, the external trade-offs law cannot be applied if a new value-creating strategy results in a new market and a single market position (i.e. a monopoly). This particular situation could also have important consequences for the competitive capabilities to which the external trade-offs law applies, and this will be discussed next.

5.2 Competitive Capabilities Impacted by the Trade-offs Laws

Most of the literature on trade-offs refers to the four 'classical' capabilities of cost, quality, delivery, and flexibility. Yet it has recently been suggested that capabilities such as innovativeness and sustainability play an increasingly significant role, influencing the performance and competitiveness of a firm. Both will be discussed in Section 5.2.1 and 5.2.2, respectively.

5.2.1 Innovativeness and Trade-Offs

Innovation and entrepreneurship are major drivers of sustained competitive advantage (Teece, 2007). Both may weaken external trade-offs and, if a single market position results, a firm may *not* even be subject to it. Meanwhile, the external trade-offs law remains valid if innovation is incremental and occurs simultaneously at more than one firm. The internal trade-offs law applies in the long run; yet, at a given moment, a major innovation can be created without any effort (e.g. by 'luck'). In fact, serendipitous innovation is prevalent across industry, country, and market contexts (cf. Dhanaraj & Parkhe, 2006). So, our trade-off laws only partly apply to innovativeness and the creative processes it involves.

5.2.2 Sustainability and Trade-Offs

As corporate governance of the firm has evolved, a broader set of stakeholders has emerged demanding more than just improved operational and financial performance (e.g. Johansson & Winroth, 2010; Green *et al*. 2015). In particular, stakeholders have sought a balance between enterprise value creation and societal value creation. This balance has manifested into movements (e.g. sustainability) and metrics (e.g. the Triple Bottom Line). In this context, the literature on sustainability has debated whether trade-offs are necessary between the economic, social, and environmental elements of the triple bottom line. While some authors have argued that it is not possible to excel in all elements of the triple bottom line, others claim that improvements in environmental and social performance may have immediate costs but can lead to financial gains in the longer term (e.g. Hahn *et al*., 2010; Wu & Pagell, 2011; Figge & Hahn, 2012; Longoni & Cagliano, 2015). Our analysis suggests that:

- There can be performance improvements in all three measures of the triple bottom line; however, the better a company's performance, the more difficult further improvement becomes (internal trade-offs).
- A company cannot have the lowest expenditure of resources or input (e.g. be the most environmentally friendly) at the highest output if there are at least two companies with similar 'waste' levels. Of course, if a company is unique in its sustainability efforts, or incorporates unique sustainability initiatives, then these efforts/initiatives could be understood as 'innovations', and their impact on the external trade-offs law would be akin to that explained in Section 5.2.1.

In addition, it is apparent that the resource-based view of an organization also applies to sustainability. It is the sustainability of the resources acquired that determines the actual competitive position (in terms of sustainability) of a firm. Hence, it is a question of which resources to choose. The link between strategic choices and the trade-off laws will be discussed next.

5.3 Trade-Off Laws and Strategic Choice

As early as 1972, Child (1972, p.2) criticized existing strategy theory because: '…*it fails to give due attention to the agency of choice by whoever have* [has] *the power to direct the organization*'. Trade-off laws do not determine strategic choices, simply because strategic choices are a choice (and not a law). Trade-off laws are the reason for the existence of strategic choices since they limit the set of possible choices. They are the reason for making choices, since otherwise the best strategic choice would be to have it all. We argued in Section 4 that the strength of a trade-off law is dependent on the 'leanness' of the company. This statement can now be further qualified by defining the strength of a trade-offs law in terms of the restriction that it imposes on the possible choices.

Business success – i.e. selling the product/service offering to the customer – depends on making the choice the customer values. Therefore, it is possible that the trade-off laws are not the defining factor when it comes to explaining successful firms. For example, a very badly performing company that has to make many trade-offs may choose the 'right' trade-off while a much better performing firm that has to make few trade-offs may choose the 'wrong' trade-off resulting in less business success than was potentially possible. A further complicating factor is that most customer decisions are subject to bounded rationality. So even for the hypothetical case that a company has no trade-offs and can offer everything, a customer may choose a different, far worse-performing company. Still, as long as the strategic trade-off laws satisfactorily explain phenomena that occur in the everyday world (Sarmiento *et al*., 2016), decision-makers should take into account its dictates and implications in order to augment the probabilities of implementing a strategy that will result in a successful company.

5.4 Summary Discussion

Our discussion has highlighted that while internal trade-offs govern performance improvements, there are differences between the resources/capabilities acquired. The resources/capabilities

acquired should be those that support a firm in sustaining a competitive position and, ideally, create competitive advantage. As witnessed in the literature, it comes as no surprise that the process of creating a capability (performance improvement) should involve creating the 'right' capability (competitive position). This is also known as strategic alignment. Additionally, the concept of *sustained* competitive advantage could be clarified by our analysis; a *unique* position makes the external trade-offs law not applicable since it is based on a relationship between a set of firms. Our discussion also introduced the idea of the strength of a trade-off law. A trade-off law is weakened if it imposes fewer restrictions on the strategic choices that have to be made. However, we have also highlighted that fewer restrictions on strategic choices do not imply that the 'right' choices – in the sense of winning the customer – are made. It could be that trade-off laws are not the defining factor that explains business success. In general, having sustained competitive advantage means an organization is more likely to have greater business success, but this is not a necessity.

Finally, while we argue that trade-off laws apply to the 'classical' capabilities of cost, quality, delivery, and flexibility and new capabilities such as sustainability, it appears to only partly apply to innovativeness. Innovativeness is a key to gaining a *unique* market position and thus to gaining sustained competitive advantage. The situation of a unique market position makes the external trade-offs law not applicable. Meanwhile, it remains unclear whether the creative processes that underpin innovativeness are subject to the law of diminishing returns. This questions the validity of internal trade-offs, but further research is required to explore the role of trade-offs in creative processes.

6. CONCLUSION

A major, prevailing question in the manufacturing strategy literature is: Do manufacturing firms have to necessarily compromise on one competitive aspect of their operations (e.g. on-time deliveries) in order to favor others (e.g. production cost or quality)? This is the essence of the strategic trade-offs debate. While some authors have argued for the pursuit of a specific set of capabilities at the expense of others, there are other authors who have argued for the pursuit of all capabilities in a sequential manner. These two trenches of opinion are poles apart and leave managers in practice at a loss with regards to what strategy to adopt. There appears to be the implicit assumption in the literature that there is only one law, which is to supplant the existing

trade-offs law. In contrast, we contribute to the literature by reaffirming the idea/proposal that there are at least two distinct types of trade-offs laws that affect all firms: one ('internal') can be understood following the dictates of the law of diminishing returns, while the other ('external') can be modeled utilizing the principle of energy conservation. Thus, we submit that this dual-law logic resolves the persistent trade-off debate. To the best of our knowledge, ours is the first study that attempts to understand the topic of strategic trade-offs based on the principle of energy conservation. Further insights are provided by discussing the impact of both trade-off laws on the resource-based view of the firm, on new capabilities such as sustainability and innovativeness, and on key strategic choices. For example, we argue that having a unique market position, which defines sustained competitive advantage, makes the external trade-offs law not applicable. This also underscores the importance of innovativeness, which aims to create a unique market position. We now close the paper with the most important managerial implications and future research directions.

6.1 Managerial Implications

Trade-off laws do not determine which trade-off to make. Rather, trade-off laws limit the set of strategic choices that can be made – they are the reason for strategic choices. In other words, trade-off laws do not determine that quality needs to be improved over improving delivery times, they just determine that a trade-off has to be made. Internal trade-offs in performance improvements have to be made in each individual company. The better a company performs, the stronger the trade-offs that have to be made due to the law of diminishing returns. This means that decisions concerning which performance attributes to improve become more important in high-performing firms. External trade-offs in competitive position only have to be made if there is more than one company competing for the same market. This highlights the importance of gaining a unique market position, e.g. through innovation.

6.2 Limitations and Future Research Directions

In terms of trade-offs, two major avenues for future research have emerged:

- *Investigating the Contingency Factors of Trade-Offs:* We have argued that there is a strength involved in trade-off laws. In other words, a trade-off law is not always true or false but contingent on environmental factors such as the 'leanness' of a company (or of companies).

Exploring this link between Lean Manufacturing (and/or other contingency factors) and trade-offs is a major avenue for future research.

- *Corroborating the Trade-Offs Law:* Our study did not attempt to falsify the trade-offs law and consequently does not corroborate it. The trade-offs law on competitive position, as put forward by Skinner (1969, 1996), is a deterministic law. Thus, it cannot be falsified by probabilistic models or methods (Sarmiento, 2013). This disqualifies a large body of research that sought to falsify this trade-offs law. We therefore took a different approach and sought to explain *why* trade-offs exist rather than exploring *whether* they exist. This sheds important light on the contexts in which the trade-offs law is likely to be falsified (if there is only one well-performing firm in a set of otherwise poorly performing firms) and in which it is tautological, i.e. always true (such as if there is more than one well-performing firm with the same level of 'leanness'). However, empirical case study research is required to corroborate our contention.

Finally, a major limitation of our study is that it only represents our interpretation. Reasoning is always to a certain degree idiosyncratic and contextual (Mantere & Ketokivi, 2013). We sought to remedy this by presenting the paper to experts and colleagues for their opinion, which triggered a lively debate that significantly benefitted our manuscript; however, a broader debate concerning the *why* of trade-offs is needed. This especially relates to our claims on the consequences of our findings for the resource-based view of the firm, new capabilities such as sustainability and innovativeness, and strategic choices put forward in the discussion section. Thus, further research is called for in the future to support or refute our claims.

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Table 1: Summary of the Two Trade-Off Laws Identified in this Study

	Trade-Off Law I (External Trade-Offs)	**Trade-Off Law II (Internal Trade-Offs)**
Explained by?	First law of thermodynamics (principle of energy conservation)	Law of diminishing returns
Process or State?	Competitive position – the actual competitive capability of a firm at a certain **point in time**	Performance improvement – a process of gaining a competitive position; improvement is the change in competitive position during a certain **time interval** (which could be negative, i.e. performance deterioration)
Level of Analysis?	Between at least two firms competing for the same market (i.e. a set of firms); the competitive position compared to other firms determines the competitive advantage of a firm	Within each individual firm; performance improvements can be compared to other firms but greater improvement does not imply a competitive advantage