The relationship among socio-environmental practices, competences and operational performance: an empirical study

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Abstract  
Based on the resource-based theory, it was proposed a model that evaluates the relationship between socio-environmental practices and operational capabilities in order to achieve operational objectives. The sample had 170 manufacturing firms and data were analyzed with SEM. The results supported that resources mediate these relationship and increase performance.

Keywords: Resource-based theory, Operational capabilities, Socio-environmental practices, Mediation.

1 Main subject text  
The investment required for the implementation of social and environmental practices may represent an increase in costs and decline in operational performance (Angell and Klassen, 1999, Carter and Rogers, 2008, Elkington, 1998, Pagell and Wu, 2009, Parmigiani et al., 2011, Pullman et al., 2009, Sarkis and Cordeiro, 2001). Hart and Dowell (2011) focus on operational capabilities, with pollution control initiatives that may offer better levels of productivity. It is notable that empirical analysis shows that the relationship between operational practices and the highest levels of operational performance is considered imprecise, i.e., the successful implementation of an organization’s best practices does not mean that this event can be repeated in other companies (Benner and Tushman, 2003, Flynn et al., 1995, Mackelprang and Nair, 2010, Swink et al., 2005).
In this context, Teece and Pisano (1994) argue that organizations should not be viewed only as resources, but as a group of capabilities and competencies that must be managed, evaluated, built and developed. In this way, the implementation of best practices and capabilities promotes an increase in an organization’s operational performance, and provides a competitive edge over competitors by presenting valuable, rare, irreplaceable and hard-to-imitate factors (Hayes and Wheelwright, 1984, Hayes and Pisano, 1996, Hart and Dowell, 2011, Schroeder et al., 2002).

Therefore, the relevance of this work may be verified by the opportunity, within the theme of manufacturing strategy, to evaluate and contribute to the relationships and synergies in operational practices, capabilities and operational performance in a socio-environmental context (Corbett and Klassen, 2006). The theoretical framework used is the Resource-Based View (RBV) and Natural Resource-Based View of the firm (NRBV) to show the role of resources and capabilities in organizational strategy (Barney, 1991, Grant, 1991, Hart, 1995, Hart and Dowell, 2011, Sarkis et al., 2011, Wernerfelt, 1984).

In this way, the subject, sustainability proves to be very important in the operations area (Hutchins and Sutherland, 2008). However, the studies that consider practices with performance and the role of capability mediating the path between practices and performance were very few (Christmann, 2000, Hart and Dowell, 2011, Narasimhan et al., 2005, Sharma and Vredenburg, 1998, Wang and Ahmed, 2007, Wu et al., 2010).

Considering the relevance of the topic to academia, the problems of this research were formulated: Among environmental and social practices, which of them really offer significant effects on operating performance criteria?; Analyzing the environmental and social practices, which of them contribute to the formation of operational capabilities?; Can the operational capabilities, in the role of mediation, leverage the performance of practices before the performance criteria do so?

1.1 Enabling superior performance
The previous presentation of the Resource-Based Theory (RBT) proposes that organizations are bundles of resources and capabilities, and, accordingly, in order to attain a competitive advantage, these elements must be valuable, rare, not imitable and not substitutable (VRIN) (Barney, 2001, Barney et al., 2011). However, organizational theories are ambiguous in defining the ways to achieve these rare, valuable, non-imitable and non-substitutable resources, and, therefore, gain a competitive advantage (Priem and Butler, 2001).

Also Priem and Butler (2001), in this scenario, validate the relevance of the empirical approach to understanding the theories and make them generalized, and not a spurious event. In this sense, the authors state that the RBT does not present the mechanisms that differentiate the strategic resources from non-strategic ones, and it does not distinguish between the concepts of "value" and "competitive advantage".

In this sense, resources, practices and organizational capabilities are conceived, the latter of which represents ways to improve the coordination and promotion of the manufacturing area resources, for them to be used in such a way that they meet the desired conditions (VRIN) (Flynn et al., 1995, Gagnon, 1999, Ketokivi and Schroeder, 2004, Powell, 1995, Shah and Ward, 2003, Wu et al., 2010).
Resources: These represent “the stocks of available factors” (Amit and Schoemaker, 1993, p.35) and symbolize the basis of the organization (Penrose, 1959). Wang and Ahmed (2007, p.6) argue that “they represent “the zero order” element of the hierarchy”. The author emphasizes the capacity of this instrument to gain a sustainable advantage for a short time. In this way, they claim there is a difference between resources and capabilities.

Practices: These represent bundles of systemic activities – for example, TQM, JIT, environmental and social practices, with a specific goal, which the managers can or cannot use in their companies (Flynn et al., 1995, Voss, 1995). In this way, Voss et al. (1997) assert that on operational practices and the impact on operational performance are supported by the fact that competitors may enable new strategies through prior learning and / or taking advantage of benchmark.

Capabilities: A set of skills in an organization that can be improved and developed over a period, are necessary to achieve product differentiation against competitors, and allow satisfaction of customers’ needs through an infrastructure that is difficult to imitate (Dierickx and Cool, 1989; Swink and Hegarty, 1998). Amit and Schoemaker (1993) define the capabilities as learning processes related to manufacturing, delivery, coordination of suppliers, establishment of quality standards, achieving shorter lead times, new product development and also complex social interactions among the company's resources.

Thus, concluding the topics on practical and operational knowledge within a socio-environmental context, it is worth noting that the companies able to transform the manufacturing function into a source of competitive advantage are those that know how to use the various improvement programs, such as JIT, TQM and TPM.

Additionally, the emphasis on operational capabilities for operations strategy reaffirms the important role of manufacturing in organizations, and suggests new ways in which this can contribute to competitive success (Hayes and Pisano, 1996). Contextualizing with sustainability, Kleindorfer et al. (2005) proposed a model for the level of importance of the production area compared to the business strategy of the organization, originally proposed by Hayes and Wheelwright (1995).

1.2 Method
The method used in this article was a bibliographic review, followed by explanatory research, analysis of the contents of the articles about the main topics: resource-based theory (RBT), natural resource-based view (NRBV), social and environmental practices, operational capabilities and manufacturing performance criteria.

In the first instance, the objective was to examine a great number of articles, mainly those called seminal as well as those from topic journals. The second moment consisted of an analysis of the relationship among the constructs judged and investigating the relationship among them. The authors analyzed how and which practices could affect performance.

In this way, a survey was employed for data collection (Malhotra and Grover, 1998). The evaluation scales of the perception of the level of implementation of the operational, environmental and social practices and the operational capabilities were based on previously utilized scales. Factorial analysis was utilized to validate the multi-item constructs and the respective indicators (Bagozzi and Yi, 2012).
1.3 The Concept Model and Research Hypotheses

Figure 1 shows the main constructs: social practices (SPR), environmental practices (EPR), operational capabilities (OCA) and, finally, operational performance (OPE). In this context, we present the research hypotheses, and, in addition, research the reports on prior empirical work:

![Conceptual model and research hypotheses](image)

**Figure 1: Conceptual model and research hypotheses**

<table>
<thead>
<tr>
<th>Description of the construct</th>
<th>Definition</th>
<th>Main bibliographic sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental practices (EPR)</td>
<td>Planning, developing and implementing industrial processes that minimize or eliminate loss, reduce waste, allow safe operation and seek to develop products that are recyclable, or may be remanufactured or re-utilized</td>
<td>Melnyk <em>et al</em>., 2003; Klassen and Whybark, 1999; Sarkis, 1995; Zhu and Sarkis, 2004.</td>
</tr>
<tr>
<td>Social practices (SPR)</td>
<td>Recognizing and measuring the initiatives for the development, safety and health of the collaborators and the guarantee of working conditions that offer dignity to the labor in organizations in the manufacturing area engaged with social responsibility</td>
<td>Ahmad and Schroeder, 2003; Brown; 1996; Brown <em>et al</em>., 2000; Dailyand Huang, 2001; Das <em>et al</em>., 2008; Pagell and Gobeli, 2009; Pullman <em>et al</em>., 2009</td>
</tr>
<tr>
<td>Operational capability Cooperation (OCC)</td>
<td>Presenting the “integration” between the organization and its environment. For such, it is necessary to develop the skill of “internalizing” the data and information correlated to the environmental practices. This requires investment that propitiates increased capacity to process the data and information in organizations: (i) management information systems; (ii) creation of multifunctional teams.</td>
<td>Flynn and Flynn, 1999; Flynn <em>et al</em>., 2010; Hart, 1995; Klassen and Vachon, 2003. Vachon and Klassen, 2008; Wu <em>et al</em>., 2010.</td>
</tr>
<tr>
<td>Operational capability of continuous</td>
<td>Reporting on the importance of the successive improvements to meet the demands of the current clients. This occurs through continuous evaluation of</td>
<td>Benner and Thusman, 2003; Christmann, 2000; Hart, 1995.</td>
</tr>
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</table>
### Description of the construct

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>improvement (OCI)</td>
<td>the organization’s processes, products and services.</td>
<td>Peng et al., 2008; Sharma and Vredenburg, 1998.</td>
</tr>
<tr>
<td>Operational performance (OPE)</td>
<td>Evaluating, by means of comparison of the interviewee's plant performance index in relation to those of other companies in the sector, in accordance with the four performance dimensions utilized in the operations strategy, as follows: (i) cost performance; (ii) consistent quality; (iii) delivery performance; and (iv) flexibility in the product mix and customization.</td>
<td>Cua et al., 2001; Narasimhan et al., 2005; Wu et al., 2012.</td>
</tr>
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</table>

### 1.4 Analysis data

Based on the data, it can be affirmed that, in all the variables, there is a positive linear correlation, as the values obtained for the coefficients are greater than zero. It can be stated that the majority are above 0.3 and not greater than 0.7, in module, thereby guaranteeing initial singularity in the representation (HAIR et al., 1998, KLINE, 2005). However, there is a limitation due to the non-normality of the arithmetic means on the part of the data referring to the constructs.

The Kaiser-Meyer-Olkin (KMO) test presented a value of 0.859, which, according to Hair et al. (1998), indicates that the sample is adequate for the factorial analysis. With regard to the Bartlett sphericity test, the level of statistical significance obtained was 0.000 ($p$-value $< 0.001$), indicating that there are correlations and that these are significant among the existing variables.

For evaluation of the model measuring the validity and reliability, factorial confirmatory analysis (AFC) of the constructs and their respective items was proposed. For this, a database with 170 respondents was utilized, and the method of estimation was the Maximum Likelihood Estimate (MLE) with the AMOS 18.0 software (Byrne, 2010).

In order to conform to the presupposition regarding the ratio 5:1 between the number of questionnaires and the number of parameters to be estimated, two nested models were utilized with the following latent variables: the first containing the environmental and social practices, and the operational capabilities; the second, the performance criteria (Bagozzi, Yi, 2012, Koufteros, 1999).

Firstly, there was evaluation to determine which items of the model presented modification indexes with a loading greater than 15, and also with regard to the residuals of the standardized covariances with values above $|2.54|$ (Hair et al., 1998).

So that all the indicators were identified, a standardized factorial loading ($\lambda$) greater than 0.7 and with statistical significance ($p$-value $< 0.01$) was utilized. For the constructs and respective indicators, the following were validated: the composite reliability greater than 0.7; the mean extracted variance (AVE) greater than 50%, characterizing a variance explained by the construct greater than the measurement error. Simultaneously, for the indicators of the revised model, the Cronbach alpha was measured, and it was proven that all the constructs present values greater than 0.7. In order to support the discriminant validity, the Fornell and Lacker (1991) method was utilized, it proved that the values of the mean extracted variances are greater than the determination coefficients.

Through the indexes of absolute and incremental adjustment, it was sought to prove the adequacy of the models, as all the values are below the indexes considered as reference ($\chi^2$; CFI,
GFI; TLI; RMSEA) (Byrne, 2010; Hair et al., 1998; Kline; 2011). With regard to the analysis of the common variance, the model obtained with the Harman single factor is worse than the revised model, corroborating that there is no bias in the responses, as the research has a single respondent per unit of response (Podsakoff and Organ, 1986; Podsakoff et al., 2003).

### 1.5 Main results

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Independent variables</th>
<th>Dependent variable</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1a</td>
<td>EPR - Environmental practices</td>
<td>CPE - Cost performance</td>
<td>Supported</td>
</tr>
<tr>
<td>H1b</td>
<td>EPR - Environmental practices</td>
<td>CQI - Conformity quality</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H1c</td>
<td>DPE - delivery performance</td>
<td>Not Supported</td>
<td></td>
</tr>
<tr>
<td>H1d</td>
<td>FPE - Flexibility performance</td>
<td>Supported</td>
<td></td>
</tr>
<tr>
<td>H2a</td>
<td>SPR - social practices</td>
<td>CPE - Cost performance</td>
<td>Supported</td>
</tr>
<tr>
<td>H2b</td>
<td>SPR - social practices</td>
<td>CQI - Conformity quality</td>
<td>Supported</td>
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<td>Not Supported</td>
<td></td>
</tr>
<tr>
<td>H3a</td>
<td>EPR - Environmental practices</td>
<td>OCC - Operational capability cooperation</td>
<td>Supported</td>
</tr>
<tr>
<td>H3b</td>
<td>EPR - Environmental practices</td>
<td>OCI - Operational capability improvement continuous</td>
<td>Supported</td>
</tr>
<tr>
<td>H4a</td>
<td>SPR - social practices</td>
<td>OCC - Operational capability cooperation</td>
<td>Supported</td>
</tr>
<tr>
<td>H4b</td>
<td>SPR - social practices</td>
<td>OCI - Operational capability improvement continuous</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H5a11</td>
<td>EPR + OCI</td>
<td>CPE - Cost performance</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H5a12</td>
<td>EPR + OCI</td>
<td>CQI - Conformity quality</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H5a13</td>
<td>EPR + OCI</td>
<td>DPE - delivery performance</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H5a14</td>
<td>EPR + OCI</td>
<td>FPE - Flexibility performance</td>
<td>Supported</td>
</tr>
<tr>
<td>H5a21</td>
<td>SPR + OCI</td>
<td>CPE - Cost performance</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H5a22</td>
<td>SPR + OCI</td>
<td>CQI - Conformity quality</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H5a23</td>
<td>SPR + OCI</td>
<td>DPE - delivery performance</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H5a24</td>
<td>SPR + OCI</td>
<td>FPE - Flexibility performance</td>
<td>Not Supported</td>
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<tr>
<td>H5b11</td>
<td>EPR + OCC</td>
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</table>

**Chart 2: Summary of the research hypotheses**

In conclusion, the environmental practices provide a direct influence on the criteria of cost efficiency as well as operational flexibility, and, in the presence of idiosyncratic features of continuous improvement, the explained variance increased more than 130%. Regarding the study
of social practices, it provided an explained variance for all performance criteria, except the criterion of flexibility. In the presence of cooperation capability, internally and externally, there is total mediation (Baron and Kenny, 1986).

1.6 Discussion
The results found suggest that the environmental practices create positive, statistically significant effects on the competitive criteria of **cost** and **flexibility**. Therefore, it can be stated that the companies in the sectors researched – metal-mechanical, chemicals and food – can seek support in these practices to achieve growing cost performance or create differentiation in the market.

Analyzing the other aspect related to the triple bottom line (3BL) (Elkington, 1998), the results suggest that the **social practices** have a significant influence on the competitive criterion, quality. In this sense, actions, such as internal integration, re-evaluation of remuneration work safety are important for the supply of goods and services within the expected quality standards. In addition, the social practices positively and significantly influence the operational capabilities of cooperation, reinforcing the idea that the existence of employees who work in a safe, healthy and competitive environment, favors the development of idiosyncratic resources, difficult for competitors to copy.

Regarding the role of mediation of the operational capabilities, the results indicated the importance of the capability of **continuous improvement** in the relation between environmental practices and **flexibility performance**. Thus, initiatives related with quality improvement, preventive and autonomous maintenance, when combined with the environmental practices, can lead companies to greater performance in aspects, such as the product mix, swifter response and also product customization.

As regards the capability of **cooperation**, investments that propitiate increased capacity for data and information processing, and training of multifunctional teams, can shorten the path to be followed for the company to improve its **cost performance** when combined with **social practices**. In this manner, these capabilities indicate the capacity of the company to draft contracts and devise informal mechanisms in order to align incentives, increase sharing and generate common objectives among the links of the supply chain.

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