Organizational task environment: evidence from the Brazilian industry

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Abstract

Purpose – Using the industry as an approximation of the external environment of companies, Dess and Beard proposed the construct organizational task environment (OTE). If the precision of the definition of industry is desirable, it involves a multiplicity of elements that restrict the ability of generalization. This paper aims to contribute by identifying clusters of industries with similar environmental profiles. As the discriminant validity of the OTE construct was tested only by Harris in US manufacturing industry, not supporting it, this study also seeks to contribute by assessing the OTE construct validity for the Brazilian manufacturing industry.

Design/methodology/approach – Authors collected data from all manufacturing sectors in Brazil, between 1996 and 2003; they used confirmatory factor analysis with the multi-trait multi-method matrix approach to assess the construct validity and ran environmental dimensions' factorial scores through the cluster analysis to find out natural groupings of industries.

Findings – The results support the convergent and discriminant validity of the construct OTE, suggesting that further replication should be conducted in the US economy and in different economic contexts.

Research limitations/implications – The study identified four groups of industries with similar environmental conditions, increasing possibilities of generalization of researches. The limitations stem from measurement in an extended period of time and not measuring changes in the environment.

Practical implications – To expand the analytical capabilities of managers for decision making on the sharing of skills between businesses in different industries.

Originality/value – The main contributions of this work are to further discussions on the validity of the OTE construct and to identify industrial clusters of homogeneous environments.

Keywords Strategy, Competitive strategy, Environment, Industry, Corporate strategy

Paper type Research paper

Resumen

El propósito – Usando la industria como una aproximación del ambiente externo, Dess y Beard propuso lo constructo ambiente de tarea de la organización (OTE). Si la precisión de la definición de la industria es deseable, se trata de una multiplicidad de elementos que restringen la generalización. Este documento tiene como objetivo contribuir mediante la identificación de grupos de industrias con similares características ambientales. Como la validez discriminante del constructo OTE ha sido probado sólo por Harris en la industria manufacturera de EE.UU., no lo apoyando, este estudio también tiene como objetivo testar la validez de constructo OTE en la industria manufacturera brasileña.

Metodología – Los autores recopilaron datos de todos los sectores de manufactura en Brasil, entre 1996 y 2003, y utilizaron el análisis factorial confirmatorio con la abordaje de la matriz multirrasgo-multimétodo para evaluar la validez del constructo OTE y realizaron un análisis de cluster con las puntuaciones de los factores de la dimensión ambiental a encontrar agrupaciones naturales de las industrias.

Management Research: The Journal of the Iberoamerican Academy of Management
Vol. 11 No. 3, 2013
pp. 280-304

1536-5433
DOI 10.1108/MRJIAM-02-2013-0500

Los resultados – Los resultados apoyan la validez convergente y discriminante del constructo OTE, lo que sugiere que nuevas replicaciones se deben realizar en la economía de los EE.UU. y en diferentes contextos económicos.

Las limitaciones/Implicaciones de la investigación – El estudio identificó cuatro grupos de sectores con condiciones ambientales similares, lo que aumenta las posibilidades de generalización de la investigación. Las limitaciones se derivan de la medición en un período de tiempo prolongado y no medir los cambios en el ambiente.

Las limitaciones/implicaciones prácticas – Ampliar las capacidades analíticas de los administradores para la tomada de decisiones sobre el compartimiento de competencias organizacionales entre los negocios en diferentes industrias.

La originalidad/el valor – Las principales contribuciones de este trabajo son para ampliar las discusiones sobre la validez del constructo OTE y identificar los clusters industriales en ambientes homogéneos.

Palabras clave Teoría de la organización, las dimensiones del ambiente externo, el ambiente de tarea de la organización, la validez de constructo, la estrategia corporativa, la gestión estratégica

Tipo de artículo Artículo de investigación

Resumo

Propósito/Objetivo – Usando o setor como uma aproximação do ambiente externo das empresas, Dess e Beard propuseram o construto ambiente de tarefa organizacional (OTE). Se a precisão da definição do setor é desejável, ela envolve uma multiplicidade de elementos que restringe a capacidade de generalização. Este trabalho busca contribuir pela identificação de agrupamentos de setores com perfis ambientais similares. Como a validade discriminante do construto OTE foi testada somente por Harris na indústria de manufatura americana, não a suportando, este estudo também tem como objetivo testar a validade do construto OTE na indústria de manufatura brasileira.

Metodologia – Os autores coletaram dados de todos os setores de manufatura brasileiros, no período entre 1996 e 2003; usaram a análise fatorial confirmatória com a abordagem da matriz multi-traço multi-método para avaliar a validade do construto OTE e executaram a análise de cluster a partir dos escores fatoriais das dimensões ambientais para achar agrupamentos naturais de setores.

Resultados – Os resultados suportam a validade convergente e discriminante do construto ambiente, sugerindo que novas replicações devem ser conduzidas na economia americana e em diferentes contextos econômicos.

Limitações/Implicações da investigação – O estudo identificou quatro grupos de indústrias com condições ambientais similares, ampliando as possibilidades de generalização das pesquisas. As limitações derivam da medição em períodos de tempo longos e a não mensuração de variações no ambiente.

Limitações/Implicações práticas – Expandir as capacidades analíticas dos gestores para a tomada de decisão sobre o compartilhamento de competências organizacionais entre negócios em indústrias diferentes.

Originalidade/Valor – As principais contribuições deste trabalho são avançar as discussões sobre a validade do construto OTE e identificar agrupamentos industriais com ambientes homogêneos.

Palavras-chave – Teoria das Organizações, dimensões do ambiente externo, ambiente de tarefa organizacional, validade de construto, estratégia organizacional, gestão estratégica

Tipo de artigo Psequisa teórico-empírica

The external environment approach to the study of organizations has been gaining in importance since the late 1950s, when the ideas of systems theory introduced the environment concept. Since then, the environment is accepted as exercising an influence, with an interest in exploring the ways in which this influence functions within organizations (Hatch, 1997; Bataglia and Meirelles, 2009).

The importance of the external environment for strategic management may be perceived through the five forces proposed for industrial analysis by Porter (1985), based on the structure-conduct-performance model of the industrial organization. Even the resource-based view (RBV) approach, which identifies potential sources of competitive advantages among internal corporate resources, acknowledges the importance of the environment, as this determines the value of the resources and the capacity to imitate or substitute them among the competitors (Barney, 2002). However, the difficulty in the strategic management field with regard to the environment construct is quite clear. Researchers in this field have used the concepts and measurements of the external environment in an inconsistent manner, in their empirical studies. At one extreme, there are works that include multiple industries and do not control for differences in their environments, while others consist of studies examining only one industry, with obvious constraints on generalization (Chang and Singh, 2000; Dess *et al.*, 1990; Hawawini *et al.*, 2003; Rumelt, 1982).

The absence of consensus about the measurement of the external environment in the literature on the theory of organizations worsens this situation (Boyd, 1995). The various theoretical environmental approaches that have arisen in management under the influence of the systems theory, such as organizational ecology (Hannan and Freeman, 1977) and structural configurations theory (Mintzberg, 1979), conceptualize and measure the environmental dimensions in differing ways, resulting in different or inconsistent findings among the studies, or even the impossibility of comparing their outcomes (Rasheed and Prescott, 1992).

Aiming to contribute to this situation, Dess and Beard (1984) proposed a measurement procedure for the characteristics of the objective environment, i.e. the set of external objective components (concrete in nature) with which the organization interacts (e.g. consumers, suppliers, competitors, regulatory agents). These authors proposed and tested exploratively three dimensions for characterizing the environment: munificence, complexity and dynamism. However, their measurement model used the industry as a proxy to the environment. If the precision of the definition of the industry is desirable, it involves a multiplicity of elements that offer a limited generalization capacity and the number of variables turns research impracticable. For example, the Brazilian industry classification, the Brazilian National Economics Activities Classification Code (CNAE 1.0), has approximately 286 different industries for the manufacturing industry at five-digit level and the American industry classification, the North American Industry Classification System (NAICS), has about 470 different industries for the manufacturing industry at six-digit level. As a facilitating procedure, one could use groups of industries at two-digit level. Nevertheless, they put together industries by technological criterion only, with no meaning for the strategic or organizational analysis.

This work strives to contribute by finding out groups of industries with similar environmental dimensions (munificence, complexity and dynamism). The identification of homogeneous environmental groups of industries widens the possibilities of design and generalization of research in the strategy and organizational areas. Besides, it allows the practitioner to identify similarities among businesses located in different industries, underpinning the corporate strategy decision making about sharing experiences and competences between businesses, enabling inter-temporal economies of scope as proposed by Helfat and Eisenhardt (2004).

However, in spite of the wide use of Dess and Beard's (1984) measurement model in subsequent studies, its validation is still an open issue. Neither the original work, nor the subsequent studies applying Dess and Beard's construct tested its discriminant validity. Solely the work of Harris (2004) tested the environment construct's discriminant validity for the US manufacturing industry, but it did not offer support for it. Without the assessment of the discriminant validity of Dess and Beard's construct, the outcomes of the work applying it, published in the major management journals through the last 25 years, would have to be discarded (Boyd, 1990, 1995; Boyd and Gove, 2006; Carpenter and Fredrickson, 2001; Castrogiovanni, 1991, 2002; Goll and Rasheed, 1997, 2005; Keats and Hitt, 1988; Lawless and Finch, 1989; Luo, 2005; Rasheed, 2005; Ray, 2004; Simerly and Li, 2000; Wiklund and Shepherd, 2003).

This problem seems to reflect the historical fact that strategic management scholars attribute low priority for measuring constructs, representing complex constructs without enough validating tests (Boyd *et al.*, 2005; Hitt *et al.*, 1998, 2004; Mezias and Regnier, 2007). However, when a single replication fails to support the original study's measuring model, it is not possible to be sure that the failure is due to the measuring model or to the inexactness of the replication procedure (Tsang and Kwan, 1999). Therefore, in the case of the assessment of the validity of Dess and Beard's environment construct, other replications are imperative. It is necessary to research whether its validity is a potentially stylized fact. That is, whether it occurs in other contexts, being or not an empirical truth:

> [...] uncovering empirical regularities requires multiple studies of the same phenomenon. Recall the definition of stylized facts: observations that have been made in so many contexts that they are widely understood to be empirical truths. This means that an inquiry must be conducted enough times that it produces consistent results. Just because one study has focused on a particular research question does *not* mean that we should tell the author of the next study that his or her study is not useful because someone else has already investigated this issue. (This happens far too often in referee reports). In contrast, we need more work to confirm or disconfirm a potential stylized fact. This calls for additional empirical research on the same topic in different settings and with different data (Helfat, 2007, p. 188).

Along these lines, this study also strives to contribute by evaluating the convergent and discriminant validity of the environment construct proposed by Dess and Beard (1984) in a different context and with a refined methodological procedure, as suggested by Rosenthal (1991) and Tsang and Kwan (1999), in order to move ahead in discussions about its validity. We used a different population of companies from the previous studies: manufacturing companies in the Brazilian economy. We also refined the original measurement model through the use of the multi-trait multi-method (MTMM) matrix approach for verifying its discriminant validity (Campbell and Fiske, 1959; Kenny and Kashy, 1992).

The choice of the Brazilian economy for testing the validity of the environment construct and the occurrence of groups of industries with similar environment dimensions is because the environment construct is promoted as a universal framework, although derived exclusively from observations in the US economy, where firms operate in a stable, market-based economy. Emerging market economies, such as developing countries in Asia, Latin America, Africa, and the Middle East, have been excluded from the environment construct research:

> This is partly because of their recent economic and political underperformance or isolation and partly because of strategy research's distaste for replication. As a result, the strategy discipline cannot be sure of the paradigm's universal applicability, which in turn limits theory building (Lukas *et al.*, 2001, p. 410).

The first part of this study evaluates the validity of the environment construct proposed by Dess and Beard (1984) and supports its reliability and convergent and discriminant validity for the Brazilian manufacturing industry, allowing its use in subsequent studies. The second part uses factorial scores of environmental dimensions to find out natural groups of industries with similar composition of munificence, dynamism and complexity. The cluster analysis identifies four groups with similar environmental conditions.

We start by exploring the organizational task environment (OTE) construct and its development. Next, we discuss the methodological procedures used in this work. Finally, we report on the findings and present the conclusions.

The OTE construct

The concept of organizations as open systems, initially consolidated in management through the contingency approach, considers the organization and its external environment to be parts of a single system, interacting continuously. From this standpoint, the organization exchanges objective resources (concrete in nature) with the external environment in order to ensure its survival (including raw materials, feedstock, equipment, finished products and monetary compensation), while adapting to environmental contingencies that assure it access to the external resources that it requires. The various theoretical environmental approaches that succeed the contingency stance in organization theory maintained the assumption that the organization is an open system (for a revision see Bataglia *et al.*, 2009). However, they differ from the contingency approach through:

- questioning the necessary condition for the organizations' adaptation when faced with changes in the environmental contingencies, according to the organizational ecology (Hannan and Freeman, 1977);
- questioning the environmental determinism on the organization, according to the resource-dependency approach (Pfeffer and Salancik, 2003);
- focusing on the institutional external environment, instead of its concrete, realistic counterpart, according to the institutional and neo-institutional approaches (Selznick, 1955; Dimaggio and Powell, 1991); and
- using rationality to moderate the influence of the environment through a set of prescriptive conducts or procedures, for instance, strategic planning, according to neo-classical approach (Drucker, 1988).

In general, the environmental approaches understood the external environment as being everything outside the organization that actually or potentially influences its result. Regarding the nature of the environment, these approaches adopt two basic assumptions (Bataglia *et al.*, 2009). The first assumes the existence of an objective, realist environment, constituted by visible and explicit elements, of concrete nature. The second assumes a relational-cognitive standpoint, envisioning the environment as composed by institutions, i.e. practices, rules and beliefs, socially built, of nominal nature. The environmental approaches' propositions about the nature of the environment are comprehensive and do not necessarily isolate environment's constituent objects in concrete and nominal. However, environmental approaches usually prioritize specific focus of analysis. For instance, the contingency and ecological approaches prioritize the objective environment; the institutional and neo-institutional approaches prioritize the nominal environment; and the resource-dependence approach focuses on both the nominal and objective environments.

Dill (1958) authored the first study that listed the objective components of the external environment of the organization, defining them as the set of external components, of concrete nature, with which the organization interacts directly through input/output transactions: customers (distributors and consumers), suppliers (materials, work force, equipment, capital and others), competitors (for resources and markets), and regulatory groups (government, trade unions, business associations). This author subsumed these components under the construct that he named OTE (or senior management task environment).

For Bourgeois (1980), the establishment of the domain of an enterprise, meaning the set of products, services, markets and territories selected by the organization for its operation, defines its OTE, drawing this construct close to the concept of an industry in economics. Similarly to Thompson (1967), as well as Emery and Trist (1965), this author distinguishes the external variables affecting the organization indirectly through their influence on the OTE components (e.g. technology, foreign exchange, demographic variables and legal and institutional systems), subsuming them under the construct general environment.

Starbuck (1976) drew up a broad-ranging review of the management literature on the OTE and its attributes. Grounded on this work, Aldrich (1979) summarized six core dimensions characterizing the OTE: geographical concentration, heterogeneity and stability of the components of the environment, turbulence (unforeseeability due to interconnection with the external environments of suppliers and customers), capacity of the environment (availability of resources required for organizational growth) and consensus on the domains disputed by government agencies in the public sphere.

Considering the private sphere, Dess and Beard (1984) raised the possibility that the first five dimensions proposed by Aldrich (1979) could be reduced to a leaner set, consisting of three main dimensions: munificence, complexity and dynamism. To test this hypothesis, these authors operationalized these dimensions through 23 variables and collected data for a random sample of 52 industries of manufacturing of the US economy, classified through the Standard Industrial Classification Code (SIC) (at four-digit level) by the US Bureau of the Census (1980), for the period between 1968 and 1977. These authors ran the data through the multivariate statistical procedure of exploratory factor analysis (EFA), confirming their hypothesis. Of the 23 initial variables, 13 variables remained, divided into three dimensions (factors) presented in Table I. This work focuses on Dess and Beard (1984)'s construct, based on Dill's construct OTE.

Environmental munificence refers to the level of abundance or scarcity of critical resources required for the operation of the firm, able to ensure the possibility of sustainable growth (Aldrich, 1979; Castrogiovanni, 1991; Starbuck, 1976). Environmental complexity refers to the level of knowledge of the environment required to understand the work to be conducted in the organization and for taking decisions. Randolph and Dess (1984), Child (1972) and Tung (1979) defined

Environmental dimensions	Measurement scale
1. Dynamism	
V11. Instability in total sales	Standard error of the regression slope coefficient for sales during the period considered, divided by the mean value
V12. Instability in price-cost margin	Same measure procedure as V11, using the value added minus the total wages
V13. Instability in total employment	Same measure procedure as V11, using total employment
V15. Instability in value added	Same measure procedure as V11, using value added
2. Munificence	
V1. Growth in total sales	Regression slope coefficient for the value of the sales during the period considered, divided by the mean value
V2. Growth in price-cost margin	Same measure procedure as V1, using the difference between the value added and the total wages
V3. Growth in total employment	Same measure procedure as V1, using the total employment
V4. Growth in value added	Same measure procedure as V1, using the value added
V5. Growth in number of establishments	Average annual percentage change in the number of establishments
3. Complexity	
V16. Geographical concentration of total sales by industry	Sum of the square of the sales in each division of the census, divided by the square of the total sales in all the census divisions
V17. Geographical concentration of value added	Same measure procedure as V16, although with value added
V18. Geographical concentration of total employment	Same measure procedure as V16, although with total employment
V19. Geographical concentration of the industry establishments	Same measure procedure as V16, although with number of industry establishments

Source: Adapted by the authors from Dess and Beard (1984)

Table I. Operationalizations of the indicators for the environmental dimensions

environmental dynamism as the level of change characterizing the activities of the environment, which are relevant for the operations of an organization. These three dimensions summarize the main dimensions used over the past few decades for the OTE in the various theoretical environmental approaches adopted in the management field.

Sharfman and Dean (1991) criticized the EFA developed by Dess and Beard (1984) with regard to the unidimensionality assumption of the tested dimensions (munificence, complexity and dynamism), suggesting that these authors had unnecessarily narrowed the conceptual framework. However, these authors proposed and tested alternative indicators that did not reach a minimum level of reliability (Dess and Rasheed, 1991). Efforts to validate the OTE construct have continued since then through articles replicating the measurement model of Dess and Beard (1984), presented in Table II, striving to expand its internal and external validity.

Works	Covered period	Sample size (manufacturing industries)/ country	Industrial classification code[a]	Data analysis method[b]	Reliability and convergent validity	Discriminant validity
Dess and Beard (1984)	1968-1977	52/USA	SIC four digits	EFA	Supported	Not tested
Rasheed and Prescott (1992)	1967-1982	60 / USA	SIC four digits	EFA	Supported	Not tested
Harris (2004)	1978-1987	247/USA	SIC four digits	CFA MTMM	Supported	Not supported
Porto *et al.* (2009)	1997-2002	466 (census)/ USA	NAIC six digits	EFA	Supported	Not tested
This work	1996-2005	104 (census)/ Brazil	CNAE three digits	CFA MTMM	Supported	Supported

Notes: [a]SIC – Standard Industrial Classification, NAIC – North American Industry Classification System, CNAE – Brazilian National Economics Activities Classification Code; [b]EFA – exploratory factorial analysis, CFA – confirmatory factorial analysis, MTMM – multi-trait multi-method matrix
Source: Analysis of the authors

Table II. Comparing the replications of the OTE measurement procedure proposed by Dess and Beard

Rasheed and Prescott (1992) and Porto *et al.* (2009) developed replications in which the same analysis techniques and populations of companies were used as in the original study, with just a new independent sample taken during a subsequent period. These two studies supported the findings of the original model. Harris (2004) developed a replication that applied analysis techniques differing from those in the original study, using the same population with a new independent sample, taken at a subsequent period. This work used the confirmatory factor analysis (CFA) by structural equations technique to test the model, examining the discriminant and convergent validities through the MTMM matrix approach. Harris' findings suggested that the original measurement model did not present discriminant validity. Faced by these findings, the author cast doubts on the validity of the environmental dimensions, and suggested a re-assessment of their theoretical grounds. However, when analyzing the work of Harris in detail, methodological problems may be perceived, that might have disguised or distorted the real relationship among the assessed dimensions. Initially, the paper does not clearly explain whether the author ascertained the multivariate normality required by the CFA technique. Second, the author did not take into consideration all the variables that remained in the final analysis conducted by Dess and Beard (1984), for there was a high percentage of unknown data in the sample.

Methodological procedures

This study had two objectives. The first objective was to contribute by evaluating the convergent and discriminant validity of the environment construct proposed by Dess and Beard (1984) in a completely new population of companies: the manufacturing industry in the Brazilian economy. The second objective was to find out natural groups of industries with similar compositions of environment factors munificence, dynamism and complexity in the Brazilian manufacturing industry.

Variables and data
We obtained data for the 13 indicators proposed by Dess and Beard (1984) for munificence, dynamism and complexity (presented in Table I), for the whole set of Brazilian manufacturing industries (census), for the period between 1996 and 2003, from the database of the Annual Industrial Survey (PIA) conducted by the Brazilian Institute for Geography and Statistics (IBGE, 2006). The manufacturing industry was chosen so that the findings could be compared with previous research. We selected the period between 1996 and 2003 due to the availability of data with the same structure. Data for the calculus of Dess and Beard's indices were available, but for geographical concentration indices. There were no data about industries organized by Brazilian census units in the database. Therefore, we calculated geographical concentration indicators based on Brazilian states instead of census divisions. We took up the information at the three-digit level of the Brazilian National Economics Activities Classification Code (CNAE 1.0), as data is available only at this level.

Data analysis
Once calculated, we ran the indicators through descriptive statistical procedures in order to detect outlier values and absence of responses, as well as to test the normality of their distributions. Subsequently, we ran the data obtained through the EFA. Then we used the CFA by structural equations statistical technique to analyze the convergent and discriminant validity of the model through the MTMM method developed by Campbell and Fiske (1959) and by the construction of reference models as proposed by Kenny (1979) and Bentller and Bonett (1980). Next, we calculated the factorial scores of the environmental factors for every CNAE's three-digit industry and ran the scores obtained through the cluster analysis, intending to find out groups of manufacturing industries with similar compositions of dynamism, munificence and complexity.

Results and discussion

Evaluating the validity of Dess and Beard (1984)'s environment construct
The descriptive analysis of the information in the PIA database on the 104 industries of Brazil's manufacturing industry (three-digit CNAEs) showed that eight industries did not present the necessary information: 23.3 – preparation of nuclear fuels; 24.4 – continuous, artificial and synthetic fibers, wires, cables and filaments; 28.8 – maintenance and repair of metal tanks, boilers and containers; 29.9 – maintenance and repair of industrial machines and equipment; 30.1 – manufacturing of office machines; 31.8 – maintenance and repair of electrical materials, machines and devices; and 32.9 – maintenance and repair of telephony and radio telephony devices and equipment, as well as television and radio transmitters – except telephones; and 33.9 – maintenance and repair of medical and hospital equipment, accuracy instruments, optics and industrial automation equipment. Therefore, we removed them, keeping 96 industries in the subsequent analyses.

The graphic analysis of the distributions of the variables used to measure environmental dynamism (V11 – instability in total sales; V12 – instability in price-cost margin; V13 – instability in total employment; and V15 – instability in value added) revealed marked positive asymmetries. We normalized these variables through an Ln-base transformation, renaming them: NV11 – Ln-base logarithm for instability in total sales; NV12 – Ln-base logarithm for instability in price-cost margin;

NV13 – Ln-base logarithm for instability in total employment; and NV15 – Ln-base logarithm for instability in value added. The statistical significances of the Kolmogorov-Smirnov normality test demonstrated that there was no evidence of any breach of the assumed univariate normality of these indicators. Then we ran the variables through the EFA procedures, which proved adequate for the KMO value (0.733), as well as the Bartlett sphericity test, which presented a χ^2 statistic equal to 1,096.04 with 66 levels of freedom and a statistical significance close to 0. We used the key component method with varimax rotation and an extraction criterion consisting of "eigenvalue greater than 1". In order to test the reliability of the factors obtained, we ascertained Cronbach's α and composite reliability values. The "NV12 – Ln-base logarithm for instability in price-cost margin" demonstrated low commonality, lower than 0.45, and so we eliminated it from the subsequent analyses in compliance with Nunnally and Bernstein (1994). With the new factor composition, we obtained an explained variance of 76 percent (Table III).

These findings are in keeping with those presented in the original study by Dess and Beard (1984). As may be noted in Table III, the factor loadings grouped into each of the three factors were high. Solely the "V17 – geographical concentration of the value added" variable presented a moderate loading (0.51). The values obtained for Cronbach's α and composite reliability statistics in each factor indicate the existence of internal consistency. Respectively: 0.91 and 0.93 for munificence; 0.93 and 0.95 for dynamism; and 0.78 and 0.87 for complexity. These values support the existence of convergent validity in these dimensions.

Then we ascertained the convergent and discriminant validities through the CFA procedures. Initially, the multivariate normality assumption was assessed

		Components	
	Munificence	Dynamism	Complexity
V4 – growth in value added	0.94		
V1 – growth in total sales	0.94		
V2 – growth in price-cost margin	0.83		
V3 – growth in total employment	0.81		
V5 – growth in number of establishments	0.75		
NV15 – ten-base logarithm for instability in value added		0.96	
NV11 – ten-base logarithm for instability in total sales		0.95	
NV13 – ten-base logarithm for instability in total employment		0.88	
V18 – geographical concentration of total employment			0.92
V16 – geographical concentration of total sales by industry			0.86
V19 – geographical concentration of the industry establishments			0.81
V17 – geographical concentration of value added			0.51
Variance	0.32	0.22	0.22
Cronbach's α	0.91	0.93	0.78
Composite reliability	0.93	0.95	0.87
Eigenvalues	4.01	2.99	2.13

Source: Analysis of the authors

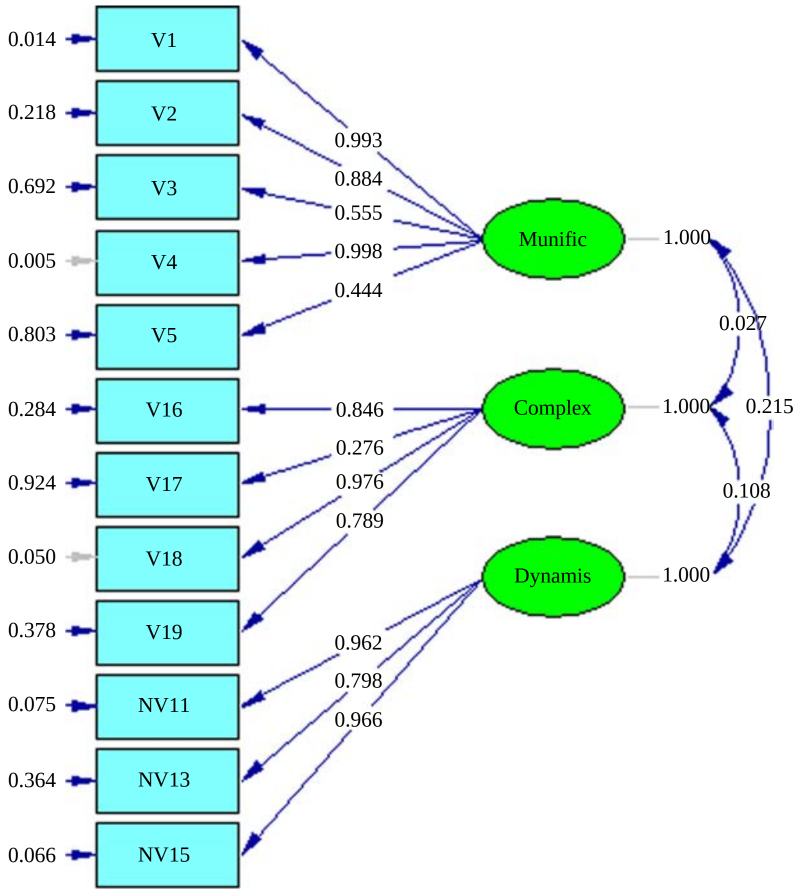
Table III. Rotated component matrix

through the Mardia PK multivariate kurtosis statistic, processed through the LISREL software, that gave a value of (PK = 1.71). According to Garson (1998), values of less than 3.0 for this statistic indicate that the multivariate normality assumption is not breached.

In order to test the convergent and discriminant validities through the MTMM method (Campbell and Fiske, 1959), we constructed hierarchical reference models (Kenny, 1979; Bentller and Bonett, 1980). We adopted a null or basic model, in which we established no relationship among the constructs or between the constructs and the indicator variables. In addition to the null model, we proposed five comparison models. For the first model, called orthogonal, the convergent validity of the indicators of munificence, dynamism and complexity was tested. To do so, we loaded these indicators solely in their respective dimensions, considering a priori, orthogonal relationships among them. For the second model, called exploratory, we considered the relationships among the constructs, as well as between the constructs and their respective variables. We used the last three models ("discriminatory1", "discriminatory2" and "discriminatory3") to assess the existence of oblique relationships among the constructs. We established a perfect correlation (equal to 1) between pairs of constructs, at the same time as the other relationships were free for calculating parameters. The "discriminatory1" model examined the correlation between munificence and dynamism; the "discriminatory2" model, between munificence and complexity; and finally the "discriminatory3" model, between dynamism and complexity. Then we undertook a hierarchical comparison among these three models and the exploratory model through assessing the χ^2 statistical value. According to Kenny and Kashy (1992), a significant reduction in the value of this statistic indicates an improvement in the model and, should this improvement result from establishing perfect correlations between construct pairs, then these constructs do not discriminate themselves. Consequently, the model does not encompass discriminant validity.

In the test of the exploratory model, the "V4 – growth in value added" and "V18 – geographical concentration of total employment" variables produced a negative error estimate (−0.05). This fact is probably due to the reduced size of industries in the census (96 industries), which reflected the level of aggregation of the data on the industries, collected at the three-digit level of the CNAE code due to the absence of information on regional concentration at the four-digit level. We re-specified the exploratory model, using the procedure proposed by Rindskopf (1983), establishing the variance's limit to 0. Figure 1 shows the re-specified exploratory model, which presented minimal alterations in the estimated parameters.

Table IV presents the statistical values of the χ^2 and the adjustment indexes for the models considered. As may be noted, there was a substantial improvement when comparing the orthogonal model with the null model, assessed by the significant difference between the χ^2 values of these two models ($\Delta\chi^2 = 683.33$; $\Delta df = 12$). This improvement associated to the composite reliability of the environmental factors (munificence = 0.93, complexity = 0.87 and dynamism = 0.95) and to the high factorial loadings exhibited by the variables in each factor (Table III) constitute power evidence supporting the convergent validity of the factors. Each variable converged in its factor in compliance with the model specified in the original study by Dess and Beard (1984).



Notes: χ^2 = 89.86; df = 53; *p*-value = 0.00118; RMSEA = 0.089
Source: Analysis of the authors

Figure 1.
Re-specified exploratory model

The assessment of the discriminant validity among the munificence, dynamism and complexity dimensions was examined hierarchically according to Kenny (1979), Bentller and Bonett (1980) and Anderson and Gerbing (1988), through an analysis of the adjustment parameters presented by the combination of the models: orthogonal, re-specified exploratory, discriminatory1, discriminatory2 and discriminatory3. As noted in Table IV, there was an improvement in the χ^2 statistic value from the orthogonal model to the re-specified exploratory model ($\Delta\chi^2 = 1.20$; $\Delta df = 1$). Although this difference is not significant at the 5 percent significance level, there was a loss of the adjustment of the re-specified exploratory model as indicated by the decrease in the parsimonious indices' values (0.75-0.73 for PNFI and 0.59-0.58 for PGFI). Nevertheless, the re-specified exploratory model does not breach the orthogonality among its dimensions. Next, we compared the orthogonal model to the "discriminatory1", "discriminatory2" and "discriminatory3" models. As may be noted in Table IV, the χ^2 statistic values for these three models increased and significant

Table IV.
Goodness-of-fit indicators for the reference models

Model	χ^2	df	p	GFI	AGFI	RMSEA	IC 90% RMSEA	NC χ^2/df	NFI	CFI	PNFI	PGFI
Null or basic	771.99	66	0.000	0.41	0.30	0.35	0.33; 0.37	11.70	0.00	0.00	0.00	0.34
Orthogonal	88.66	54	0.002	0.86	0.79	0.08	0.05; 0.12	1.64	0.91	0.96	0.75	0.59
Re-specified exploratory	89.86	53	0.001	0.85	0.79	0.08	0.05; 0.12	1.70	0.92	0.96	0.73	0.58
OTE	87.12	53	0.002	0.86	0.79	0.08	0.05; 0.11	1.64	0.92	0.96	0.74	0.58
Discriminatory1	261.46	54	0.000	0.67	0.52	0.21	0.18; 0.23	4.84	0.69	0.71	0.55	0.45
Discriminatory2	232.85	54	0.000	0.69	0.55	0.19	0.17; 0.22	4.31	0.74	0.78	0.60	0.47
Discriminatory3	284.84	54	0.000	0.61	0.43	0.22	0.19; 0.24	5.30	0.59	0.62	0.60	0.47

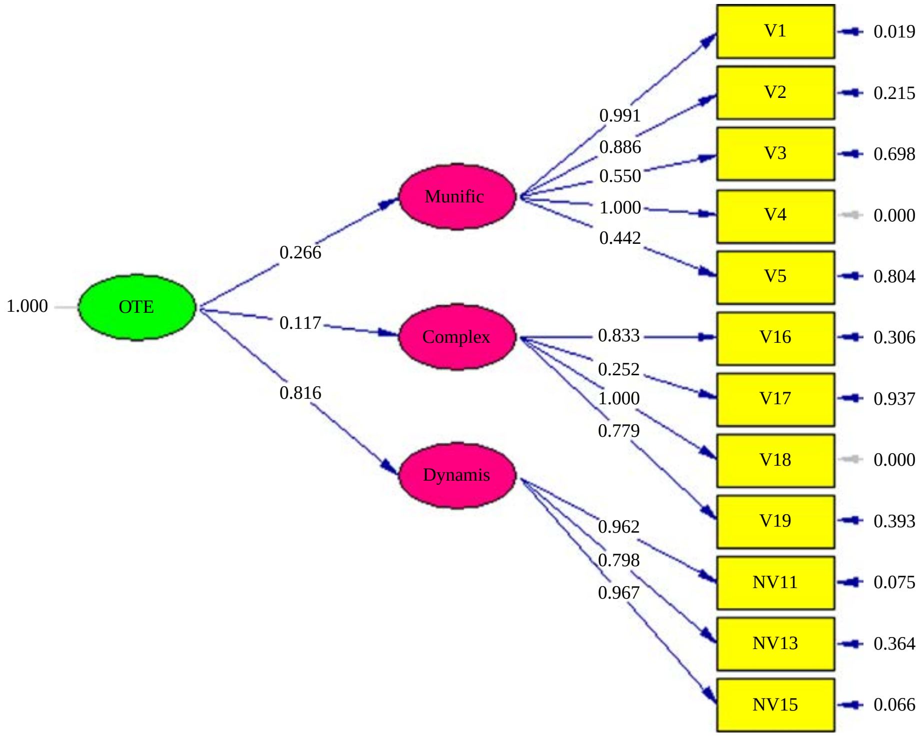
Notes: CFI – Comparative Fit Index; RMSEA – root-mean-square error of approximation; GFI – Goodness-of-Fit Index; AGFI – Adjusted Goodness-of-Fit Index; NC – normed χ^2; NFI – Normed Fit Index; CFI – Comparative Fit Index; PNFI – Parsimonious Normed Fit Index; PGFI – Parsimonious Goodness-of-Fit Index
Source: Analysis of the authors

differences ($\Delta\chi^2 = 172.80$, $\Delta df = 0$; $\Delta\chi^2 = 144.19$, $\Delta df = 0$ and $\Delta\chi^2 = 196.18$, $\Delta df = 0$) resulted from the hierarchical comparisons. The reduction of the scores of parsimonious indices (PNFI and PGFI) indicates the loss of the adjustment of these models when compared to the orthogonal one. Therefore, the dimensions assessed in the study diverge, supporting the model's discriminant validity.

The correlations shown in Figure 1 between the constructs complexity and munificence (0.027), munificence and dynamism (0.215) and dynamism and complexity (0.108), suggest the existence of a second-order underlying construct. For testing this possibility, the authors made a new hierarchical reference model, named OTE as shown in Figure 2. The χ^2 statistic value for the OTE model ($\chi^2 = 87.12$, df = 53, $p = 0.002$) was slightly lower than the χ^2 statistic values generated for the orthogonal ($\chi^2 = 88.66$, df = 54, $p = 0.002$) and re-specified exploratory ($\chi^2 = 89.86$, df = 53, $p = 0.001$) models. Although the differences were not statistically significant, they indicate a better fit for the OTE model than for the previous models.

For assessing the OTE model's goodness of fit, the authors used three categories of evaluation indices: absolute (GFI, AGFI and RMSEA), comparative (CFI, NFI) and parsimonious (PNFI and PGFI) indices. The fit of the model is indicated by scores above 0.90 for GFI, AGFI, CFI and NFI; between 1.0 and 2.0 for NC (Finch and West, 1997; Hair Jr *et al.*, 1998); below 0.10 for RMSEA (Browne and Cudeck, 1993); and above 0.50 for PNFI and PGFI (Baumgartner and Homburg, 1996; Hu and Bentler, 1995).

As presented in Table IV, the OTE model's GFI and AGFI are below the recommended levels ($GFI = 0.86 < 0.90$ and $AGFI = 0.79 < 0.90$). However, the RMSEA index ($RMSEA = 0.08 < 0.1$; $0.05 < 90$ percent CI for $RMSEA < 0.12$), considered by Hair Jr *et al.* (1998) as the most appropriate index to assess the fit in confirmatory models, and the comparative ($CFI = 0.96 > 0.90$ and $NFI = 0.91 > 0.90$) and parsimonious indices ($PNFI = 0.74 > 0.50$; $PGFI = 0.58 > 0.50$; $1.0 < NC = 1.86 < 2.0$) are in the ranges recommended by the literature. Therefore, they support that the OTE model's goodness-of-fit is satisfactory.

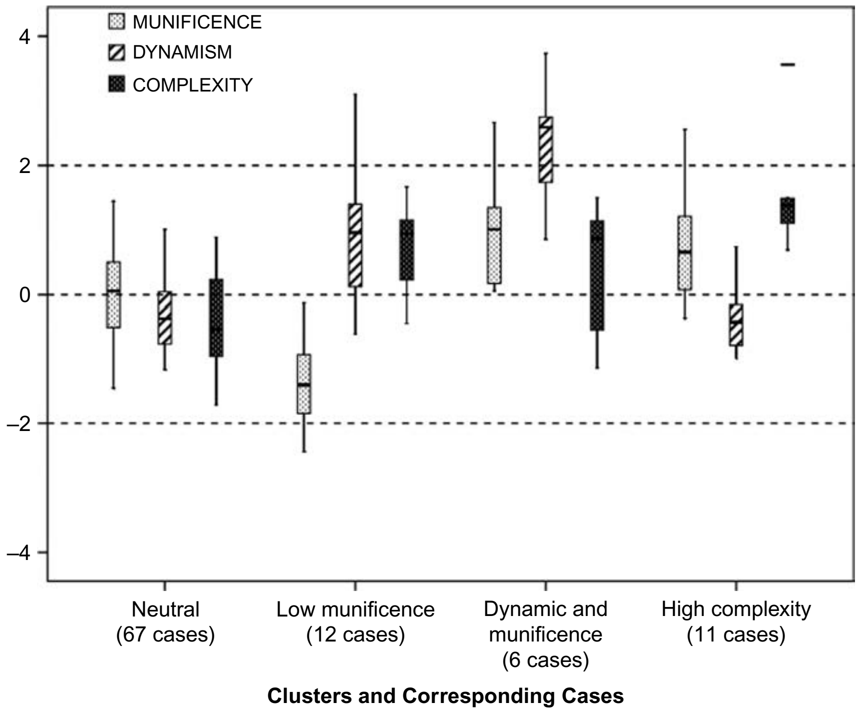


Notes: $\chi^2 = 87.12$; df = 53; p-value = 0.00218; RMSEA = 0.086
Source: Analysis of the authors

Figure 2.
OTE model

Along these lines, the constructs munificence, dynamism and complexity not only demonstrated convergent and discriminant validity, but also revealed themselves as underlying dimensions of the construct OTE. After establishing the validity of Dess and Beard's (1984) organizational-task-environment construct, in the next section, this work examines the existence of industrial groupings with similar environmental profile in the Brazilian manufacture industry.

Cluster analysis
Based on the factorial scores, the authors submitted the 96 industries to a cluster analysis in order to find out natural groups of industries with similar munificence, dynamism and complexity. The factorial scores represent the intensity of each task environment dimension, exhibiting by definition a normal frequency distribution, with mean equal to 0 and standard deviation equal to 1.0. Using the *K*-means procedure, the cluster analysis indicated four different groups, as shown in Figure 3. Table V presents the environment dimensions' description for each cluster of industries. Table VI presents the distribution of industries by the four clusters for a general view of this distribution. The Appendix presents the classification of the 96 industries (three-digit CNAE) by clusters.



Source: Analysis of the authors

Figure 3.
Clusters of industries (three-digit CNAE)

The first and larger cluster aggregates 67 different manufacturing industries. Munificence, dynamism and complexity are evenly distributed around the average and at similar ranges of extension. For that reason, the authors understood that this cluster represents a neutral situation, corresponding to the average mix of munificence, dynamism and complexity randomly found in the environment. For being the most numerous of all groups, this is the cluster of the majorities. Virtually all activity groups have one or more representatives in this cluster, with a significant numerical predominance of activities related to the basic manufactures. According to the Appendix, it represents the task environment faced by all kinds of basic industries, such as food, textile, apparel, paper, among many others.

Low munificence is the most evident characteristic of the second cluster. Including no more than 12 different industries, their scores for growth of sales, value added, employment, establishments and price-cost margin were significantly below the average. For these industries, dynamism presents itself as a dimension of wide range of possibilities, almost exclusively above average. An elevated complexity comes along with the high level of dynamism observed for them. In this cluster, one can find industries such as production of pig-iron and ferroalloy; manufacture of equipment for distribution of electric power; wires and cables; cells, batteries and electric accumulators; basic electronic material; radio and television receivers; chronometers and watches; to cite only a few of them (the Appendix).

Cluster number	Descriptive	Munificence	Dynamism	Complexity
Cluster 1: neutral	Mean	0.03	−0.32	−0.42
	Median	0.06	−0.36	−0.53
	SD	0.65	0.54	0.71
	Minimum	−1.45	−1.17	−1.72
	Maximum	1.44	1.30	0.89
	Range	2.90	2.47	2.60
Cluster 2: low munificence	Mean	−1.49	0.96	0.72
	Median	−1.40	0.96	0.94
	SD	0.89	1.15	0.66
	Minimum	−3.51	−0.60	−0.44
	Maximum	−0.13	3.10	1.67
	Range	3.38	3.69	2.10
Custer 3: munificent and dynamic	Mean	1.04	2.38	0.45
	Median	1.01	2.59	0.87
	SD	0.94	0.98	1.05
	Minimum	0.06	0.86	−1.14
	Maximum	2.66	3.73	1.49
	Range	2.60	2.88	2.64
Cluster 4: high complexity	Mean	0.86	−0.38	1.55
	Median	0.66	−0.42	1.44
	SD	1.13	0.55	0.76
	Minimum	−0.36	−0.99	0.69
	Maximum	3.12	0.74	3.56
	Range	3.48	1.73	2.87

Source: Analysis of the authors

Table V. The environmental dimensions' description for each cluster of industries (three-digit CNAE)

In the third group, the emphasis is on the two extreme positions of munificence and dynamism, because in this cluster all the indicators of these dimensions are characterized as being higher than average. The three dimensions have wide internal distributions, but the complexity here reaches its greatest extension band, representing that this is the group in which the geographical concentration of employment, sales, establishments and value-added reach various possibilities. It is also the narrowest cluster in terms of industries, encompassing activities such as recorded material; steel; manufacture of machinery and equipment of electronic systems for data processing, industrial automation and control of production process; construction, assembly and repair of rail vehicles and ships (the Appendix).

The fourth cluster consists of 11 activities. It is the cluster with predominantly positive munificence, dynamism and complexity entirely negative larger than average, and high values concentrated in a narrow range of dispersion. With such characteristics the following industries are present: manufacture of miscellaneous chemical products; powder metallurgy and metal processing services, manufacture of electrical equipment for vehicles – except batteries; optical instruments and material for photography; cabins, trailers and carts; parts and accessories for automotive vehicles; assembly and repair of aircraft; manufacture of other transport equipment such as motorcycles, bicycles, non-motorized tricycles and similar; scrap metal and non-metal recycling; and miscellaneous industries (the Appendix).

Manufacture group	Cluster 1: neutral	Cluster 2: low munificence	Cluster 3: munificent and dynamic	Cluster 4: high complexity	Total of cases by industrial group
Food and beverage industries	9				9
Tobacco	1				1
Textile	7				7
Apparel	2				2
Manufacturing of leather and leather worn, travel and shoes	3				3
Wood manufacturing (except furniture)	2				2
Pulp, paper and paper products	4				4
Publishing, printing and reproduction of recordings	2		1		3
Coke, petroleum refining, nuclear fuel development and production of ethanol	1	2			3
Chemical industry	7			1	8
Rubber and plastic goods	2				2
Non-metallic minerals manufacturing (glass, cement, concrete, etc.)	5				5
Basic metallurgy	3	1	1		5
Manufacture of metal products – except machinery and equipment	4			1	5
Manufacture of non-electric machinery and equipment	7	1			8
Manufacture of office machinery and data equipments			1		1
Manufacture of electric machinery and equipment	3	3		1	7
Manufacture of electronic material and devices and communications equipment	1	2			3
Equipment and instruments of precision (medical, industrial automation, etc.)	1	2	1	1	5
Fabrication and assembly of automotive vehicles, trailers and carts	2	1		2	5
Fabrication of other transport equipment			2	2	4
Manufacture of furniture	1				1
Miscellaneous industries				1	1
Recycling				2	2
Total of cases	67	12	6	11	96
Percentage of cases	69.79	12.50	6.25	11.46	100

Source: Analysis of the authors

Table VI.
Distribution of industries by clusters

Conclusion

The first objective of this work was to evaluate both convergent and discriminant validity of Dess and Beard (1984)'s environment construct in the Brazilian manufacturing industry, with a refined methodological procedure, as suggested by Tsang and Kwan (1999) and Rosenthal (1991), in order to move ahead in discussions about its validity. The second objective was to find out natural groups of industries with similar compositions of environment factors munificence, dynamism and complexity in the Brazilian manufacturing industry. The study achieved its objectives, establishing the validity of the environment construct and identifying four groups of industries with similar environmental conditions.

Contributions from the academic research standpoint

One contribution provided by this work is to move ahead along the path leading to the validity of Dess and Beard's (1984) objective-environment measurement model, ratifying its reliability and convergent validity and establishing its discriminant validity. These findings enhance the model's internal consistency and expand its external validity, generalizing and extending it to the Brazilian manufacturing industry, paving the way for future empirical surveys. The contrasting of these findings to Harris' ones (2004) for the US manufacturing industry suggests that new replications of Dess and Beard's original study must be conducted in the US economy and in different economic contexts with different data, enough times to confirm or to disconfirm its validity, producing consistent results (Helfat, 2007).

Another contribution is the recognition of groupings of industries with homogeneous environments, presenting similar compositions of munificence, dynamism and complexity in the Brazilian manufacturing industry. It would generate better possibilities of design and generalization for researches, allowing researchers to choose industries or samples by group of industries with similar environmental profile in accordance with their research interests. It would also simplify the control of the environment in empirical researches in Brazil, as suggested by Chang and Singh (2000), Dess *et al.* (1990), Hawawini *et al.* (2003) and Rumelt (1982). Instead of controlling 96 three-digit industries in Brazilian National Economics Activities Classification Code (CNAE 1.0), researchers would have to control four groups with different environmental profiles.

Contributions from the managerial standpoint

From the managerial standpoint, this work helps to expand analytical capacities of managers in corporate strategy decision making, allowing the identification of not apparent similarities among businesses located in different industries. The identification of environmental homogeneity among industries underpins the decision of sharing experiences and competences among businesses in different industries, enabling inter-temporal economies of scope as proposed by Helfat and Eisenhardt (2004). For example, the similarities between the industries of manufacture of miscellaneous chemical products and assembly and repair of aircraft or between the industries of alcohol and chronometers and watches are not apparent. In spite of that, this work indicates that the first two industries are close to the cluster 4's centroid, characterized by a high complex environment, and the last two are close to the cluster 2's centroid, characterized by a low munificent environment.

Research constraints

One constraint of this research is linked to its own measurement procedure, which characterizes the OTE over a given period of years. Analytical anticipations based on the model must be drawn up carefully, as they are valid only for the period under consideration. Besides, changes in trends of environmental characteristics during the period considered for measurement may result in skewed construals. The use of relatively brief periods can improve this situation. Another constraint is that the model does not control positioning factors within the industries. In other words, as the model aggregates the data at the industry level, it does not take in consideration environmental variations related to participation in specific strategic groups or even due to different positions in the supply chain, which may also result in skewed construals. Another constraint is that factors that were not controlled may influence the possibility of sharing experiences and competences between businesses in different industries, so comparisons must also be done carefully.

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Appendix. Classification of the 96 industries (three-digit CNAE) by clusters

Grouping 1 – neutral environment (activity code and description)

151 Slaughter and preparation of meat products and fish

152 Processing, preservation and production of canned fruits, vegetables and other vegetable

153 Production of vegetable and animal oils

154 Dairy

155 Milling and production of starch and balanced pet and animal food

156 Production and refining of sugar

157 Coffee roasting and grinding

158 Other food products

159 Beverages

160 Tobacco products

171 Processing natural fibres for weaving
172 Wiring
173 Weaving – including spinning and weaving
174 Manufacture of textile artifacts – including weaving
175 Finishes in yarn, fabrics and textile articles for third
176 Artifacts from textile fabrics – except apparel – and other textile articles
177 Manufacture of fabrics and knitwear
181 Apparel
182 Clothing and accessories of occupational safety
191 Tanning of leather and other preparations
192 Travel and other worn leather
193 Footwear
201 Split wood
202 Production of wood, cork and twisted stuff – except furniture
211 Pulp and other paste for paper manufacturing
212 Manufacture of paper and cardboard
213 Manufacture of containers of paper or cardboard
214 Other artifacts of paper and cardboard
221 Edition and printing
222 Printing and related third parties services
232 Production of petroleum
241 Inorganic chemicals manufacturing
242 Manufacture of organic chemicals
243 Manufacture of resins and elastomers
245 Manufacture of pharmaceutical products
246 Pesticides
247 Manufacture of soaps, detergents, cleaning products and articles of perfume
248 Paints, varnishes, enamels lacquers and similar products
251 Manufacture of rubber
252 Manufacture of plastic products
261 Manufacture of glass and glass products
262 Cement manufacture
263 Artifacts of concrete, cement, asbestos, plaster and stucco

264 Ceramics

269 Stone cutting and manufacture of lime and other products of non-metal minerals

273 Tubes – except in steel

274 Metallurgy of non-ferrous metals

275 Foundry

281 Metal structures and articles of heavy boiler making

282 Manufacture of tanks, reservoirs and metal boilers

284 Cutlery, hand tools and welding devices

289 Other metal products

291 Engines, pumps, compressors and transmission equipments

292 Machinery and equipment for general use

293 Tractors, machinery and equipment for agriculture, poultry and animal livestock

294 Machine tools

295 Machinery and equipment for use in mineral extraction and construction

296 Machinery and equipment other specific use

298 Household appliances

311 Generators, transformers and motors

315 Lamps and lighting equipment

319 Other electrical equipment and apparatus

322 Equipment for telephone, TV and radio transmission

331 Equipment and tools for human medical, hospital, dental laboratories and orthopedic appliances

341 Cars, trucks and utilities

342 Trucks and buses

361 Articles of furniture

Grouping 2 – low munificent environment (activity code and description)

231 Coke

234 Alcohol

271 Pig iron and ferroalloy

297 Arms, ammunition and military equipment

312 Equipment for distribution and control of electricity

313 Wire, insulated electric cables and drivers

314 Batteries and electric accumulators

321 Basic electronic equipment manufacturing

323 Radio and television receivers, recording and amplified sound and video

332 Measuring; test and control equipment and instruments – except industrial process control

335 Chronometers and watches

345 Rebuilding or recovery engine for automotive vehicles

Grouping 3 – dynamic and munificent environment (activity code and description)

223 Reproduction of recorded material

272 Steel

302 Machinery and equipment for electronic systems and data processing

333 Machinery and equipment for electronic systems dedicated to industrial automation and control of production process

351 Construction and repair of vessels

352 Construction, installation and repair of rail vehicles

Grouping 4 – high complex environment (activity code and description)

249 Manufacture of other chemical products and preparations

283 Forgings, stampings, powder metallurgy and treatment services

316 Manufacture of electrical equipment for vehicles – except batteries

334 Optical and photographic equipment, instruments and materials

343 Cabins, trailers and carts

344 Parts and accessories for automotive vehicles

353 Construction, installation and repair of aircraft

359 Other transport equipment

369 Production of miscellaneous

371 Metal scrap recycling

372 Non-metal scrap recycling

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