Efficient Identification Model of Strategic Key Dimensions in SMEs

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Abstract
Small and medium enterprises (SMEs) make-up 99.8% of all enterprises which comprises 57.4% of added value and 66.8% of employment within the European Union economy. In the age of the fourth industrial revolution, there will be an increasing competition among SMEs to operate efficiently, to hold on to their customers while capturing additional market share.

Most of the SMEs leaders have difficulties to establish an overall strategy that is consistent and optimised due to a lack of time, methodology and/or knowledge. For instance, the leader may focused on the internal performance of the company at the expense of its customers’ expectations; or launching innovative products/services but neglecting its industrial strategy; or improving its operating profit without involving its stakeholders in the business development.

This article explores how the assessment of the environment threats and opportunities may help SME leaders to formalize their strategic vision through the identification of the key strategic dimensions. It comprises three sections: (1) the notions of strategy, strategic dimensions and performance measurement system (PMS) are defined (2) the SME’s environment factors and their level of risks are evaluated, (3) the conceptual framework that identify the priority index of each strategic dimension is proposed.

Keywords
Strategy, SME (small and medium enterprises), Risks, Strategic dimensions, Environmental analysis

1. Introduction
At the dawn of the twenty-first century, Small and Medium enterprises (SME) will compete fiercely to improve their efficiency while retaining the interests of their customers or new businesses. Unfortunately, many SME managers have difficulty in establishing a coherent and optimized overall strategy due to lack of time, methodology and / or know-how (Gueguen 2010). For example, the leader can focus on the internal performance of the company at the expense of the expectations of its customers; or launch innovative products / services by neglecting its industrial strategy; or improve its operating result without involving its employees in the development of the company. In addition, they usually make their decision based on limited knowledge of the environment and may, in this case, subscribe to the new internally developed action plan or reuse past success strategies that do not match the opportunities or constraints market threats (Grant 2016). In the digital age, the rise of data analytics as a new source of knowledge can help leaders make decisions faster, shape their ability to cope with environmental change and mitigate risk decision-making (Merendino et al. 2018).
Research on strategic management has highlighted the idea that there is a strong link between the internal and external environment factors and the success of the company (Brenes et al. 2008). Thus, according to a study by Zacharakis (Zacharakis et al. 1999) limited to eight high-tech manufacturing companies in bankruptcy. Among these, 58% of entrepreneurs surveyed attributed the failure of their company to internal factors such as lack of operational strategy and lack of capitalization. As for the investors surveyed, 75% of them felt that the failure was due to external factors such as strong competition, weak growth and small market size.

Experience shows that the strategy is not to guess what the future will be, but rather to create the future the company needs. To create this promising future, a successful strategy must concatenate three main characteristics: the ability to quickly assess and adapt to a changing environment, the identification of clear objectives and their associated indicators. From this observation, emerged the following question: **How can we identify the key strategic dimensions of an industrial SME through an environment risk analysis?**

2. **The notion of Strategy**

Strategy is a word with many meanings and all are relevant and useful for those who are responsible for defining the strategy of their organizations. Historically, the term strategy derives from the Greek word “strategos”, which means "general", or as defined by BH Liddell Hart, "the art of distributing and applying military means to achieve policy objectives". Alfred D. Chandler defines it as "the act of determining the long-term goals and objectives of the enterprise, of putting in place the actions and of allocating the necessary resources to achieve the said goals" (Chandler, 1962). Frédéric Le Roy defines it as the act of determining clear objectives, aligned with the understanding of the environment and available resources, then on the allocation of these resources for a sustainable competitive advantage (Le Roy, 2012).

2.1. **The Performance Measurement Systems (PMS)**

Due to the volatile nature of today's globalized businesses, it becomes imperative that SMEs monitor the performance of their processes, and align them with the strategic goals of the business. However, recent data suggests that only 5% of employees understand the strategy of their company, 25% of managers only have incentives related to their organizational strategy, 60% of organizations do not even tie their budgets to the company strategy and 85% of management teams spend less than one hour per month discussing strategy (Kaplan and Norton 2001).

SMEs focus mainly on the operational and financial performance of their structure, whereas innovation, human resources, work climate, R&D and training are rarely measured (Taticchi et al 2008). However, the growth of a business depends on its ability to continuously measure the performance of the key processes (Braam and Nijssen 2004). The recent literature shows that performance measurement systems (PMS) are not only the tools for communicating about the company's strategy and facilitating its execution and monitoring its implementation but can also be used to formalize the company strategy.

By the end of 2004, 85% of organizations had implemented a Performance Measurement System (Marr and Neely 2003) and the main models of PMS used and discussed in the literature are:

- Pyramid Performance System (Lynch and Cross 1991)
- Performance Measurement Matrix (Keegan et al. 1989)
- Results and determinants matrix (Fitzgerald et al. 1991),
- Balanced Scorecard (Kaplan, 1996) (Kaplan and Norton 2001),
- Performance Prism (Neely et al. 2002),
- Scoreboard (Epstein and Manzoni 1997),
- Organizational performance measurement (Chennell et al. 2000),
- Integrated Performance measurement for small firms (Laitinen, 1996),

The literature shows the positive impact of PMS on SMEs, such as the 25% reduction in overhead costs, increased sales (Lawson et al. 2003) or improved decision-making performance of managers and employees (De Waal 2003). On the other hand, Speckbacher found that several German companies had decided not to implement the Performance Measurement System, as they did not identify any benefit from the efforts needed to implement it (Speckbacher et al. 2003). This is corroborated by Neely (Neely 2008) which identifies that PMS have little impact on a company's performance unless employees take corrective or preventive actions based on the data collected. Large companies need an interactive PMS to encourage communication within the enterprise, while small businesses need a simple PMS to implement and successfully monitor their emerging strategy (Chenhall, 2003).
Finally, Garengo has identified that PMS has to ensure that stakeholders needs, strategy and companies objectives remains aligned to maximise the stakeholders satisfaction, and that PMS models are often difficult to manage, sometimes not very clear and not responsive to changes in the internal and external environments (Garengo et al. 2005). This research will propose a solution to this lack of responsiveness to an ever-changing environment.

2.2. Strategic Key Dimensions

The first phase in defining a company strategy is to identify and prioritize the strategic dimensions and objectives of the company. Neely (Neely et al. 2005) has identified the most recurrent dimensions of performance as quality, flexibility, cost and time. In the literature, we have identified up seven other dimensions: finance, human resources, product innovation, supplier relations, environmental performance, community and alliances. Over the last thirty years, the authors have focused on different aspects of a PMS with respect to their expertise. However, their research shows that by exploiting the synergies between the dimensions of performance, the best company creates a sustainable competitive advantage that is difficult for competitors to overcome (Narasimhan et al. 2005). Table 1 shows the ten strategic dimensions identified in the literature.

Table 1. The main Strategic Dimensions

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</tr>
</thead>
<tbody>
<tr>
<td>Product and services Quality (defect rates, quality awards)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Operational Performance (productivity, safety, cycle time)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td>Flexibility</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finance (annual earnings, return on assets, cost reduction)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Customer relation (market share, customer satisfaction, customer retention)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Human resources / Employee relations (employee satisfaction, turnover, workforce capabilities)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Product and services innovation (new product or service development success, development cycle time)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Supplier relations (on time delivery, input into product/service design)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Alliances with other organizations (joint marketing or product design, joint-ventures)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
</tr>
<tr>
<td>Environmental performance (environment compliance or certification)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Community (public image, community involvement)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</table>

3. Assessing the SME Environment and Level of Risks

The purpose of an SME’s strategy is to continually align its organization with its uncertain environment. As a result, the SME needs to identify, analyse and quantify the level of risks.

3.1. Risks Identification and Analysis

The literature review highlights the fact that SMEs suffer from limited human and financial resources and their inability to effectively manage all risks at the same time (Sukumar et al. 2011). It is therefore advisable for SMEs to identify all potential risks, then focus on the most critical ones and train their employees to effectively manage these risks. The causes of entrepreneurial failure are considered to be multiple and linked to external (or exogenous) factors, which the company does not control, and / or to internal (or endogenous) factors specific to the company individuals (Cardon et al. 2011) (Coulibaly 2004).
Internal factors involve the resources and capabilities of the company, while external factors integrate macro and competitive environments (Miller and Kent 1992). The competitive environment is where the SME buys, sells to its customers the goods or services it produces, and competes with competitors that produce similar goods. On the other hand, the macroeconomic environment is the set of political, economic, social, technological, legal and environmental factors that directly or indirectly affect the operations of the company. The twenty identified factors are shown in Figure.1.

![Figure 1. A pictorial view of the SME environment factors](image)

It is unanimously recognized in the literature that it is the man who is at the origin of the success of SMEs (Coulibaly 2004). For the risk analysis to be relevant and to protect against biases, specifically those that minimize risk perception, the analysis must be done as a team and following a well-structured process (Houghton et al. 2000).

### 3.2. Quantifying the Level of Risks

The “fear of harm ought to be proportional not merely to the gravity of the harm, but also to the probability of the event”, as mentioned by Antoine Arnauld in 1662 in a monastic publication entitled: Logic, or the Art of Thinking. Nowadays, the notion of risk is defined as, “the chance of something happening that will have an impact on objectives” (Standard 2004) in other words, the risk assessment process requires the assessment of the likelihood of each risk and its impact. The risk factor is defined as:

\[ R = P \times I \]  

(Equation 1)

where R is the risk factor, I is the impact (severity), P is the likelihood (probability).

Assessing the level of risk is a complex subject because quantifying probability and impact can be subjective and imprecise (Carbone and Tippett 2004). Moreover, the level of qualification of those performing the risk analysis may impact the relevance of the exercise (Gao et al. 2013). In order to cope with these limitations, Marcelino-Sádaba (Marcelino-Sádaba 2014) proposes a simplified process of risk analysis in SMEs, consisting of only two variables (likelihood and impact) and based on a 5-level scale (Military 1949) as shown in Table 2.

<table>
<thead>
<tr>
<th>Likelihood Score</th>
<th>Description</th>
<th>Impact Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Expected to occur</td>
<td>9</td>
<td>Very high impact</td>
</tr>
<tr>
<td>7</td>
<td>Very likely to occur</td>
<td>7</td>
<td>High impact</td>
</tr>
<tr>
<td>5</td>
<td>Likely to occur</td>
<td>5</td>
<td>Medium impact</td>
</tr>
<tr>
<td>3</td>
<td>Unlikely to occur</td>
<td>3</td>
<td>Low impact</td>
</tr>
<tr>
<td>1</td>
<td>Very unlikely to occur</td>
<td>1</td>
<td>Very low impact</td>
</tr>
</tbody>
</table>

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In accordance with the guidelines (Table 2), each risk factor (see Figure 1) is quantitatively assessed to determine its likelihood and impact on each strategic dimension (see Table 1). The risk factor is displayed in an orthonormal frame (Hillson 2002), the vertical axis of the matrix represents the probability and the horizontal axis represents the impact of the risk, whether negative (threat) or positive (opportunity). An example is illustrated in Figure 2 with a likelihood assessed at 7 (very likely to occur) and an impact of 5 (a medium opportunity impact).

![Figure 2. Probability-Impact matrix for one risk factor](image)

Then, the scores of the twenty risk factors are distributed on the matrix (see Figure 3) for each strategic dimension $p$ ($p$ from 1 to 10). The overall likelihood-impact weight of those factors are discussed below so that the critical and none-critical strategic dimension are identified.

![Figure 3. Example of a completed: Probability-Impact matrix for one Strategic Dimension](image)

The Probability-Impact Matrix identifies 6 distinct areas: L-, M-, or H- representing low, medium, or high threat zones, and L +, M +, or H + representing low, medium, and high opportunity zones. Various combinations of Likelihood and Impact can be assigned in the same risk zone: a same color (red, yellow or green for the threats and purple, cyan or light green for the opportunities). The identification of each zone (Low, Medium and High) by using the guideline shown in Table 2 reduces the bias related to the interpretation of a simple numerical value as identified in the SPACE model (Gurbuz 2013) and replies to the three axioms of a well-defined risk matrix as defined by Cox (Cox 2008).

<table>
<thead>
<tr>
<th>Threats</th>
<th>Opportunities</th>
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<tbody>
<tr>
<td>9</td>
<td>81 -81 -63 -45 -27 -9</td>
</tr>
<tr>
<td>7</td>
<td>63 -63 -49 -35 -21 -7</td>
</tr>
<tr>
<td>5</td>
<td>45 -45 -35 -25 -15 -5</td>
</tr>
<tr>
<td>3</td>
<td>27 -27 -21 -15 -9 -3</td>
</tr>
<tr>
<td>1</td>
<td>9 -9 -7 -5 -3 -1</td>
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<table>
<thead>
<tr>
<th>LIKELIHOOD</th>
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</table>

![Table 2. Threats and Opportunities zones identification](image)
3.3. Identifying the Weight of each Risk Factor

In a risk analysis, all factors are often considered equally important, but it must be taken into account that most factors do not have the same weighting (Louw and Radder 1998). To overcome this disadvantage, we will use the Analytical Hierarchy Process (AHP), which is a multi-criteria and weighted decision-making method proposed by Saaty (Saaty 1980). The Analytical Hierarchical Process (AHP) is composed of 4 steps (Ben Jeddou et al. 2015):

a) Building an hierarchical tree

In this research, each strategic dimension is analyzed according to its macro, competitive and internal environment factors (see Figure 3).

![Figure 3. Risk factors hierarchical tree](image_url)

b) Collecting interview data

In the Analytical Hierarchical Process, the relative weight of each environment factors (or criterion) is determined after the consultation of a group of experts. Each criterion is compared in pairs using a nine-point numerical scale, called the Saaty scale (Saaty 1980). In AHP, the relative importance of the criterion \( i \) with respect to the criterion \( j \) is determined using the Saaty scale and is assigned to the \( a_{ij} \) position of the pairwise comparison matrix (Chang et al. 2007). The final matrix (of size n x n) is shown below:

\[
\begin{pmatrix}
    a_{11} & a_{12} & \cdots & a_{1n} \\
    a_{21} & \cdots & \cdots & a_{2n} \\
    \vdots & \ddots & \ddots & \vdots \\
    a_{n1} & \cdots & \cdots & a_{nn}
\end{pmatrix}
\]

The input \( a_{ij} \) is the arithmetic medians of the votes of a panel of experts. An interesting aspect of expert use is that it minimizes the problem of "group thinking" or the dominance of a strong member within the group.

c) Calculating the priority vector

The eigenvalue \( \overline{a}_{ij} \) of each criterion \( a_{ij} \) is calculated by performing the sums of each column and dividing each element of the matrix by the total of the column. Finally, the priority vector \( w_i \) of all criteria \( \overline{a}_{ij} \) is constructed by averaging the entries of each line of the eigenvalues associated with this matrix. It should be noted that the calculation procedure described by Wabalicis (Wabalicis 1987) and Cheng (Cheng and Li 2001) is used to obtain the eigenvector.
\( w_i = \frac{\sum_{j=1}^{n} a_{ij}}{m} \)  
(Equation 2)

\[
\begin{pmatrix}
\bar{a}_{11} & \bar{a}_{12} & \ldots & \bar{a}_{1n} \\
\bar{a}_{21} & \bar{a}_{22} & \ldots & \bar{a}_{2n} \\
\bar{a}_{31} & \bar{a}_{32} & \ldots & \bar{a}_{3n} \\
\vdots & \vdots & \ddots & \vdots \\
\bar{a}_{n1} & \bar{a}_{n2} & \ldots & \bar{a}_{nn}
\end{pmatrix}
= 
\begin{pmatrix}
w_1 \\
w_2 \\
w_3 \\
\vdots \\
w_n
\end{pmatrix}
\]

**d) Calculating the coherence ratio (CR),**

According to the work of (Yurdakul 2004), the value of CR must be less than 0.1 to conclude that pairwise comparison judgments are consistent. On the other hand, if the value of CR is greater than 0.1 the matrix coefficients are inconsistent and cannot be referred to for further analysis (Wong and Li 2007).

### 4. Formalizing the Strategic Vision

Recent literature shows that performance measurement systems are not only tools for communicating business strategy and facilitating its execution and monitoring, but can also be used to build a company's strategy (Gimbert et al. 2010). However, the risks related to the SME's environment can have an impact on the company's strategic vision and objectives, hence its integration into the formalization process of the strategy. A comprehensive risk strategy, which is well controlled and regularly updated can help the development of the company and ensure its sustainability. The strategy formalization process is shown in Figure 4 & 5.

![Figure 4: Macro vision of the strategy formalization process](image-url)
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4.1. Priority Index for each Strategic Dimension
The basic argument of this study is tested using a multiple linear regression model (see Equation 3). It describes the best fit between the environmental risk assessment and each identified strategic dimension.

The priority index for each strategic dimension ($DS^P$) satisfies the equation below:

$$DS^P = w_{e1}^P \times \sum_{i=1}^{6} (w_{di}^P \times MacUi_i^P) + w_{e2}^P \times \sum_{i=1}^{5} (w_{bi}^P \times ConUi_i^P) + w_{e3}^P \times \sum_{i=1}^{5} (w_{ai}^P \times AcUi_i^P) + w_{e4}^P \times \sum_{i=1}^{4} (w_{di}^P \times SouUi_i^P)$$

(Equation 3)

where $DS^P$ = Priority index of the strategic dimension (p), p = 1 to 10, $MacUi_i^P$ = value of each macro risk factor, $ConUi_i^P$ = value of each competitive risk factor, $AcUi_i^P$ = value of each internal-primary risk factor, $SouUi_i^P$ = value of each internal-support risk factor.

The value of each priority index is then identified by the Probability-Impact matrix (see Figure 6):
5. Conceptual Framework

The conceptual framework proposed in this research is presented in Figure 7. The literature review has highlighted the fact that a successful strategy includes three key characteristics: the ability to adapt to the environment, the formalization of a strategy with the identification of clear objectives and the adoption of a plan of actions with the allocated resources. In order to bring a response to those specific features, the conceptual framework will be used to verify that the SME performance is affected by environmental factors. It will further propose that the best means of assessing those risks is by using likelihood-impact matrices. Finally, the framework will model the links between the likelihood of each risk factor and its impact on the ten key strategic dimensions. In addition, several important control variables are included in the model to eliminate or reduce the bias.

Control variables. The proposed conceptual framework incorporates several important control variables. The first control variable is the size of the SME as measured by its total number of employees. It will reveal any specific effect of the size of the firm on the performance of the SME. Second, the proportion of employees with a university degree or higher relative to the total number of employees is used to control the quality of the company's human resources, which is a key factor in generating innovation in the literature. The third control variable is the age of the business, to determine whether start-ups tend to adopt a more radical innovation in terms of product/process/organization or whether the age of the business has an impact on its structure administrative costs. A fourth control variable is predictability, it will reveal to what extent the assessment of the impact and likelihood of each risk is affected by its predictability (Jackson and Musselman 1987). The last control variable is a dichotomous variable with a value of 1 if the company has initiated a new product/process innovation in the last 3 years, otherwise it is set to 0.

6. Conclusion and Further Work

There is a consensus in Europe that SMEs are an essential part of a strong and prosperous economy. However, SME managers have difficulties in establishing a coherent and optimized global strategy due to lack of time, methodology and/or know-how. This entails a mechanism for developing the strategic plan either by reusing a previous success strategy or by subscribing to an in-house action plan. In addition, in the book by Chunka Mui and Paul Carroll entitled the "Billion dollar lessons", after analysing 750 large companies, the authors identified that 46% of failures resulted from poorly developed strategies. This fact is corroborated by Zacharakis (Zacharakis et al., 1999) who identified that in the high-tech industrial sector, more than half the failures were due to a lack of operational strategy and/or external factors such as strong competition, weak growth and small market size.

This research propose a framework to link the assessment of the company internal, competitive and macro environment risk factors with their impact on the key performance dimensions. Furthermore, the extensive use of analytical hierarchy processes will allow the SME leader to assess and review its strategic dimension priority indexes quickly and easily so that he can adjust his strategy to an ever-changing environment. The weight of each risk factor will be constructed through a survey of experts and then the conceptual framework will be tested on a panel of SMEs. Further
work: SMEs leaders having difficulties to establish an optimised overall strategy due to a lack of time and methodology, a dashboard displaying the index of each strategic dimension is under development.

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Biography

Jean-Marc Vasnier is the Head of Continuing Education at Ei.Cesi Campus Saint-Nazaire, France. He has 15 years experience working in the automotive industries in UK, USA and South Africa as manufacturing engineer to lean director. His areas of expertise are in lean manufacturing, problem solving and change management. He obtained a Fellowship in Manufacturing Management from Cranfield University, UK and also holds a Six Sigma Black Belt. He has supervised over 40 masters students in quality, supply chain and lean disciplines. His research interests are in manufacturing strategies, the deployment of innovation and new product design in SMEs.

Mourad Messaadia was born in Constantine, Algeria. He received a diploma of engineering in 1997 from BMA, Algeria. In 2003, he received his Masters degree in Automation and Production Processes at Polytechnic National Institute of Grenoble (INPG). In 2008, he held a PhD degree in Industrial Engineering at LAAS-CNRS laboratory, University of Toulouse. Dr. Messaadia was a reviewer of papers for IJPLM, IFAC, INCOM, and APMS and was member of research team at French System Engineering Association (Afis) and Eco-Design Systems for Sustainable Development (EcoSD). His current research interests are OEM-Supplier relationship, PLM approaches, system engineering and Eco-design.

Nicolas Maranzana is Associate Professor at the Arts et Métiers School of Engineering in Paris, France and a member of the Product Design and Innovation Laboratory (LCPI). His research interests focus on design performance improvement by learning innovative network design.

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