Toward an Innovative Risk- and Opportunity- Oriented System for SMEs' Decision-Makers

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ROMAIN BEN TALEB[1], MATHIEU DAHAN[3], AURELIE MONTARNAL[1], MATTHIEU LAURAS[1,3], ROMAIN MICLO[2]

[1] Center of Industrial Engineering, University of Toulouse, IMT Mines Albi
Albi, France
romain.bentaleb@gmail.com; aurelie.montarnal@mines-albi.fr; matthieu.lauras@mines-albi.fr

[2] AGILEA
Toulouse, France
romain.miclo@agilea-group.com

[3] School of Industrial and Systems Engineering, Georgia Institute of Technology
Atlanta, GA, USA
mathieu.dahan@isye.gatech.edu

***Résumé* – La crise de la COVID-19 a mis en exergue de nombreuses faiblesses dans les entreprises, notamment les petites et moyennes. Parmi ces faiblesses, il en est une symptomatique : l'incapacité des décideurs à prendre des décisions stratégiques robustes dans un contexte incertain et fortement perturbé. Pourtant, un tel contexte, peuplé de risques et d'opportunités, est à considérer comme une nouvelle normalité. Une analyse plus fine de la situation montre que les responsables d'entreprises utilisent principalement des outils issus de la Stratégie et du Contrôle de Gestion pour soutenir leurs décisions. Or, ces outils présentent de nombreuses limites telles que leur ancrage déterministe, leurs analyses ex post, ou encore leur dimension souvent qualitative de la gestion du risque. Le présent travail de recherche propose les bases d'un premier modèle original centré sur la gestion des actifs des entreprises et inspiré du Génie Industriel et de l'Intelligence Artificielle. Ce modèle vise à mieux appréhender les risques et les opportunités dans les mécanismes de prise de décision stratégique. La proposition est illustrée sur un cas d'école permettant de mettre en perspective son potentiel. Des axes de développement futurs sont finalement proposés pour alimenter la suite de ce travail de recherche débuté récemment.**

***Abstract* – The COVID-19 crisis has demonstrated numerous weaknesses in Small- and Medium-sized Enterprises (SMEs). Among them, the incapability of top management to make robust strategic decisions in an uncertain environment composed of risks and opportunities, is probably one of the most critical. Unfortunately, such a disrupted context is now the norm. By analyzing the situation, we notice that most of these top management decision-makers use traditional Strategy and Management Accounting methods to make decisions for their business. However, these methods have numerous limits regarding the management of uncertainties. Notably, most of them are deterministic and reactive (i.e., a posteriori analysis) and they often manage risks through pure qualitative approaches. Based on these limitations, this article develops the fundamentals of a first innovative model focused on the management of assets and inspired by Industrial Engineering and Artificial Intelligence risk- and opportunity-oriented tools. The proposed approach intends to support more robust strategic decisions in disrupted contexts. An illustrative case is then developed in order to highlight the potentiality of our approach. Finally, some avenues for future research are exposed regarding the current work which is currently in its infancy.**

***Mots clés* – Système d'Aide à la Décision, Risque, Opportunité, Contrôle de Gestion, PME.**
***Keywords* – Decision Support System, Risk, Opportunity, Management Accounting, SME.**

1 INTRODUCTION

The COVID-19 crisis revealed to the whole world how fragile the economy is with respect to uncertainties and disruptions. In particular, the economic consequences of this crisis are catastrophic for many Small- and Medium-sized Enterprises (SMEs). In France for instance, the economic growth of SMEs should drop by 15% for the year 2020 [INSEE, 3rd trimester 2020]. As explained by [Schumpeter, 1943], managing a company requires managing the impacts of uncertainties it faces, whether they are negative (risks) or positive (opportunities). Unfortunately, catastrophes such as the financial crisis of 2007-2008, or the pandemic crisis of 2020 and later, seem to demonstrate that companies, and notably SMEs, are not properly equipped to efficiently cope with such uncertainties.

Essentially, the SMEs' decision-makers define and implement a strategy to ensure the proper functioning of their company. As shown by [Mintzberg, 1987], a strategy is composed of a plan, a positioning, a perspective, a pattern, and a ploy (5P's). Currently, the SMEs' top management teams mainly use strategy and management accounting tools to make decisions, particularly with respect to the strategic time frame. However, most of these tools are either purely qualitative, or only provide limited quantitative insights derived from analytical and deterministic analyses. These tools mainly utilize descriptive analytics, i.e., they first analyze past information to determine the cause of bad performances, and then make corrective decisions for the future.

Nevertheless, each component of a company's strategy is potentially impacted by hazards, changes, and variabilities during their implementation. As a result, the current decision tools do not enable SME's managers to make robust decisions in what is henceforth known as the VUCA worlds (Volatile, Uncertain, Complex and Ambiguous) [Du and al. 2018.]. In addition, most of the decision-makers lack a culture of risk and opportunity, and have solely focused on maximizing efficiency [Peretti-Watel, 2005]. This results in decisions that are not sufficient for staying economically safe in case of disruption and for being sustainable, as demonstrated by the current COVID-19 crisis. Thus, it is of prime importance to consider the VUCA environment as a new normal for governance and decision-making.

Considering this, our research problem consists in studying how the SMEs' decision-makers tools can be improved to better manage the new normality of the economic world. Our main research claim is that a cross learning opportunity between various disciplines such as Strategy and Management Accounting on one hand, and Industrial Engineering and Artificial Intelligence on the other hand, can significantly improve the decision-making process. In particular, we aim to leverage the maturity of the Industrial Engineering and Artificial Intelligence disciplines in terms of uncertainty management to create prescriptive analytics tools. It is a potential avenue for enhancing the capabilities of SMEs to perform well and to become sustainable regardless of the risks and opportunities they have to cope with. Finally, our research objective is to develop an innovative risk- and opportunity-oriented decision-support system dedicated to SMEs' strategic decisions.

In this article, we intend to (i) position this contribution within the existing literature; (ii) describe the potential design of such a system; (iii) share a first illustrative example; and (iv) draft a roadmap for future research on this subject.

2 BACKGROUND

2.1 Major Strategic Decisions for SMEs

Among the resources available to decision-makers, environment analysis patterns can be used to identify risks, opportunities, strengths and weaknesses of their firm. [Knuston, 2018] reviews several of these tools. First, Business Model Canevas can help define value creation by taking into account stakeholders and available resources of the firm. Once this process is defined, analyzing and qualifying the environment is required. For example, the PESTEL pattern triggers a particular environment analysis based on Political, Economic, Social, Technological, Environmental and Legal dimensions and enables to identify opportunities.

[Aguilar, 1967] and [Learned et al., 1969] combined the PESTEL pattern with the SWOT (Strengths, Weaknesses, Opportunities, Threats) matrix. This matrix analyzes risks and opportunities regarding strengths and weaknesses of the firm. Another combinable analysis pattern is given by Porter's 5 (+1) competitive forces. They consider competitors on a firm's market or strategic activity domain and also help decision-makers to set up the firm's position, as one of Mintzberg 5P's described in the introduction section.

However, these analysis patterns mainly use qualitative inputs. One of the first tools using quantitative dimensions is the BCG (Boston Consulting Group) Matrix [Hofer et Schendel, 1978]. It consists in positioning each of the firm's strategic activity domains on a graph with two axes: relative market share and potential growth rate. Still, the BCG matrix can be combined with the above-mentioned analysis patterns as well others, such as the Technology and Product Life Cycle analyses.

Other analytical tools are available for top managers to base their decisions upon. For example, generic strategies defined by [Porter, 1997] set up three different types of strategies in a strategic activity domain: focus, differentiation, and cost domination. Each strategy type triggers specific decisions and actions in the firm. Similarly, different types of decisions are based on the Ansoff matrix [Ansoff, 1957] and depend on product and market innovation.

Thus, we have identified two steps for decision-making. First, an analysis of the environment is required to identify risks and opportunities. Then, the decision is made by taking into account the firm's strengths and weaknesses, and by considering the resulting impact from the risks and opportunities. For this reason, our proposed model will implement these two steps of ex-ante decision assessment.

2.2 Basics of Strategy and Accounting Management

At the beginning of the last century, [Fayol, 1917] defined top management work through 5 tasks: Predict, Organize, Command, Coordinate and Control.

Management Accounting is an ally of this vision as explained by [Anthony, 1965], who describes it as the process that ensures the efficient use of resources to reach the firm's objectives. Moreover, each management function of organizational structure that assists top management (Human Resources, Purchase Department, Marketing, etc.) can be controlled by management accounting with specific methods [Mintzberg, 1993].

Plans in the organization have been managed by Accounting through the budgeting process. Each function of the firm has to prepare its budgets and only top management is able to sum up the predicted resources engaged in the following year(s). However, the most common methods for budgeting are limited by this specialization and lack of interdependence between the firm's departments. Moreover, a large subjective part of estimations is etched in these documents.

For this reason, a significant body of work in management accounting has been developed following the Balanced Scorecard [Kaplan and Norton, 1997]. This method enables a thorough evaluation of a firm's performance by combining decisions and four types of objectives in the value creation process: learning, processes, customers and finance.

Further research in management accounting opens another gate in systemic approach. For example, combining Simon's levers of control and Mintzberg's 5P's shows that a firm is a system where management accounting is an enabler and a controller. This enables and controls culture, performance, position and processes.
Management Accounting is thus an interface between strategic decisions and their implementation. However, the current work lacks a quantitative systemic approach, which drives our current research.

2.3 How Strategy and Accounting Management Consider Risk and Opportunities?

As explained in previous paragraphs, usual decision tools take primarily qualitative inputs to produce qualitative outputs. Quantifying the impact of a risk or an opportunity is the final step of a quantitative process that carries uncertainty and subjective information at each step. One example is the risk matrix [Thomas et al., 2013] in which the identified risks are quantified. The quantitative impact of a risk is the product of its potential occurrence and gravity. Although the occurrence of a risk can be statistically estimated, no quantitative methods that evaluate its impact on a firm's performance have been developed, to the best of our knowledge. At best, a firm can simply refer to past risks faced by comparable firms, and estimate the corresponding impacts.

In the context of risk management in the strategic and accounting dimensions, we aim to propose a model to predict the impact of a risk on a firm's performance and the cascading effects on the firm's assets.

2.4 How Industrial Engineering and Artificial Intelligence Consider Risk and Opportunities?

[Zeng et al., 2017] define a risk, in its usual understanding in the Industrial Engineering domain, through three main components: (i) a driver that triggers the risk, (ii) an event with a probability of occurrence, and (iii) the resulting consequences. The authors go further by defining the Risk with Casual Relationship (RCR) model in which the drivers can be both triggering factors, defined as "uncontrollable or immeasurable" causes but also risks themselves, defined with a probability. The RCR model also considers the consequence as either a direct financially quantifiable impact or another subsequent risk (with a potentially bigger consequence). In line with this, research works such as [Fang et al., 2012] aim to model and evaluate the interactions between risks and their cascading effects, using network theory in this particular case, and provide decision-makers with an enhanced visibility about the trajectory of a project.

Essentially, [Benaben et al., 2019] came up with two statements: (i) the usual risk representation above-mentioned remains simple and does not fully support the cascading effect and (ii) the step of risk identification remains a laborious human task based on reviews, interviews or questionnaires.

In the field of supply chain risk management where risk analysis is a cornerstone activity, [Baryannis et al., 2019] suggest that the use of a proactive approach to predict the occurrence and impact of risks is necessary and that, considering the large datasets it should utilize, AI-based methods are quite relevant. The authors define several categories of candidate AI solutions such as: continuous or scenario-based stochastic programming, fuzzy programming, robust optimization, hybrid mathematical programming, machine learning and big data, and network-based and agent-based reasoning. [Baryannis et al., 2019] observe that only 8% of the articles studied in their survey define a decision support system, and 4% combine risk identification and assessment. Thus, risk identification remains a hardly covered topic that requires solutions using for instance network-based models, automated reasoning and machine learning/big data analytics. Interestingly, the authors describe a lessened interest of managers in techniques that do not provide any decision-making capability while researchers are inclined to use proven mathematical programming solutions rather than other AI techniques.

In the field of accounting, [Sutton et al., 2016] urge AI researchers to deepen the efforts: while knowledge-based systems did not survive in the field, there are new promises enabled by the recent machine learning techniques – especially natural language processing, considering that text has become a very large source of data in accounting activities – that have to be considered.

This overview of the state-of-the-art shows that decision-making should be based on a proper risk analysis including their identification and impact assessment, which can only be relevant when considered in the entire firm's environment. In addition, accounting management is at the interface between decision-making and proper decision implementation, and therefore takes an important place in the risk management process that has to be led. AI comes with big promises and expectations in this regard.

3 PROPOSAL

3.1 The Process

Following a traditional risk management lifecycle [ISO 31000, 2009], we suggest a seven-step approach to support our ambition as shown in Figure 1.

Figure 1. The risk and opportunity management process (inspired by ISO 31000)

Basically, the first step consists in identifying the trigger events which are in our case, risks or opportunities. These events might be endogenous (internal processes) or exogeneous (external environment).

The second step is about assessing the potential impacts and consequences of each individual or combination of risks and/or opportunities on the one hand, and the probability of occurrence on the other hand. Usually this is called a criticality evaluation even if in our case, this criticality can be negative or positive.

The third step consists in identifying concrete alternatives (actions, options, etc.) which can bring a solution to mitigate the risks and/or to catch the opportunities if needed.

The fourth step leads to the selection phase. During this phase, evaluation of all alternatives (scenarios) will be made in order to assess the potential benefits that each of them can bring to the SME, along with the associated costs (in cash, resources, etc.).

During the fifth step, the decision-maker will select the best alternative for them, i.e., the scenario that provides the optimal tradeoff between the costs and the benefits among all the identified alternatives.

The sixth and seventh steps represent the implementation of the decision in the field and the gathering of associated feedbacks to close the loop with the first step.

3.2 The Model

Given our summary in Section 2.1, our proposal is based on the paradigm that all SMEs' strategic decisions are driven by the assets of the company. Specifically, each strategic decision of a manager can be categorized as:

- Purchasing a new asset,
- Removing an existing asset,
- Updating an existing asset to optimally exploit it.

According to management accounting research, a company manages at least 7 main categories of assets if we consider capitals identified in EFQM framework [Trebucq and al., 2017]:

- Cashflow,
- Human resources,
- Material resources,
- Information Technologies,
- Business processes and abilities,
- Brand and image,
- Customers' portfolio.

For each of them, the challenge for the decision-maker will be to apply the process described in Figure 1 to objectively assess the positive or negative impacts of an internal or external trigger event on an asset or a group of assets. In particular, risks and opportunities might have different features for each category of assets and must be managed in a tailored manner.

Based on this approach, we developed the model presented in Figure 2. This model shows how an endogenous or exogeneous trigger event (e.g., a change in the demand, a delay in a supply, new bank conditions, a human resource application, etc.) can generate a risk or opportunity for one or several assets of the SME. This risk or opportunity will imply potential changes in the asset's status and its associated performance level. Therefore, a specific decision could be deduced to benefit from this new status or to avoid potential performance decrease. This decision relates to one of the above-mentioned three generic behaviors that a decision-maker may have on an asset [IFRS, 2020].

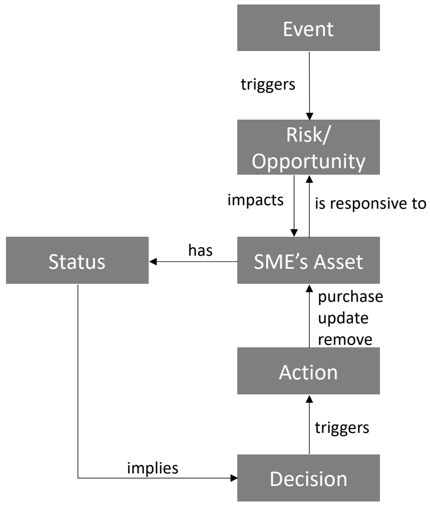

Figure 2. The proposed model

All the associations (verbs) described in Figure 2 must be applied to past, current, and potential situations. For instance, this model can be applied in reaction to an existing situation or a projected one.

As an illustration, Table 1 develops a set of potential strategic decisions that an SME can activate to mitigate some risks or leverage opportunities according to the model described in Figure 2.

Considering this model, two main stakes can be identified. The first one consists in providing capabilities to detect and evaluate as soon as possible current or future potential risks and opportunities that can have an impact on the SME's assets. The second one consists in making a robust decision in such a situation to maximize efficiency while avoiding potential failure or degradation of the SME's performances.

Regarding the detection stake, and as indicated in Section 2, existing decision support systems used by the majority of SMEs at the strategic level gather historical information to analyze past situations and make corrective actions to go toward a better position. In other words, this kind of approach is mainly reactive and descriptive, and entails managing the SMEs' business with ex-post Key Performance Indicators (KPIs). Our ambition with the current proposal is to move toward a more proactive and predictive step implying ex-ante KPIs and management.

Regarding the decision-making stake, our proposal consists in exploiting the causal relationships described in Figure 2 to better prepare the future of SMEs. Specifically, we propose to secure long-term perspectives with respect to a large set of potential scenarios. In practice, this consists in predicting a set of potential futures regarding ongoing or potential risks or opportunities in order to support a large, qualitative and quantitative "what-if" perspective. Ultimately, we aim to derive a prescriptive approach that provides dynamic, wide, and effective contingency plans.

3.3 The Tools

Regarding the suggested process and framework, two main obstacles should be considered for selecting the most appropriate decision-support tools from existing literature and practices in Industrial Engineering and Artificial Intelligence. The first one relates to the core capabilities that the tools are

Table 1. Examples of decisions

ASSETS	EXAMPLES OF DECISION VARIABLES				
	Purchase	Update			Handover
		Availability	Ability	Capacity	
Cashflow	Get a loan	Transfer money to checking account	Repurchase some shares	Reduce customer payment period term	Invest
Human Resources	Hire someone	Accept or Decline a day-off	Train someone	Train someone	Fire someone
Material Resources	Buy an equipment machine	Procure row material	Change the machine adjustments	Open a new shift	Sell an equipment
Information Technologies	Buy a software	Contract with a third-party provider	Adapt the parameters	Buy additional tokens	Do not renew a licence
Business Processes and Abilities	Design a new process	Plan the activities	Adapt the means of an activity	Adapt the means of an activity	Stop an activity
Brand and Image	Buy an existing brand	Buy a domain name (Internet)	Change a logo	Do a social network campaign	Sell a brand
Customer's Portfolio	Buy a new company	Create key account manager roles	Develop a Customer Relationship Management Project	Start a promotional campaign	Sell a customer portfolio to another company

supposed to have and the second one is about their abilities to estimate the future. Let us start with the identification of the main abilities that are required to execute the process described in Section 3.1. Basically, such an instantiation needs to be able to:

- Identify, detect or predict the information pertaining to the risks and opportunities to be assessed on one hand, and to the data and parameters of the evaluation models (i.e., models able to assess the past/current or potential future status and performance of each asset) on the other hand. To achieve this goal, we can use traditional tools such as statistics or more advanced ones such as data mining or machine learning. Naturally, more qualitative techniques such as Natural Language Processing or Knowledge-Based Engineering might also be useful.
- Assess quantitatively and/or qualitatively the potential consequences of an occurrence of a risk or an opportunity on a given asset or group of assets. This ability could be activated through the use of quantitative techniques such as Heuristics or Simulation on one hand, and of qualitative techniques such as Expert Systems or Model Driven Engineering on the other hand.
- Design alternative scenarios able to mitigate the risks or to benefit from opportunities. This task can be performed manually or automatically depending on the context, with the help of modeling tools from Operations Research (Simulation and Optimization models mainly). However, learning from the past through Machine Learning techniques or Expert Systems (rule-based) might also be a good option. Finally, using a Model-Driven Engineering approach could be an interesting option to support the design step from a qualitative perspective.
- Evaluate the different alternative scenarios to assess a priori the expected performance of each scenario. Here, quantitative techniques should be preferred such as Optimization, Simulation and Heuristics. It is important to notice that this evaluation can be carried out with respect to both benefits (i.e., the stakes) and costs (i.e., accessibility). Several performance dimensions might be considered and should be driven by the typology of the associated assets.
- Compare the results of the different scenarios in order to support the final choice for the decision-maker. This ability relates to the overall performance of each scenario in terms of stakes and accessibility, or in terms of Return-On-Investment. Decision-support tools such as Multi-Criteria Decision Making, Decision Trees, Data Mining could be used accurately to support this ability.
- Monitor and control the execution of the plan in the field. This ability could be supported through Data Mining or Online-Flow Simulation systems.

Table 2 summarizes our vision of potential decision support tools extracted from the Industrial Engineering and Artificial Intelligence disciplines that can be used to concretize our proposal. Basically, techniques such as Machine Learning (reinforcement, supervised, unsupervised), Flow Simulation (discrete event simulation, multi-agent, system dynamics) and Optimization models are excellent candidates as they have the ability to proact ahead instead of "only" learning from the past.

One important justification of this model comes from the international accounting rules (IFRS) and the key concept of assets. This work could be a bridge between Industrial Engineering and Accounting research. Using different forms of capitals identified in Management Accounting research and converting them into relevant objects both in the Accounting and Industrial Engineering framework is an illustration of this

Table 2. The potential toolbox to solve the proposed model

Process Step	Data Mining	Machine Learning	Statistics	Natural Language Processing	Knowledge Based Engineering	Model Driven Engineering	Exert Systems	Heuristics	Optimization	Simulation	Decision Trees	Multi Criteria Decision Making
Identify Risks and Opportunities	X	X	X	X	X	X				X		
Assess Impact and Occurrence		X				X		X		X		
Define Alternatives		X			X	X	X	X	X	X		
Evaluate Benefits vs Costs							X	X	X	X		
Make Decision	X		X				X		X		X	X
Implementation												
Control	X									X		

purpose. We claim that this first concept of assets is necessary to achieve this goal. However, a more complex model involving contracts between assets may be able to propose a more sophisticated system in order to interface the planning and simulation methods from Industrial Engineering with this first model.

The purpose of this proposed model is to develop a tool able to connect firms and their environment and assess a decision implementation regarding the performance criteria chosen by top management. Integrating common externalities in the assets' attributes and firms' processes seems to be an opportunity to enable decision-makers to asses multi-impact decisions and multi-objective achievements.

4 ILLUSTRATIVE EXAMPLE

In this section, we illustrate our approach for the ex-ante evaluation of decisions using two examples involving a risk and an opportunity. We aim to highlight the impacts on different assets that can be possibly quantified, predicted and optimized with Industrial Engineering and/or Artificial Intelligence common processes.

We first consider the example of a firm that produces computers and suppose that a new component provider is entering the market. To make a decision regarding this event, the decision-maker must evaluate its impact on the firm's assets. Since this event can positively impact the firm's ability to get components for its production process (Material Resources), purchase costs (Cashflow) and production quality (Business Processes and Abilities), it can be qualified as an opportunity.

Making a decision in regard to this opportunity depends on the status of the firm's different assets. The status is defined by the availability, capacity and ability of the affected assets. Moreover, the status is monitored through a performance measurement. In the case of a new supplier, the information provided in the offer can be leveraged to evaluate the impact on the assets of a decision regarding this event. Particularly, opportunities can be evaluated on their impact on Cashflow. The identification of this new supplier triggers alternatives to the current purchase options that should be evaluated.

Designing the flow of impacts on the firm's assets status triggered by the event as a system can enable the choice between not purchasing new components, including the new components and keeping the current suppliers, or exclusively purchasing from the new supplier.

Basically, the costs associated with a decision are evaluated on the main impacted asset. For example, getting components from a new supplier might be evaluated in terms of their purchasing costs. An ex-ante evaluation of a decision entails taking into account all of the decision's consequences. In this case, buying components from a new supplier can require updating the processes for delivery reception, can impact components storage in the plant, and may need to update the information system procedures for command and invoicing.

More complex impacts can also be evaluated by taking into account lead-time and quality. An increase in component quality can reduce non-quality costs and thus production costs. Regarding the lead-time and quality improvement of components, the firm might also increase its own products' lead-time and quality and increase its prices, its sales and thus its turnover. Moreover, a new supplying contract can be a new asset for the firm depending on its ability to generate revenue or savings and to reduce risks of shortages. An ex-ante evaluation can predict the complete cost of the decision and value creation for the firm.

The flow of impacts on different assets has to be processed ex-ante to make the best decision triggered by the event qualified as risk or opportunity.

Evaluating a risk is driven by the same ex-ante evaluation to decision-making. For example, the risk of a fire at a provider's plant has a probability to affect buyers purchase ability and thus its production process, its turnover, and its brand. An ex-ante evaluation requires to set up the flow of impacts on different assets and their features. This model also predicts the complete cost of the risk and the associated decisions. Stopping the contract with the supplier, purchasing from another supplier, or updating the contract in

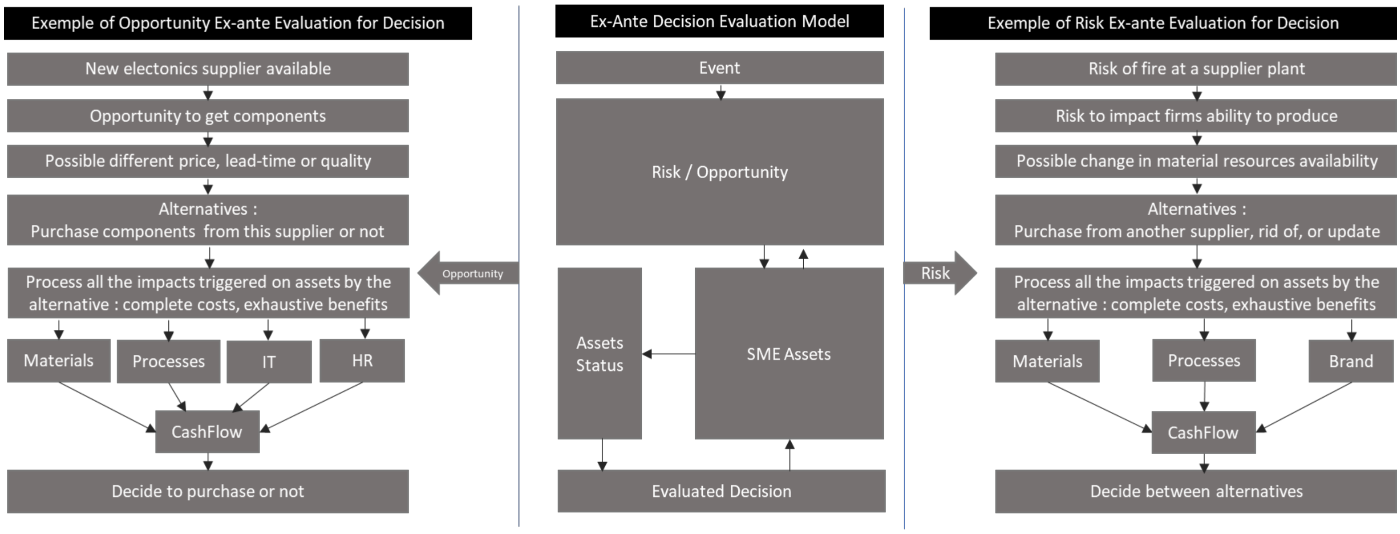

Figure 3. Examples of risk and opportunity decision process

a supplier development strategy can be evaluated ex-ante. This last option could lead to more research because contracts are assets for the firm and increasing their value could be a lever of value creation. As in opportunity evaluation, the best decision regarding future cashflows triggers choice.

To conclude this example, our model highlights a parallel process for risks and opportunities and thus an ex-ante evaluation of decisions as it is evaluated on its impact on the firm's assets, their features, and their ability to trigger cashflow.

5 CONCLUSION AND PERSPECTIVES

In this article, we have argued that the current top manager decision support tools are not appropriate for the management of risks and uncertainties that SMEs have to cope with. Particularly, the methods issued from Strategy and Management Accounting disciplines present some critical limitations such as their deterministic and *a posteriori* features. Based on this diagnosis, we have presented the first characteristics of an innovative model able to serve as a basis for future SME's top manager decision support systems developments. The main assumption of this research work consists in changing the decision paradigm of top managers by using both a risk-management process and a set of predictive and prescriptive techniques capable of better exploiting uncertainties. Industrial Engineering and Artificial Intelligence backgrounds should be relevant sources of inspiration to go further.

To sum up, this work is still in its infancy. As a consequence, there are numerous avenues for research. First, the asset-oriented approach should be tested and validated with several real cases. Second, a finite set of typologies of risks and opportunities must be defined to enable the implementation of the approach in the field. Third, additional investigations regarding the decision categories associated with each asset of a company should be conducted. Fourth, each association of the suggested model presented in Figure 2 should be supported by a specific decision-support tool able to deliver a quick, relevant and accurate decision-support support mechanism. Further research work should consequently be done to both define the technical requirements and select the appropriate decision-support tools for each association of the model. For instance, some specific online predictive algorithms might be derived to detect in real time the risks and opportunities that top managers should account for regarding their business.

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