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## **Procurement Function between Digitalization and Risk Management**

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### **Abstract**

In the age of economic globalization when the market is becoming more challenging and pervasive, especially after Covid-19 and the Ukrainian war, businesses are working to strengthen their management systems and strategies. One of the most important functions to be considered is procurement, since it represents a key driver of the value chain that must enhance efficiency and effectiveness.

Using emerging technologies to digitalize procurement function will help companies to provide more opportunities and gain a competitive edge by focusing more on customers' requirement and supplier relationship. However, it is crucial to implement a procurement risk management system to avoid future potential issues and ensure leadership of companies.

The main purpose of this research is to define the significant role of procurement 4.0 in providing greater flexibility and control over all aspects of the purchasing process. Moreover, it aims to bring light on the procurement risk management combined to digitalization. This paper is based on two real case studies related to: Food industry & Energy infrastructure industry.

**Keywords:** E-Procurement, Risk management, Digitalization, Process

### **1. Introduction**

The procurement function is involved in transactional processes including numerous internal and external stakeholders, mostly suppliers. In order to independently shape its position as a crucial function, procurement must not only investigate its strategic plan but also play a vigilant role in developing the company's digital strategy. By concentrating more on their customers and having the necessary agility to meet continuously shifting client requirements, businesses that are using digitized procurement can gain a competitive advantage.

Managers who lack the necessary prior experience may feel as though they are taking a step into the unknown when embarking on the digital transformation journey. Based on that vision of leadership and collaboration, which are essential success factors in every digital transformation, this requires careful consideration, discipline, and forward-looking action.

Moreover, new uncertainties regarding the macroeconomic situation have surfaced today for all purchasing practices. This Business Partner, who accounts for between 50% and 80% of variable costs, is exposed to a variety of different avenues that could directly affect the company's operational margins.

The global economic environment is poised to confront unknown circumstances. Today, there is no doubt that the function is a high-stress activity due to the high international transportation costs, and the scarcity of basic materials. As a result, the degree of maturity of the procurement function's performance will depend on how well it understands and manages the risk.

This paper reports a research project that seeks to address the following questions:

How can digital procurement liaise and connect business partners, suppliers, and experts across with business units? And what is the added value of digital transformation in the procurement process? How to manage and mitigate procurement risk to keep the business operational using automation?

## **2. Method**

As the current study is about digitalizing and managing the risk related to the procurement function based on two business cases: Company A (food industry) and Company 2 (Energy & infrastructure industry), it is necessary to develop two detailed methods M1 & M2:

### *2.1. M1: Company A*

First, we define the current context, pinpoint the primary issue, and assess how it has impacted the company's procurement strategy. The next step is to establish a key issue statement and attempt to generate comprehensive information about the procedure. A literature review is also necessary to situate the study in the context of previous works and to support the necessity of the investigation.

Second, it is essential to evaluate this procedure using the pertinent baseline measurements to see how it actually works. Furthermore, visualizing the gathered information to obtain correlations and narrow down the various concepts and theories to vital possible future root causes so that we can check and guarantee that advancement is focused on them.

Third, we'll examine and recommend solutions to the various issues we've encountered, assess them, and choose the ones with the greatest opportunities of working. We should consider maintaining these improvements after the digital solution has been implemented in order to increase complementarity through synthesizing results for convergent and appropriate interpretations.

### *2.2 M2: Company B*

The second method follows a specific process, which starts with the definition of the problem, the issues, and the constraints, moves through measuring and analyzing the data collected, ends

with implementing the best course of improvement to meet the set goals, and then assesses the effectiveness of those improvements by describing the effects of their implementation.

To be more specific, the process must be initialized with choosing the problem, which involves defining the difficulties encountered, gathering, and grouping all of the faced issues, deciding on the problem, informing others, and informing oneself. Then comes analyzing the issue: once the issue has been identified, it is necessary to fully understand it, measure the various aspects, and establish and validate the goals. Afterward, we need to determine the primary causes and determine their validity, since it becomes, in this step, necessary to gather all contributing factors and classify them. Looking for solutions is eventually the next step, by exploring potential solutions and classifying them to pick the right one to test and validate. After that, we will choose the experiments to prepare and conduct and interpret results and gather insights. This will help in the decision-making to determine the best solutions and the comparison between them. Last but not least, we have to create an action plan that will finally help follow the compared results to the previously defined objectives and adjust if necessary.

This couldn't have been possible without the companies Cluster involvement, through meetings and collaborative workshops. The paper is concluded by an evaluation of the impact of the project and the future research needs and opportunities.

### **3. Literature review**

This section of the research paper highlights the study's findings regarding the digitalization of the procurement process and its risk management, based on the information and data collected from evaluating and reviewing numerous articles.

#### *3.1 Procurement in the light of industry 4.0*

It has been determined that the relationship between procurement department and the company's corporate strategy for cutting-edge manufacturing differs over time and among nation divisions [1]. There is evidence of a connection between business strategy and procurement strategy in companies with European or American headquarters.

Bill Michel, senior vice president of the Institute for Supply Management and president of ADR North America, who claims that there are several ways for buyers to better leverage the internet to minimize costs associated with the procurement practices [2]. It is simple and quick for the firm to streamline its supplier network, which will lead to considerable cost savings. Additionally, firms can save a significant amount of money by using e-auctions, that are extremely advantageous for commodity products.

Procurement 4.0 is a web-based Business - to - business e-commerce tool [3] that enables suppliers to manage and report the accomplishment of purchase orders while also enabling purchasers acquire goods and services. It involves financial operations and payment services, control and validation, reception and exception handling. In comparison to traditional mechanisms as price and quality, the new manufacturing requires high supply security and the ability of supply networks to instantly ensure optimal operations after instabilities [4].

The future procurement function will be engaged in every stage of the business value chain [5], from product creation to distribution, as well as controlling budgets and costs, detect and reduce

supply risk, and ensure compliance. Thus, it presents a novel approach that leverages a strong mix of McKinsey's industry expertise and content-rich services in digital procurement with Orpheus' advanced platform technology (Orpheus is a leader of digital procurement that creates software and was formed in Germany in 2005). Digital procurement is the application of emerging technologies to make strategic procurement more predictive, interactional purchasing process more digitalized, and supplier relationship management quite proactive [6].

In brief, procurement function and spend analytics positions have evolved over time. The fourth industrial revolution, the value chains, and increasing customer need for mass-customized goods and services are some examples of how the global economic landscape is changing. In fact, businesses need to gather useful data that they can use to increase the effect of their procurement efforts.

*3.2 Procurement & Risk Management*

Risk can be characterized throughout the project life cycle as uncertainties or unknown circumstances [7]. Even though the word "risk" is frequently associated with danger or a negative connotation, risk can also have beneficial consequences on project goals. Anything that affects a construction project during both the planning and execution phases is considered a risk [8].

Regarding the risk related to procurement and supply chain, multiple researchers presented different understandings (Zsidisin,2003; Ellis, 2010, Jüttner, 2003; Wagner & Bode, 2006; Bogataj & Bogataj, 2007) as summarized in the table below:

Authors	Definitions of supply risk	Scopes
<b>Zsidisin (2003)</b> [9]	“The probability of an incident associated with inbound supply from individual supplier failures or the supply market occurring, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety.”	Supply risk only
<b>Jüttner et al. (2003)</b> [10]	“Any risks for the information, material and product flows from original suppliers to the delivery of the final product for the end user.”	Information , material, and product flow risks
<b>Wagner and Bode (2006)</b> [11]	“The negative deviation from the expected value of a certain performance measure, resulting in negative consequences for the focal firm.”	General risks
<b>Bogataj and Bogataj (2007)</b> [12]	“The potential variation of outcomes that influence the decrease of value added at any activity cell in a chain.”	General risks
<b>Ellis et al. (2010, p. 36)</b> [13]	“An individual’s perception of the total potential loss associated with the disruption of supply of a particular purchased item from a particular supplier.”	Supply risk only

*Table 1 : Definitions of supply risk*

Management of supply risk has received a lot of attention. Numerous procurement risks were considered when studying the supplier performance and selection problem, including:

- Poor quality and delivery delays [14] [15]
- Lack of supplier involvement are all contributing factors [16]
- Unsure capabilities [17]
- Dispersed geographical location [18]
- Provider failure [19] [20] [21]
- Supply disruption [22] [23]

Supply chain risk is defined as the likelihood and impact of unforeseen macro and micro events or conditions affecting any part of the supply chain, leading to operational, tactical, or strategic level failures or deviations. Risk management is a management effort to control the risk of the company's operational activities by conducting a risk analysis, risk evaluation, and mitigation plans. The risk management program includes the following stages:

- Identify the risks faced;
- Measure or determine the amount of the risk;
- Finding ways to face or manage risks;
- Develop strategies to minimize or control risks;
- Coordinating the implementation of risk management and evaluating the risk management program that has been made;

Creating a clear mitigation strategy after formally reviewing supplier risks, which may include financial and logistical issues. This strategy is a "risk management framework," a precisely defined, all-inclusive method for predicting and reducing risk. The essential components of a procurement organization will then be subject to these actions (strategy, category management, requisition to pay, supplier relationship management). Companies can create formal strategies and actions by properly segmenting risk-related procedures, which helps mitigate procurement risk's potentially intimidating effects.

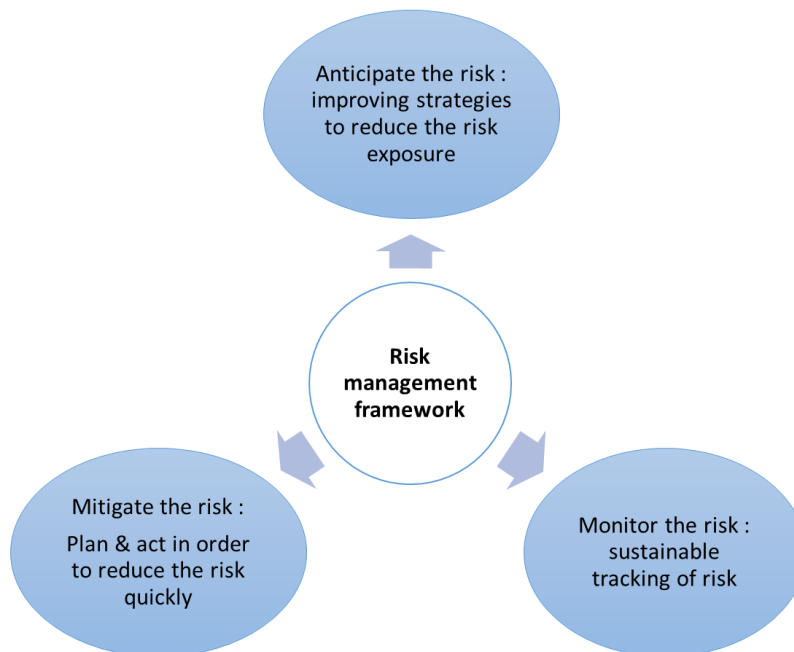


Figure 1 : Framework of risk management applied to procurement function

### 3.3. Automated procurement combined with risk mitigation

Neef's strategy and implementation of e-procurement clarified how the system works to lower transaction costs by automating procedures and substituting computer technology for human labor [24]. Additionally, it encourages the dismantling of functional departments in favor of horizontal procedures that promote greater integration. The authors have adopted the definition of e-procurement [25], which states that it is the digitization of an organization's procurement processes through web-based applications. The availability of commodities is crucial to the success of companies. Variations in raw material prices brought on by international problems like wars, pandemics, and trade wars present a huge management challenge for operating costs. The buyer must develop a risk management strategy to minimize unforeseen risks in order to anticipate them and win big deals at the best prices.

According to a study by "Agile Buyer" and "X-Achats" carried out in 2017 [26] through a questionnaire administered to 489 buyers, mainly CAC40 companies, supplier risk management is a priority for 75% of purchasing decision-makers, 40% of between them even feel that they have encountered difficulties in their supplier relations over the past three years. The main risk feared by Purchasing decision-makers is directly linked to the availability of the offer, and this is more particularly for innovative companies [27].

We can conclude that having an efficient purchasing department mainly lies in the digitalization of the process itself and the automation of purchasing risks in order to generate the best profit.

**4. Case Study 1: E-Procurement**

*4.1. Data Collection & Discussion*

This first case study features a market leader in the food sector whose procurement department significantly influences strategic decision-making and accounts for more than 47% of overall income (Figure.2). Particularly crucial when the goal is to set priorities for measures that will enhance the transformation of resources that have been externally mobilized to create a long-lasting competitive advantage. Industrial companies must have effective procurement management in to guarantee long-term survival and consistently raise sales volumes in order to preserve and grow profitability.

A significant competitive problem for firms is managing the expenses of either direct or indirect acquisitions together with the cost benefit that result. a solid understanding of data analysis, which, when applied effectively, may truly increase performance. Indirect spending made for 52% of the company's global acquisitions in 2019. The percentages have risen by 4% by 2020, and the overall indirect cost is 56%.

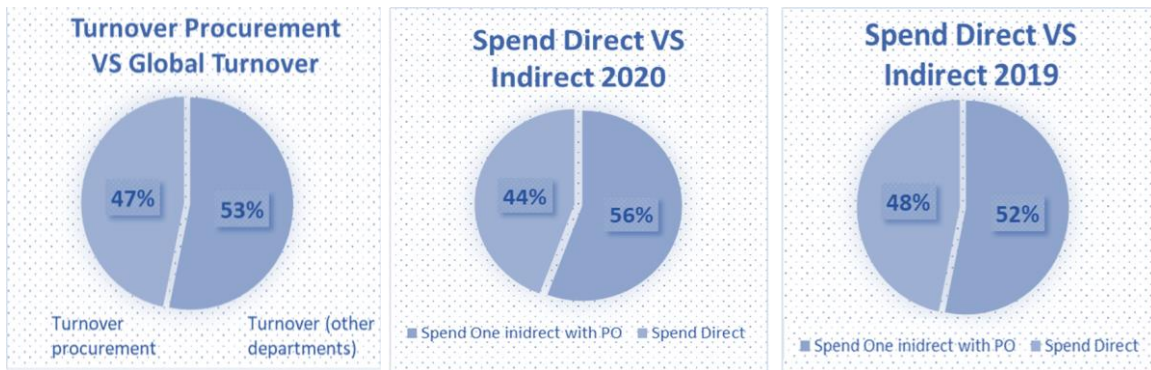


Figure 2 : Turnover & Spend Graphs 2019-2020

After acquiring information and evaluating it to ascertain the severity of the critique. The Company's procurement coordinator and the Category Managers were present for our meeting, and we went over the problems we found.

Each participant in this conference must assess the issues in light of their significance and likelihood of occurrence. We've chosen to use 8 as the threshold. To put it another way, if the result is higher than 8, the product's family will receive scathing treatment. If the outcome is less than 8, the issue is not a threat that has to be fixed. For both the impact and likelihood of occurrence, the notation system's range is 0 to 4.

Aside from financial difficulties associated with the studied category and details on risky purchases, The Kraljic matrix (Figure.4) is used to position the section of indirect purchases [28]., and the results lead us to the conclude that it's a strategic category with a high risk.

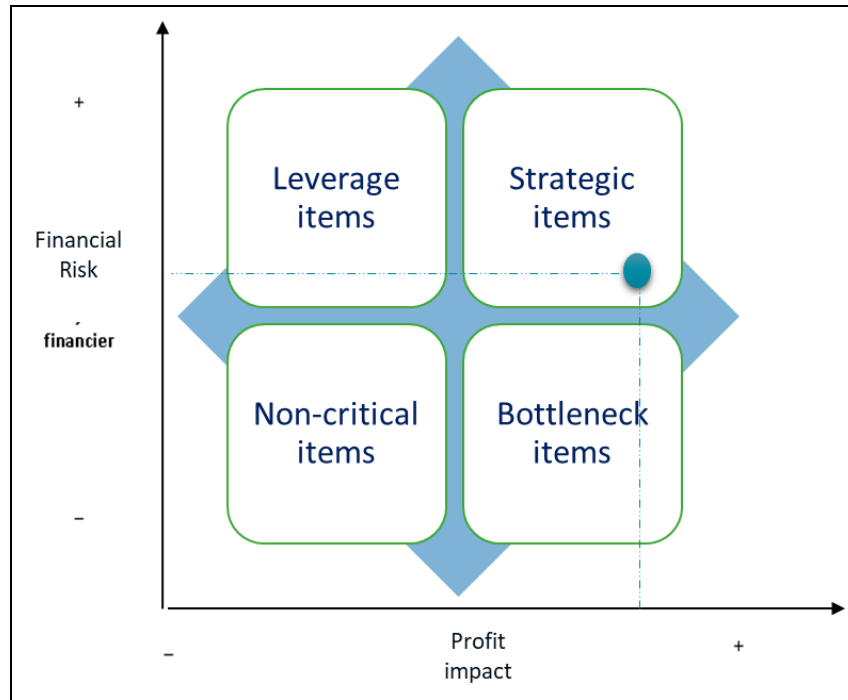


Figure 3: Kraljic Matrix

In order to identify the most significant subfamilies within this category, we've chosen to further explore the subfamilies within this category. Therefore, in order to examine how items are managed and acquired, we choose the most important family "A" in the ABC analysis.

From the unjustified pricing changes from one year to the next and from one site to the next, we can conclude that each site contacts its providers independently of the other sites. We also recognize that each order for each site is assigned to a certain provider. As a result, the mass impact does not work in the firm's favor.

4.2. Actions & Improvements

Building an e-procurement platform with an enormous number of features is one of the best propositions as best-performing solutions to this case study. This solution (platform) has been analyzed and implemented for preliminary testing which succeeded and went beyond expectations of the company's procurement department (Based on 15 buyer's feedback).The major goal is to consolidate both payment and procurement procedures involving the company's vendors in a unified too.

By taking this move, the business will be able to globalize procurement, handle contracts easily, and ensure automation of many stakeholder interactions.

In addition, automation is an excellent technique to improve and assess the effectiveness of the procurement process because it is crucial to the supply chain during a recession.

The table (Table.2) below represents a sample of 9 products purchased from the 5 sites of the company:



Product	F1	F2	F3	F4	F5	Miss to Win
P1	325,20	346,88	-	672,08	346,88	<b>390,24</b>
P2	261,96	392,94	120,83	130,98	392,94	<b>695,50</b>
P3	54 114,93	54 114,93	-	108 229,85	-	<b>54 114,92</b>
P4	-	1 691,04	-	1 268,28	2 536,56	<b>1 691,04</b>
P5	1 182,00	4 728,00	-	3 546,00	3 546,00	<b>8 274,00</b>
P6	433,60	-	975,60		867,20	<b>975,60</b>
P7	-	487,80	450,00	1 951,20	1 463,40	<b>2 552,40</b>
P8	3 800,00	15 200,00	7 600,00	3 800,00		<b>15 200,00</b>
P9	3 306,20	6 612,40	-	9 918,60	3 306,20	<b>9 918,60</b>

*Table 2: Miss to win - Sample*

The purchaser will be able to keep track of his progress in this part using a number of indicators.

\*Saving VS Planned chart: to draw attention to the buyer's efforts throughout the negotiation.

\*Entity and lift graph: indicating the proportion of monthly purchases of subfamilies.

\*Target VS Treatment chart: indicating the target associated to the request treatment chart's dwell duration, process time, and target

\*On-time In full (OTIF): The purchaser will be able to determine how many orders were performed that met the desired quality level by the desired quantity

\*Emergency rate processed: Emergency purchases are those unforeseen orders made to fill a lack of goods or services.

The ability of the many stakeholders to accept and respond to changes in the procurement process is the foundation of cooperation and the significance of digital optimization of the supplier panel. On the other side, it is based on the competitiveness between known providers. As a result, the total amount of these acquisitions will be split out among a very small number of vendors due to the reduction in the supplier panel for the relevant products, giving the buyer more negotiating power that will typically result in a significant price reduction.

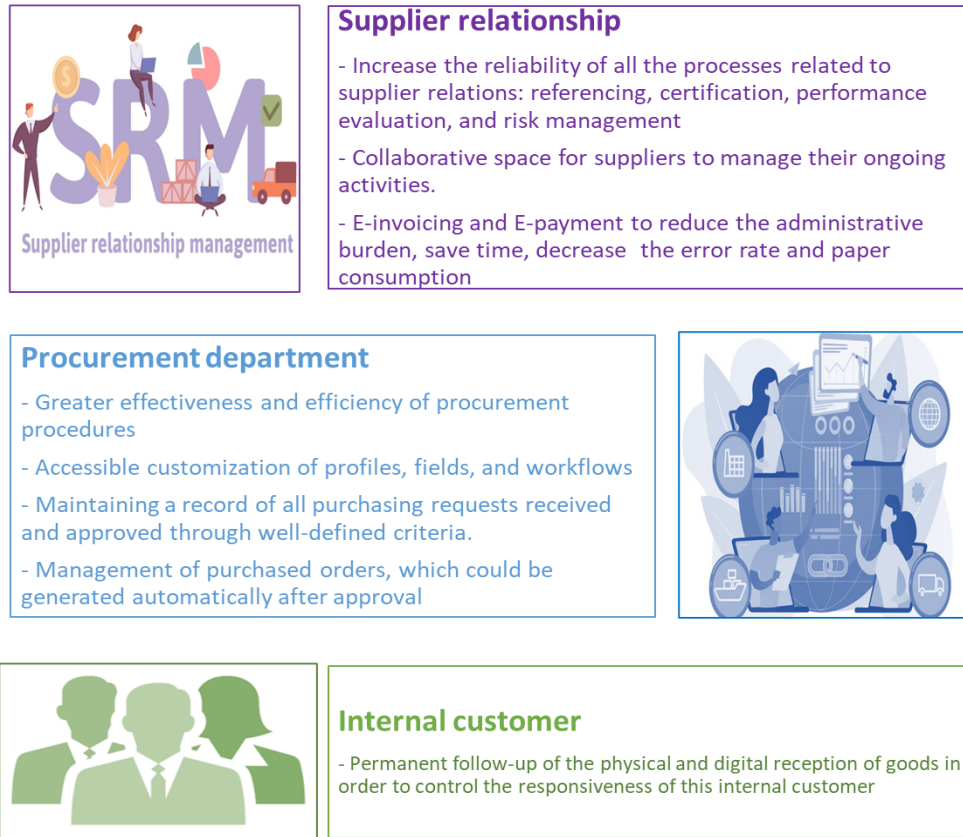


Figure 4: Features of the proposed platform



Figure 5 : Examples of procurement KPIs

The platform would be a key performance driver for the organization’s procurement department, and it will especially promote:

- Speeding up the processing of purchase requests by digitalization
- Although we have a total of 1246 orders in 2019 and 1309 orders in 2020, the firm previously created considerable administrative costs compared to the panel, including the ordering cost, which amounted to 366,54 DH (as stated by the performance management department).

- As an alternative, we shall have a restriction of 250 orders under the present rationalization option. (Table 3)
- The provider will be able to monitor the situation of his invoice at any time using the E-payment platform, saving each purchaser 20% of his time (as reported by the procurement department). (Table 4)

	Order Number	Total cost of ordering in DH
Before (2019)	1246,00	1246*366,54 = 456708,84
After	250,00	250*366,54 = 91635,00
Gain	996,00	365 073,84
Percentage Gain	79,93%	

Table 3: Total annual gain on ordering

Category Manager	Number of working hours per year	Daily gain (hours)	Annual gain (hours)	Total annual gain in hours
1	2 112	8	2 112	5 069 h
2				
3				
4				
5				
Buyers	Number of working hours per year	Daily gain (hours)	Annual gain (hours)	
1	2 112	11	2 957	
2				
3				
4				
5				
6				
7				

Table 4: Total annual gain after implementing the platform

### 5. Case study 2 : Procurement risk management

This second case study is about a market leader in the energy infrastructure that helps ensuring secure supply and developing sustainable energy in Africa & Europe. In this company, procurement function has a significant strategic impact, accounting for more than 62% of the company's total revenue. Particularly crucial when the goal is to develop a lasting competitive advantage by prioritizing measures that enhance the transformation of externally mobilized resources.

The global economic recovery in 2020–2021 following the Covid-19 pandemic has resulted in a high demand for raw materials, along with a slow redeployment of manufacturing and transportation capacity, driving up prices and lengthening delivery times. The consequences of Ukraine's war will be added to this tense situation beginning in February 2022. The uncertainty surrounding the world's leading provider of energy infrastructure solutions remains unresolved,

and this will almost certainly continue in the coming months. The exposure to risks, specifically those associated with project purchases, appears to be exorbitant.

As a result, it is necessary to strengthen the risk management culture associated with procurement and to give it the importance necessary to the procurement function, which remains one of the functions directly impacted by this completely unusual situation.

Domains	Risks	Low	Middle	High	Action Plan	Action responsible	Date of action	Status
Economic & Financial	COC (chain and control certification) requirements			X	Consultation phase: request the COC need to the supplier	Buyer – Procurement & logistic manager	The end of 2020	Done
Economic & Financial	Covid Impact: Problems with Treasury			X	Putting suppliers in competition	Buyer / procurement manager	2020	Done
Economic & Financial	Covid Impact: Price increases for raw materials			X	Follow the price of the raw material in order to choose the right time to place the order	Buyer / procurement manager	2020	Done
Economic & Financial	Impact Covid : No availability of international transportation			X	Ensure booking by the supplier before the merchandise is available	Buyer / procurement & logistic manager	First semester 2020	Ongoing
Brand reputation	Supplier not familiar with Ethic & Compliance values			X	Partnership evaluation underway for 2019	Department manager	First semester 2020	Ongoing
Supply Chain	Increased logistics costs that can impact			X	Set up a rigorous follow up of the monitoring of logistics costs	Department manager	First semester 2020	Done

	business results							
Supply Chain	Risk on customs deadline for export orders			X	Identify an indicator that would allow to monitor the export performance	Department manager	First semester 2020	Done
Supply Chain	Accusation of receipt confirmed by the provider with objections		X		Set up a follow-up of suppliers by mentioning those who do not comply with the negotiated conditions	Department manager	First semester 2022	Ongoing

Table 5 : Procurement department cartography

Analyzing the company’s procurement department cartography reveals:

- The risk analysis does not include all external risks and pays almost no attention to internal risks, whether they are related to the procurement function or the business, leaving an entire pane unanalyzed, resulting in a lack of depth in the analysis. As a result, it is critical to develop a comprehensive methodology that eliminates all risks associated with the procurement function by implementing a true anticipatory system.
- The risk is assessed in an estimate based on the expertise of the project buyer team in collaboration with the department head, resulting in a significant margin of error in risk estimation, a given of capital importance becoming the subject of an entry element for the rest of the analysis.
- The risk map lacks graphs illustrating the distribution of various risks based on the criteria I've previously selected.
- In the absence of a correlation between the risk analysis table and a detailed action plan, the actions resulting from the analysis will be automatically incorporated into the action plan.
- The concept of residual risk, or the monitoring of the effectiveness of actions implemented, is not depicted in the map.

### 5.1. Identifying the Risks

In this first phase of identification, several workshops were organized in order to identify the most exhaustive risk register possible, containing all the risks related to purchases within the company, grouped into risk categories :

<b>Risk category</b>	<b>Risk nature</b>	<b>Risk ID</b>	<b>Indicator</b>
<b>Economic Risk</b>	<b>Price</b>	<b>RE1</b>	Price Change Rate Risk
<b>Economic Risk</b>	<b>Change</b>	<b>RE2</b>	Exchange Rate Variance Risk
<b>Economic Risk</b>	<b>Meteorology</b>	<b>RE3</b>	Natural disaster risk
<b>Economic Risk</b>	<b>Market</b>	<b>RE4</b>	Imposed Supplier
<b>Economic Risk</b>	<b>Marché</b>	<b>RE5</b>	Market risk Monopoly / oligopoly / Highly speculative market / Imposed supplier
<b>Country Risk</b>	<b>Économique</b>	<b>RP5</b>	Dues and taxes
<b>Country Risk</b>	<b>Politique</b>	<b>RP6</b>	Possible politically induced shortage
<b>Country Risk</b>	<b>Ethique</b>	<b>RP7</b>	Risk related to non-compliance with CSR criteria
<b>Country Risk</b>	<b>Social</b>	<b>RP8</b>	Social instability
<b>Country Risk</b>	<b>Infrastructure</b>	<b>RP9</b>	Customs: clearance and transit procedures
<b>Financial Risk</b>	<b>Trésorerie</b>	<b>RF10</b>	Requirement for payment in advance by suppliers
<b>Financial Risk</b>	<b>Exploitation</b>	<b>RF11</b>	Dependency rate/Penetration rate
<b>Financial Risk</b>	<b>Fournisseur</b>	<b>RF12</b>	Financial health of suppliers
<b>Contractual risk</b>	<b>Légal</b>	<b>RL19</b>	Corruption
	<b>Légal</b>	<b>RL21</b>	Non-Transparency in Negotiations
<b>Contractual risk</b>	<b>Contractuel</b>	<b>RL22</b>	No Clarity and completeness of the buyer/supplier contract
			Risks related to non-

<b>Technical Risk</b>	<b>Logistic</b>	<b>RT13</b>	compliance with deadlines required for products or services
<b>Technical Risk</b>	<b>Logistic</b>	<b>RT14</b>	Risks related to failures and unavailability of logistics and transport providers
<b>Technical Risk</b>	<b>Logistic</b>	<b>RT15</b>	Risk on customs clearance times for export orders (Binding customs procedure)
<b>Technical Risk</b>	<b>Logistic</b>	<b>RT16</b>	COC requirements
<b>Technical Risk</b>	<b>Logistic</b>	<b>RT17</b>	Emerging risks of arbitrations on production made by suppliers
<b>Technical Risk</b>	<b>Industrial</b>	<b>RT18</b>	Production capacity of suppliers
<b>Technical Risk</b>	<b>Quality</b>	<b>RT19</b>	Quality not adapted to the need
<b>Brand image risk</b>	-	<b>RM22</b>	Absence of a “Responsible Purchasing” policy
<b>Brand image risk</b>	<b>Procurement performance risk</b>	<b>RM24</b>	Absence of Savings
	<b>Procurement performance risk</b>	<b>RM25</b>	Lack of Procurement Risk Management
	<b>Procurement performance risk</b>	<b>RM28</b>	Absence of Purchasing / Procurement process management
<b>Other risks</b>	<b>Technical risk</b>	<b>RA26</b>	Risk of technology monopoly by the supplier
<b>Other risks</b>	<b>Cyber security risk</b>	<b>RA27</b>	Risk of cyber security attack
<b>Autres Risques</b>	<b>Health Risk</b>	<b>RA28</b>	Risk of border closures

*Table 6: Risk categories*

5.2. Implementation of an integrated risk management tool with an instruction manual

Relying on technology, especially an automated risk management tool, would be beneficial for the department and allow it to follow the procedure while adhering to ISO 31000's guiding principles [29].

This approach led to the creation of an Excel system associated with the internal ERP of the company that redraws all of the steps in the risk management process. The tool is quite helpful since it enables the automatic generation of results in the form of graphs, risk maps, and automated action plans.

The buyer will have access to a risk management system that integrates risk analysis, or, in other words, risk identification, analysis using the two previously suggested methods, such as SCORING method [30] and the proposal of a plan of action.

5.2.1. Automatic access to tool sheets

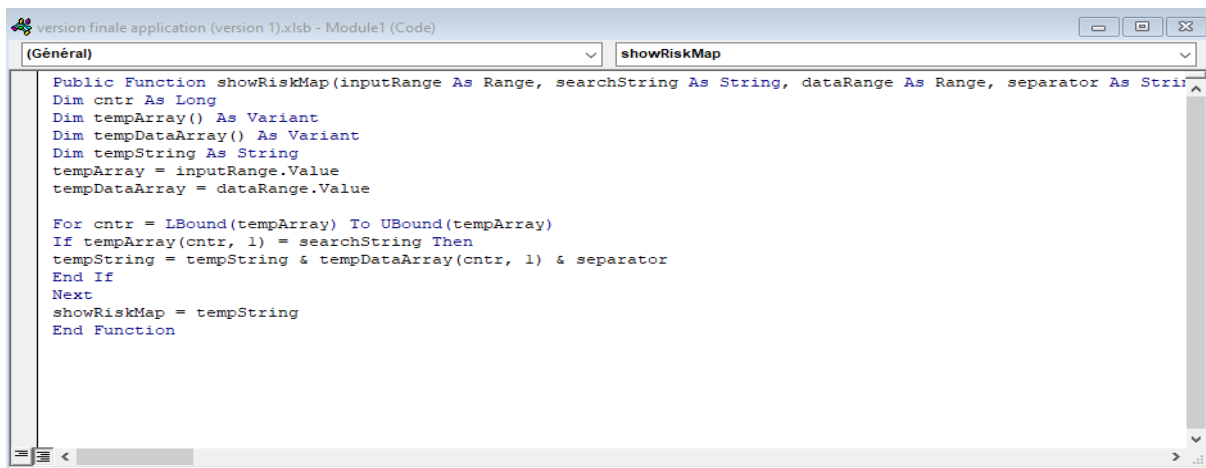
In order to quickly access information associated with but appearing in other sheets of the tool, hypertext links have been incorporated into the cells connected to the calculation sheets.

5.2.2. The creation of a risk map (with an associated VBA code):

The ID identifiers for each risk, along with their gravity and occurrence, can be added on the first line of an Excel configuration sheet. The data that is connected to those cells will later be used as scrollable lists.

Once the risk tables have been rearranged, the name robot administrator is essential for creating the columns of the data table as well as the scrolling elements. Currently, we may look at the VBA code that allowed us to automatically create the risk map.

Once the code has been executed, the risk map is created, taking into account the two criteria: gravity and occurrence.



```
Public Function showRiskMap(inputRange As Range, searchString As String, dataRange As Range, separator As String)
    Dim cnt As Long
    Dim tempArray() As Variant
    Dim tempdataArray() As Variant
    Dim tempString As String
    tempArray = inputRange.Value
    tempdataArray = dataRange.Value

    For cnt = LBound(tempArray) To UBound(tempArray)
        If tempArray(cnt, 1) = searchString Then
            tempString = tempArray(cnt, 1) & separator
        End If
    Next
    showRiskMap = tempString
End Function
```

Figure 6: VBA code Risk Map





Figure 7: Risk Heat Map

Based on the results of the cartography, the buyer will devise a detailed and appropriate action plan to reduce residual risks as much as possible.

The goal of this associated is to provide a clear picture of the risks associated with the company procurement department. Analyze, evaluate, and map them in order to offer recommendations and treatment plans. All of that is based on the guidelines of the ISO 31000 standard for risk management [31].

In light of the current economic situation, procurement teams confirm the strategic importance of their contribution to their company's goals.

The digital is a strategy for carrying out this mission: on the one hand, it evaluates and manages supplier risk in real time; on the other, it pilots the purchase action plans that are associated with it. Hence, the proposed tool is highly recommended to move forward with the digital transformation of the company.

**Conclusion**

To conclude, A procurement risk mitigation plan is crucial during the process as more and more businesses rely largely on it. There is no doubt that using emerging technologies and digital procurement may significantly reduce risk.

By automating processes with an e-procurement platform, its functions can benefit from real-time reporting and data tracking providing greater transparency and insights into supply chains.

Indeed, based on the actual economic status, an effective digital procurement strategy will improve the profitability of companies by reducing costs, mitigating risks and boosting productivity.

Combining such powerful tools and frameworks will have a great impact on the feet of scaling companies in the shadow of the Industrial Revolution 4.0.

In this intriguing field, our findings are just a starting point for future research such as:

- How can IOT & AI Bring more customization to the procurement function, improve customer satisfaction and also efficiency and margins?
- Digitalization of procurement risk management to anticipate the value chain issues.
- How far we can take supply chain productivity and efficiency with better technologies than ever before?
- What are the key benefits of digitization in contract management, and how smart contracts can mitigate procurement risks in light of industry 5.0?

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