

Supplementary material - Questionnaire

Multicriteria Analysis of Risks in Food Supply Chains in Brazil

Presentation

You are taking part in a scientific research project whose purpose is to gain a deeper understanding of the interactions between the risks faced by food supply chains in Brazil, with a view to developing proposed solutions to mitigate them.

The inherent complexity of food supply chains, driven by rising demand, adaptation to e-business models and increasing globalization, highlights the pressing need to adopt innovative approaches to managing these chains. Disruptive events such as climate change, economic crises and pandemics highlight the vulnerabilities of wide-ranging supply chains involving multiple suppliers, manufacturers, distributors and retailers.

This questionnaire is organized into three distinct blocks. The first aims to provide a description of the respondents. The second block is aimed at evaluating the interactions between the risks identified, while the third focuses on exploring measures aimed at mitigating these risks. We anticipate that the estimated average response time for the questionnaire is 15 minutes.

Section 1- Respondent characterization

1. What is your professional profile?
2. What is your area of expertise?
3. How many years' experience do you have working in this area?

Section 2 - Evaluation of the relationships between the risks identified

We have identified ten main risks that impact food supply chains in Brazil, as shown below:

2.1 Risk description

R1 - Macro-level risk: (Examples: Political instability, Terrorist attack, Government regulation, Labor strikes, Shortage of skilled labor, Trade shocks and choke points, Lack of information sharing between partners).

R2 - Demand management risk: (Examples: Decrease or volatility in demand, Failure to communicate with customers, Changes in food safety requirements, Forecasting error, Excess or insufficient supply, Information asymmetry, Market price volatility).

R3 - Supply management risk: (Examples: Supplier bankruptcy, Partnership failure, Poor quality of products supplied, Inability to supply, Inconsistency in quality and quantity of products, Poor logistics performance, Fluctuations/shortage of capacity in the supplier market, volatility in the cost of fertilizers).

R4 - Product management risk: (Examples: Excessive Inventory, Underutilized Capacity, Variability in Production Quantity, Variability in Production Quality, Variability in Production Time, Insufficient Quality Control, Labeling and Packaging Problems, Unsuccessful Product Innovation, Supply Chain Problems, Variations in Consumer Preferences, Seasonality Problems in Production, Sustainability Risks, Fluctuations in Production Costs).

R5 - Technology and Information Management Risks: (Examples: Storage and Distribution Problems, Information Sharing Distortions, IT Systems Failures, Cyber Security, Information Systems Failures, Connectivity Interruptions, Systems Integration Challenges, Data Standardization Problems, Inefficient Metadata Management, Lack of Transparency in the Supply Chain, Compliance with Data Regulations, Data Quality Risks, Information Lifecycle Management Challenges, Rapid technological development, Lack of real-time information, Lack of employee training, Lack of implementation of operational routines and standards, Lack of continuous process improvement, Irregular collaboration with supply chain partners).

R6 - Political and regulatory risks: (Examples: Changed or uncertain monetary, fiscal and tax policies, Change or application of uncertain regulatory/legal policies, Changing and/or uncertain trade and market policies, Changing and/or uncertain land policies and tenure system, Stricter food quality and safety standards, Animal welfare legislation negatively affecting competitiveness, Potential restrictions on waste disposal).

R7 - Logistics and Infrastructure Risks: (Examples: Changes in transportation, Incremental changes in energy costs, Unreliable transportation, Lack of infrastructure and service unit, Fuel price volatility, Delivery delays, Theft in transit, Packaging problems and loss of quality, Lack of transportation coordination).

R8 - Financial Risk and Company Performance: (Examples: High cost of doing business, High exchange rates, Fluctuating interest rates, Equipment downtime and excessive waste, Inadequate financial support, Uncertain financial support (credit), Periodic changes/uncertain

interest and exchange rate policies, Late payment and even possible non-payment, Improved return on investment, Growth in market share, Improved customer satisfaction, Overall competitive position, Poor management decisions in asset *allocation*).

R9 - Management and operational risks: (Examples: Poor management decisions in the allocation of assets, Poor decision-making in the use of inputs, Breakdowns of agricultural and business equipment, Inability to adapt to changes in cash and labor flows, Forecasting and planning errors, Lack of investment in the promotion of agri-food products, Oral contract or agreement with partners).

R10 - Natural risks: (Examples: Earthquakes, hurricanes, floods and forest fires can disrupt production, transportation and storage of goods; Intense snowstorms, prolonged droughts, heat waves; Pandemics, epidemics; Landslides, avalanches; Contamination of natural resources; Diseases affecting crops or livestock Increase in Commodity Prices due to natural events; Scarcity of natural resources (Such as: water, energy or minerals); Pests, diseases, income losses, Contamination related to poor sanitation and diseases, Contamination affecting food security).

2.2 Filling in the VAXO Matrix

The VAXO matrix is a concise way of describing how two variables are related to each other, indicating whether one affects the other, whether both influence each other, whether one influences in an antagonistic way, or whether they are independent of each other.

V - The variable in the row influences the variable in the column, indicating that changes to the variable in the row directly affect the variable in the column. In other words, the variable in the row influences the variable in the column.

A - The variable in the column influences the variable in the row, indicating that changes in the variable in the column have a direct impact on the variable in the row. In other words, the variable in the column influences the variable in the row.

X - The row variable and the column variable influence each other. This refers to the situation in which both variables influence each other. Changes in the row variable affect the column variable, and vice versa.

O - Both variables do not influence each other. Represents the condition in which the two variables have no mutual influence. Changes in one variable do not affect the other.

Identify the relationship between the variables in the table (V; A; X; O) as explained above

ISM table	Natural risks	Management and operational risks	Financial Risk and Company Performance	Logistics and Infrastructure Risks	Political and regulatory risks	Technology risks	Product management risk	Supply management risk	Demand management risk	Macro-level risk
Macro-level risk	VAXO	VAXO	VAXO	VAXO	VAXO	VAXO	VAXO	VAXO	VAXO	
Demand management risk	VAXO	VAXO	VAXO	VAXO	VAXO	VAXO	VAXO	VAXO		
Supply management risk	VAXO	VAXO	VAXO	VAXO	VAXO	VAXO	VAXO			
Product management risk	VAXO	VAXO	VAXO	VAXO	VAXO	VAXO				
Technology Risks and Information Management	VAXO	VAXO	VAXO	VAXO	VAXO					
Political and regulatory risks	VAXO	VAXO	VAXO	VAXO						
Logistics and Infrastructure Risks	VAXO	VAXO	VAXO							
Financial Risk and Company Performance	VAXO	VAXO								
Management and operational risks	VAXO									
Natural risks										

Section 3 - Measures to mitigate identified risks

Propose strategies to reduce the impacts generated by risks in food supply chains, based on your experiences as an expert or professional, if there are no suggestions, just enter "No suggestions".

1. Macro-level risk

2. Demand management risk

3. Supply management risk

4. Product management risk

5. Technology risks and information management

6. Political and regulatory risks

7. Logistical and infrastructural risks

8. Financial risks and company performance

9. Management and operational risks

10. Natural hazards

Experts proposals for mitigating risks in FSAs

Code	Risks	Suggestions for mitigating risks, according to experts
R1	Macro-level risk	▪ Clear <i>advocacy</i> processes. ▪ Monitoring trends in the macro-environment in order to foresee possible implications of the occurrence of risks and thus be able to anticipate strategies. ▪ Developing resilience criteria. Example: strategic partnerships (long term and risk dilution) with business partners and suppliers, balance between lead time, installed capacity and inventory levels for materials and finished products, investment in data collection and data processing. ▪ The strategy is to be open to external situations and to have trained people who can pass on knowledge about your employees and new cases, should the need arise. ▪ The company must build mechanisms that make it possible to forecast trends, so that internal decision-making can be carried out in advance of political, economic or social events. ▪ Implement an early warning system to monitor political and economic indicators that could signal instability. ▪ Develop strategic partnerships with organizations that can provide insights into government regulations and policies. ▪ Attention to and monitoring of trends in government and society
R2	Demand management risk	▪ Periodic alignment process between the operations, logistics, sales and finance and controls areas.

Code	Risks	Suggestions for mitigating risks, according to experts
		▪ Maintain an advanced data science system to capture changes in demand behavior. ▪ Development of business partnerships in sales and the ability to interpret demand. ▪ Portfolio management, also avoiding unnecessary complexities. ▪ Make the product essential so that it is indispensable to customers and seek loyalty to your product; if it is good, no one will go to the market to look for something similar. ▪ Increased quality and customer loyalty. ▪ Tools for monitoring the market and understanding consumer trends should be used continuously, enabling greater assertiveness in production volume. ▪ Adopt advanced demand forecasting technologies to improve accuracy and responsiveness to market changes. ▪ Implement an efficient feedback system to collect information directly from customers and adjust operations as necessary. ▪ Constant communication between company and clients
R3	Supply management risk	▪ The different categories of inputs require specific strategies, such as supplier diversification, loyalty incentive policies, quality management models and technical assistance. ▪ For differentiated inputs: strengthen partnerships with suppliers. ▪ For non-differentiated inputs: diversify the supplier base. ▪ Development of strategic partnerships and investment in production reliability. ▪ Diversify suppliers. ▪ Supplier control. ▪ Research into innovation and technology to identify alternative raw materials that could make up the product.
R4	Product management risk	▪ Knowledge of markets, customers and sales channels, process flows and established standards, and project management methodologies with operational stages can minimize the risks of product launches. ▪ Various strategies: each specific type of risk within this category will have a specific strategy. ▪ Quality management and innovation management. ▪ Manage and have people trained to analyze the entire production process from the outset, thus avoiding cost risks in product management. ▪ Small product mix. ▪ The company must have knowledge of the market and its trends, as well as accurate tools and methodologies for Production Planning and Control (PCP). ▪ Diversify the supplier base and establish robust contractual agreements to mitigate risks of bankruptcy and supply interruptions. ▪ Carry out regular audits and implement quality assurance processes to maintain consistent standards. ▪ Having several suppliers for each input
R5	Technology Risks and Information Management	▪ Technological and information management risks can be mitigated by using them as a differentiator, anticipating trends, with clear and standardized communication channels. ▪ Invest in advanced IT systems for SCM. ▪ Investment in information technology and <i>analytics</i>. It is necessary to build the organization's digital transformation strategy. ▪ Today, technology is indispensable. It must be aligned with all the information needed for work, so that information in control technology systems is reliable for decision-making. ▪ Data security. ▪ As well as investing in the production side, the company should also direct its efforts towards improving knowledge management processes within the company

Code	Risks	Suggestions for mitigating risks, according to experts
		and implementing technologies that promote greater digital security for shared information. ▪ Developing and testing an IT continuity plan to ensure continued operation in the event of system failures. ▪ Provide ongoing IT training for employees, ensuring that they are up to date with the best security and efficiency practices. ▪ Well-qualified and motivated staff
R6	Political and regulatory risks	▪ Clear <i>advocacy</i> processes, analysis of economic and political scenarios, understanding correlations as a business model. ▪ Monitor trends and local legislation, observing what is already happening abroad and could become a reality at the supply chain location. ▪ Ensuring active action at a macro level, anticipating elements of regulatory transition for the organization, as well as guaranteeing compliance at a manufacturing and product technology level. ▪ Imminent risk: the company can protect itself against legislative situations, but unfortunately it is subject to government changes. ▪ Updates on social and political events, as well as continuous monitoring of projects in the legislative houses. ▪ Carry out periodic regulatory assessments to understand the potential impact of policy changes and adjust business strategies. ▪ Actively participate in lobby groups and sector associations to influence policies that affect the industry. ▪ Monitoring trends and speeding up adjustments
R7	Financial and company management risk	▪ Depending on the business model, the strategy can be to concentrate or decentralize distribution, with diversification of distribution players and modes that serve different locations, reducing the risks of supply and distribution of inputs and products. ▪ Focus on cash flow management. ▪ This topic is far too broad. Generally speaking, the strategy could vary greatly depending on whether we're talking about a family business, a publicly traded company or a privately held company. ▪ The degree of financial leverage should influence and be influenced by this. ▪ It is essential to have a professional in the field trained to analyze the entire process in order to avoid unnecessary costs, which can lead to a company going bankrupt. ▪ Control of suppliers and analysis of the financial health of chain members. ▪ Application of tools and methodologies so that production management is compatible with market needs and the company's financial capacity. ▪ Carry out regular analysis of financial risks, including exchange rates and interest rate fluctuations, in order to make informed decisions. ▪ Diversify investments to minimize exposure to financial risks and maximize returns. ▪ Management committed to the company's mission and objectives and agility in decision-making
R8	Logistics and Infrastructure Risks	▪ Process flows defined for managing cash flows and investments. ▪ Seek multimodal transport when possible and establish a robust distribution network, with its own distribution centers or those of third parties. ▪ This is a major challenge. The organization needs to define whether logistics is a competitive differentiator or not, so that it can decide whether or not to manage logistics. For example, between managing its own fleet or outsourcing the service. ▪ Analyzing the logistics process is essential, since it has an added cost that can affect the product. The entire process must be studied and analyzed. ▪ Reduce the structure and reduce the number of suppliers.

Code	Risks	Suggestions for mitigating risks, according to experts
		▪ Application of advanced technologies that enable greater intelligence and assertiveness in cargo handling and control, as well as monitoring market trends to verify the need to update cargo handling planning, equipment and methodologies. ▪ Carry out regular analysis of transport routes to identify efficiencies and alternatives in the event of disruptions. ▪ Establishing strategic partnerships with logistics service providers to ensure reliability and efficient coordination. ▪ Availability of several service providers
R9	Management and operational risks	▪ Short-, medium- and long-term operational planning, with the definition of goals and the main drivers of the business, in order to leverage the company. ▪ Various strategies: each specific type of risk within this category will have a specific strategy. ▪ In this case, the maxim is obsession with operational efficiency and continuous process improvement. Ensuring that operational management is aligned with business strategy is fundamental. ▪ It is essential to have a professional in the field trained to analyze the entire process in order to avoid unnecessary costs, which can lead to a company going bankrupt. ▪ Improving the quality of the workforce. ▪ Definition of indicators and metrics that enable continuous monitoring of activities, assessing the need for possible adjustments to achieve the desired performance. ▪ Adopt a dynamic strategic planning model that allows rapid adaptation to changes in cash flows and market conditions. ▪ Investing in research and development to promote innovations that guarantee competitiveness and operational efficiency. ▪ Management committed to the company's mission and objectives and agility in decision-making
R10	Natural risks	▪ Sustainability policy and process that assesses the links in the value chain, identifying the materiality of each impact and the strategies to mitigate them. ▪ Identify which natural hazards are most likely in each location of the chain's facilities and look for more protected sites. ▪ I believe there is a need to consider tactical and strategic actions when dealing with natural risks. ▪ At a tactical level, it is necessary to consider production and distribution planning associated with natural risks. When it comes to strategic actions, it is necessary to be associated with the agents of change in relation to the impact brought about by the operation in question, as well as guaranteeing concrete actions to minimize the impact itself. ▪ Unavoidable risk, something that happens by surprise; what you can do is study something to avoid or reduce the impacts. ▪ In addition to a plan to prevent abnormalities, the company must be insured against setbacks. ▪ Implement advanced warning and rapid response systems for natural events, enabling immediate action. ▪ Carry out regular environmental risk assessments to adjust production and storage strategies. ▪ Agility to adapt and change